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Scientific and Social Research

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Table of Contents

- 1 Research on Value Evaluation and Protective Development Strategies for Chongqing's Port-Opening Heritage Park**
Dian Dang, Jinxin Lv, Yuling Weng, Xudong Li
- 12 Diatom Distribution Pattern in Surface Sediments of the Kara Sea and Adjacent Areas**
Jingfang Lu, Wei Huang, Xuwen Wu, Jun Sun, Dandan Zhang
- 21 A Brief Analysis of the Cultural Roots of Substantive Justice and Procedural Justice**
Ying Dong, Hao Lei
- 28 Study on Performance Evaluation of Process Management of State-owned Assets in Colleges and Universities**
Qinglin Feng
- 36 The Impact of Social Media Use on Teens' Health: A Literature Review**
Ethan Spencer Ku
- 44 From "Streamlining Administration" to "Good Governance": "Credit +" Reform Empowers Modernization of Government Services and Grassroots Governance in Zhucheng City**
Wenhui Shang
- 50 Practical Dilemmas and Practical Paths of Community Elderly Care Empowered by Digital Technology**
Jianguo Liu
- 56 Construction and Practice of a Multi-Agent Collaborative Mechanism in Grassroots Smart Governance Based on Actor-Network Theory**
Zongyuan Liu
- 62 The Logic and Pathways of Stringent Financial Regulation Empowering Corporate ESG Practices**
Xiaoyan Guan, Pengqian Zhang, Ningning Zhang
- 67 Exploration of Embedded Service Models in Urban Communities from the Perspective of Good Governance**
Xiaohan Wang

- 73 Research on the Historical and Cultural Connotations and Tourism Development Strategies of the Huai'an Prefecture in Jiangsu Province**
Yongyi Yan
- 80 The Symbiotic World of Humans and Animals: An Interpretation of the Dog Imagery in *A Village of One's Own***
Gaotong Feng, Tao Li
- 91 Sustainable Renewal of the Old City: Planning Practices and Institutional Innovation in Suining, China**
Shuting Xiao, Hanyuan Li , Qiye Luo
- 110 Analysis of the Effectiveness of Traffic Restriction Policies and Public Management**
Xinyi Zhao
- 116 Historical Memory in the Foreign Policy of Spanish-speaking Countries**
Zilun Huang
- 123 Exploration of the Impact and Mechanisms of Socioeconomic Status on Adolescent Health Behaviors**
Yanru Li
- 129 From Local Knowledge to Global Wisdom: The Ecological Dimension of Nomadic Ethics and Its Value in Civilizational Dialogue**
Sheleng Bai
- 134 Challenges and Pathways for Deepening China's Cultural System Reform in the New Era**
Qinyu Li
- 141 Research on the Construction of Smart Manufacturing Systems under the Lean Production Model**
Wensheng Chen
- 149 The Current Challenges and Strengthening Strategies of Ideological and Political Leadership Capacity of College Counselors**
Lingbin Zhou
- 156 Research on Legal Issues of Adolescent Data Security from the Perspective of Global Data Security Law**
Weiwei Li, Fangyu Liu
- 162 Analysis of the Reasons for Employee Turnover in Liaoning Province**
Jigang Lin, Wenli Bao, Fei Xu, Yue Han, Hui Cao

- 168 The Logic of “Viral Popularity” and the Development Path of “Sustained Popularity” in Influencer Cities**
Danqi Liu
- 176 Local Governments Explore the Path System of High Quality Development of Social Organizations—A Grounded Theory Analysis Based on Local Government Policy Documents**
Zeyu Yang, Xijing Huang
- 188 On Leveraging Multi-Agent Models in Countermeasures for Deepfake Detection and Mitigation: A Comparative Analysis of Social Media Platform Strategies**
Yuan Yuan Liu, Yu Zhang, Jicheng Sun
- 198 The Process Philosophy Interpretation of Chinese-style Modernization: Theoretical Innovation and Practical Path Research**
Xiong Tian, Wen Li
- 205 Research on the Path of ESG-driven Development of the Silver-haired Economy by Chinese Characteristic Enterprises**
Shijie Lin, Pan Ai Xi Wang
- 216 Analysis on Optimization Countermeasures of Dairy Enterprise Supply Chain Under the Background of Digital Intelligence**
Dongdong Miao, Dexin Zhang, Jiaqi Tian, Jie Zhao, Zhiwei Chen
- 223 Issues and Solutions of Cultural Rupture in Ethnic Minority Village Planning**
Zichen Zhao, Chun Wang, Hui Luo
- 231 The Research on the Value Realization Mechanism of Marine Ecological Products in China**
Zhuli Li, Zhijun Liu, Zhaoyong Zheng, Ping Hu, Zhiwei Zhang
- 242 The Influence Mechanism of Social Role Adjustment and Reconstruction on Internet Addiction Behavior of Retired Older Adults: A Case Study of Xuhui District, Shanghai**
Linqi Zhou
- 250 A Pragmatic Analysis of Corporate Public Relations Apology Strategies on Weibo**
Jinmei Ke, Qing Yang
- 259 Quantitation Method Research for the Pyrrolizidine Alkaloids (PAs) Determination in Botanicals by HPLC-MS/MS**
Fan Li, Ke Zeng, Pengfei Hu, Jinjing Li, Yanjun Zhang, Peter Chang, Gary Swanson

- 269 Research on the Communication of Design Symbols of “The 15th National Games” From the Perspective of Short-Video Platforms**
Xiaojuan Tong, Daxi Qiu, Nan Zu, Yanping Liu, Huiying Chen
- 274 Analysis of the Transformation and Innovation of Public Libraries in the Post-Emergency Era**
Yanli Liu, Xiong Deng
- 280 On Laozi’s “Tao” and Confucius’s “Tao”**
Changshun Chen
- 286 Urban Design of Tianfu Chinese Medicine City from the Perspective of Park City**
Hanyuan Li
- 298 The Importance of Perfectionism to Chinese International Students and How This Affects Their Emotional and Mental Health**
Yifei Wang
- 303 Research on the Construction Path of the Ideological and Political Education Community for Postgraduates in Colleges and Universities of Heilongjiang Province**
Dongqi Li, Qian Zhang, Shuo Wang, Li Zhao
- 311 The Role of Social Learning Theory in the Construction of Hospice Care Volunteer Training System**
Xu Zhang
- 319 Exploration of the Mechanism and Path for the Organic Connection between Red Resources in the Gaoligong Mountain Area and Forging a Strong Sense of Community with a Shared Future for the Chinese Nation**
Birong Yang, Chuanwen Fu, Qiulu Liu
- 328 Intercultural Communication in Medical Context: An Analysis of Regional and Cultural Factors**
Chenjie Zhang, Yunping Zhao

Research on Value Evaluation and Protective Development Strategies for Chongqing's Port-Opening Heritage Park

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Abstract: This study focuses on Chongqing's Port-Opening Heritage Park, employing a combination of the Analytic Hierarchy Process (AHP) and Fuzzy Comprehensive Evaluation Method. Through expert interviews and the quantitative analysis of 492 valid questionnaire responses, the park's comprehensive value was assessed. The findings indicate that the park's comprehensive value score is 3.205 out of 5, placing it at an above-average level. Among the evaluated aspects, social value performed the best, while historical and cultural values were balanced. However, there is room for improvement in ecological and scientific values. Based on the evaluation results, this paper proposes protective development strategies, including deepening cultural experiences and educational functions, innovating historical narratives and intangible cultural heritage revitalization, developing low-impact and high-value-added business formats, strengthening ecological interpretation and scientific planning, and fostering value consensus through targeted communication and dynamic feedback mechanisms. This research provides theoretical and practical foundations for the sustainable development of heritage parks and offers insights for the protection and development of similar cultural heritage sites.

Keywords: Chongqing's Port-Opening Heritage Park; Value evaluation; Protective development; Analytic Hierarchy Process; Fuzzy comprehensive evaluation; Cultural heritage protection

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1. Introduction

The "14th Five-Year Plan" for the cultural and tourism development of Chongqing proposes to strengthen the protection of open historical and cultural resources and to construct Chongqing's Port-Opening Heritage Park. The Chongqing Port-Opening Heritage Park is an important part of China's historical and cultural heritage, bearing witness to the historical development of Chongqing as a vital inland commercial and trade port. On December 5, 2019, the fourth special session of the Municipal Planning Committee reviewed and approved the "Research on the Site Selection and Planning Scheme for the Port-Opening Cultural Heritage Park (Draft for Review)." In

2020, it was designated as a key project by the Chongqing Municipality. Research on the value assessment of cultural heritage parks is relatively scarce in China. This study takes the Chongqing Port-Opening Heritage Park as its research subject, clarifies the research direction supported by the Analytic Hierarchy Process (AHP) theory, organizes the constituent dimensions of the park, determines weight values, and combines quantitative data from questionnaires to analyze the value deficiencies of the park and explore strategies for its protective development, promoting sustainable development of the heritage park.

2. Literature review on value assessment and protective development strategies for the Chongqing Port-Opening Heritage Park

2.1. Development trajectory of heritage park research

As a unique form of urban space, the development of heritage parks reflects the evolution of cultural heritage protection concepts and practices. According to the “Classification Standard for Urban Green Spaces” (CJJ/T85-2017), a heritage park is defined as “a green space constructed primarily around a heritage site and its surrounding environment, serving functions such as protection, display, and recreation”^[1].

Early research primarily focused on its protective functions. For instance, Shan Jixiang proposed the “Two Zones, Three Lines” framework for the protection of large heritage sites, emphasizing the need for spatial planning to ensure the integrity of the heritage sites themselves^[2]. Scholars such as Li Aimin et al. used Xi’an as a case study to construct a “cultural-ecological corridor” heritage park. They pointed out that the naming paradox of the “Archaeological Heritage Park” at Yuanmingyuan could potentially lead to a leisure-oriented trend in heritage protection areas, calling for a balance between protection and utilization^[3–5]. The protective practices at Hadrian’s Wall, for example, integrated archaeological maintenance with visitor management through heritage management planning, laying the institutional foundation for heritage parks^[6]. Capozzi et al., using the example of the Baiae Ancient Baths, proposed that collaborative design between architecture and urban planning is an effective approach to revitalizing heritage sites^[7]. Mauro et al. focused on the impact of environmental factors on heritage sites, highlighting the necessity of scientific restoration techniques^[8].

As practice deepened, scholars gradually recognized the multifaceted values of heritage parks. Wu Xin et al. proposed a cultural-ecological synergistic development model, emphasizing that heritage parks should balance cultural preservation with ecological enhancement functions^[9]. Zhang Jianzhong et al., from a tourism perspective, defined heritage parks as a new industry format integrating tourism and culture, stressing the enhancement of visitor experiences through resource activation^[10]. Huang Chenyang et al. described heritage parks as both a “special form of urban park” and an important vehicle for tracing history and promoting culture, advocating for designs that balance preservation with activation^[11]. Tao Li et al. noted that the “park” attribute allows cultural heritage resources to be transformed into tourist attractions through moderate development^[12]. Dai Juncheng emphasized the need to align heritage preservation, cultural dissemination, and public services based on site types and regional characteristics^[13]. Internationally, Romeril and Fuller were early advocates for the educational and community development roles of heritage parks, while Gerlach and Kinossian explored the significance of heritage imagery in constructing local identity^[14–15]. Szromek et al. examined business model transformations in industrial heritage tourism, Bayramova et al. highlighted the need to expand evaluation dimensions for recreational potential in historical parks, and Korunovski and Marinoski emphasized clustered development models for cultural tourism^[16–18].

In recent years, emerging concepts such as digitalization and inclusive tourism have been introduced into heritage park research. Vahtar-Jurković et al. even incorporated climate change into preservation frameworks, marking a trend toward diversified research perspectives^[19–21]. Future studies should further explore directions such as digitalization and community engagement^[22].

Overall, heritage site parks have evolved from single venues for cultural relic protection into comprehensive spaces that integrate preservation, tourism, education, community participation, and sustainable development. This evolution reflects a deepening understanding of heritage value and innovation in management models.

2.2. Literature review on value assessment studies

In recent years, scholars have systematically evaluated the comprehensive value of heritage sites by constructing multi-dimensional and multi-level evaluation systems. The Analytic Hierarchy Process (AHP) and other methods have been widely adopted in academia to build multi-dimensional value evaluation systems that encompass historical, cultural, ecological, and economic dimensions.

Guo Jinyu conducted an in-depth exploration of the AHP method itself, enriching its application foundation in heritage evaluation^[23]. The determination of indicator weights often relies on expert judgment, lacking validation from public perception data^[24].

2.3. Literature review on protective development strategies

The core of protective development lies in balancing the conflict between conservation and development. International studies have shown that S Amin et al. employed qualitative methods to propose that historical parks serve as an alternative concept that combines the interests of preserving historical heritage with inclusive tourism^[25]. V Bayramova et al. advocate that, among the primary tasks of effectively managing historical parks, efforts should not only be made to protect the park but also to create year-round public appeal and develop special recreational programs^[26]. Domestic research exhibits a case-oriented characteristic. Mei Qing et al. pointed out that the tourism development of historical districts relies on policy support and resource integration, as demonstrated by cases such as Pingyao and Lijiang^[27]. Wang Xiaoling et al. argued that scientific resource evaluation is the foundation for avoiding overdevelopment^[28].

Overall, the development of heritage parks should be tailored to local conditions, balancing ecological protection and cultural inheritance. Future research could further explore the synergistic mechanisms between technological innovation and community participation^[28, 30].

3. Research methodology and data sources

3.1. Research methodology

3.1.1. Analytic Hierarchy Process

The Analytic Hierarchy Process (AHP) is a multi-level weighted decision-making analysis method. It involves decomposing the overall research objective into multiple levels and indicators, conducting pairwise comparisons and assigning values, and ultimately calculating the weights of various factors. This study employs the AHP method to evaluate the multidimensional value of the Chongqing Port Opening Heritage Park.

3.1.2. Expert interview method

To scientifically and reasonably assess the actual value of the Chongqing Port Opening Heritage Park, this study

adopts the Delphi expert evaluation method, inviting six experts from relevant fields to form an evaluation team. The 1-to-9 scaling method, combined with a random consistency RI table, is utilized to ensure the reliability and validity of the evaluation results (**Tables 1** and **2**).

Table 1. Random index (RI)

Order (n)	1	2	3	4	5	6	7	8	9
RI value	0	0	0.52	0.89	1.12	1.26	1.36	1.41	1.46

Table 2. Scaling method

Scale a_{ij}	Meaning / Definition
1	Factor i and j are equally important
3	Factor i is slightly more important than j
5	Factor i is strongly more important than j
7	Factor i is very strongly more important than j
9	Factor i is absolutely more important than j
2, 4, 6, 8	Intermediate values between two adjacent judgments
$a_{ij}=1/a_{ji}$ (1/2, 1/3, 1/4.....1/9)	If factor i has one of the above numbers assigned to it when compared to j, then j has the reciprocal value when compared to i.

3.1.3. Fuzzy comprehensive evaluation method

The fuzzy comprehensive evaluation method is used to address the fuzziness in indicator evaluations, particularly in situations where precise quantification is not feasible. This study conducts a comprehensive evaluation based on fuzzy matrices and weight vectors, deriving an overall assessment of the Chongqing Port Opening Heritage Park.

3.2. Data sources

This study collected a total of 492 valid questionnaires, with a well-represented sample covering different genders, educational backgrounds, and geographical regions, ensuring the broad applicability of the results.

3.3. Construction of the indicator system

The United Nations Educational, Scientific and Cultural Organization (UNESCO) adopted the Convention Concerning the Protection of the World Cultural and Natural Heritage in Paris, proposing Outstanding Universal Value (OUV) as the core criterion for selecting World Heritage sites and promoting effective protection of cultural and natural heritage through international cooperation. On this basis, China has successively introduced and developed the three core values of history, art, and science in the “China Principles for the Conservation of Heritage Sites” as the foundation for heritage assessment. At the same time, it has extended local practices to include expanded dimensions such as cultural value and social value, forming a more comprehensive value judgment system. In recent years, the policy landscape has also continuously enriched the connotations of heritage value. The “14th Five-Year Plan” emphasizes promoting the economic transformation of cultural heritage resources, while the “Opinions on Strengthening the Construction of Ecological Civilization” points out that heritage sites should simultaneously plan for their ecological functions. Building on this foundation and

incorporating the research findings of previous scholars such as Wang Xinwen et al., this study constructs a value assessment indicator system for the Kaibu Heritage Site Park in Chongqing ^[31].

Table 3. Value indicator system

Objective layer	Criterion layer	Indicator layer
Treaty Port Site Park (A)	B1 Historical Value	Historical Antiquity (Time Depth) Historical Significance Historical Richness/Diversity
	B2 Cultural Value	Cultural Diversity Cultural Representativeness Cultural Continuity
	B3 Economic Value	Environmental Support Conditions Related Resource Conditions Economic Feasibility of Regeneration
	B4 Social Value	Science Popularization & Educational Value Emotional/Sentimental Value Recreational Experience Quality
	B5 Ecological Value	Ecological Sensitivity Landscape Spatial Combination Coverage Rate of Environmentally Friendly Facilities
	B6 Scientific Value	Scientific Planning Construction Technology Level Digital Scientific Presentation

4. Research process

4.1. Overview of the research area

The Kaibu Heritage Site Park is located on Ma'anshan Hill along Nanbin Road in Chongqing. Its history can be traced back to the opening of Chongqing as a port in 1891. It was once a hub for foreign consulates, foreign firms, and trading companies, witnessing Chongqing's modernization as the first treaty port in the upper reaches of the Yangtze River. This event marks a significant chapter in the history of the upper Yangtze River region and serves as a testament to China's further descent into a semi-feudal and semi-colonial society. It had a profound impact on the politics, economy, society, and culture of Chongqing and the entire upper Yangtze River region. As Chongqing has intensified its efforts to preserve and inherit historical and cultural heritage in urban and rural construction, the park has now become an important heritage site that showcases the integration of commerce, diplomacy, and culture during the port-opening period.

4.2. Determining indicator weights

The maximum eigenvalue of the criterion-level matrix is 6.000, with a Consistency Index (CI) value of 0, a Consistency Ratio (CR) value of 0, and a Random Index (RI) value of 1.260. These results indicate that the judgment matrix is consistent, with a high level of agreement among the experts' evaluations, suggesting strong reliability of the assessment results (**Table 4**).

Table 4. AHP hierarchical weight table for the Kaibu Heritage Site Park

Objective layer A	Criterion layer B	Weight	Indicator layer C	Weight	Global weight
Treaty Port Site Park	Historical Value	0.1884	Historical Antiquity	0.2668	0.0503
			Historical Significance	0.4249	0.08
			Historical Richness	0.3083	0.0581
	Cultural Value	0.1884	Cultural Diversity	0.2773	0.0522
			Cultural Representativeness	0.2941	0.0554
			Cultural Continuity	0.4286	0.0807
	Economic Value	0.1750	Environmental Support Conditions	0.2824	0.0494
			Related Resource Conditions	0.3467	0.0607
			Economic Feasibility of Regeneration	0.3709	0.0649
	Social Value	0.2000	Science Education Value	0.3008	0.0602
			Emotional Value	0.3984	0.0797
			Recreational Experience	0.3008	0.0602
	Ecological Value	0.1382	Ecological Sensitivity	0.3949	0.0546
			Landscape Spatial Combination	0.3194	0.0441
			Coverage of Eco-friendly Facilities	0.2857	0.0395
	Scientific Value	0.1100	Planning Scientificity	0.3740	0.0411
			Construction Technology Level	0.2764	0.0304
			Digital Scientific Presentation	0.3496	0.0385

4.3. Questionnaire data analysis

A reliability and validity test was conducted on the 492 valid questionnaires collected. For reliability analysis, Cronbach's alpha coefficient and Composite Reliability (CR) were used as indicators. The results showed that the alpha coefficients for all six latent variables exceeded 0.91, and the CR values were all above 0.92, indicating a high level of internal consistency in the scale (**Table 5**). Validity was assessed using standardized factor loading coefficients and Average Variance Extracted (AVE) values. All standardized factor loading coefficients for the measurement items were greater than 0.86, indicating strong explanatory power of the measurement items for the latent variables. The AVE values for all six dimensions were above 0.5, ranging from 0.789 to 0.824, confirming that the scale possesses good convergent validity and that the measurement items effectively reflect the characteristics of the latent variables.

Table 5. Proportion of evaluator comments for each indicator

Specific indicator C	Very unimportant	Relatively unimportant	Neutral	Relatively important	Very important
Historical Antiquity	0.1179	0.2093	0.1260	0.3476	0.1992
Historical Significance	0.1057	0.2012	0.1545	0.3537	0.1850
Historical Richness	0.1423	0.1768	0.1565	0.2947	0.2297
Cultural Diversity	0.1016	0.2439	0.1138	0.3598	0.1809
Cultural Representativeness	0.1057	0.2276	0.1585	0.3171	0.1911
Cultural Continuity	0.1037	0.2256	0.1484	0.3252	0.1972
Environmental Support Conditions	0.1382	0.2581	0.1402	0.3150	0.1484
Related Resource Conditions	0.1423	0.2358	0.1728	0.2866	0.1626
Economic Feasibility of Regeneration	0.1606	0.2500	0.1484	0.2846	0.1565
Science Education Value	0.1138	0.2195	0.1606	0.3272	0.1789
Emotional Value	0.1037	0.2093	0.1890	0.3211	0.1768
Recreational Experience	0.1179	0.2053	0.1850	0.2927	0.1992
Ecological Sensitivity	0.1382	0.2337	0.1159	0.3516	0.1606
Landscape Spatial Combination	0.1341	0.2134	0.1524	0.3272	0.1728
Coverage of Eco-friendly Facilities	0.1565	0.2073	0.1667	0.2825	0.1870
Planning Scientificity	0.1850	0.1829	0.1098	0.3374	0.1850
Construction Technology Level	0.1667	0.1789	0.1646	0.3171	0.1728
Digital Scientific Presentation	0.1341	0.2256	0.1341	0.3049	0.2012

4.4. Fuzzy comprehensive evaluation

The study employed the Analytic Hierarchy Process (AHP) weight vector and the fuzzy relation matrix derived from the questionnaire data to conduct a fuzzy comprehensive evaluation. The weights for each dimension were normalized, and the fuzzy evaluation results for each dimension were calculated. Finally, by multiplying the weight matrix of the objective level with the membership relation matrix of the criterion level, the comprehensive evaluation result for the Chongqing Port Opening Heritage Park was obtained. After defuzzification, the overall value development score for the Chongqing Port Opening Heritage Park was 3.205, indicating that the park's comprehensive value is at a moderately high level.

5. Analysis of comprehensive evaluation results

5.1. Analysis of indicator weights

The results show that the comprehensive value score of Chongqing's Port-Opening Heritage Park is 3.205 points (out of a total of 5 points), placing it between neutral and relatively important, leaning towards the relatively important level. This indicates that the overall value development is at an above-average level. Furthermore, an analysis of the basic values reveals that the social value score is the highest, benefiting from the outstanding contributions of emotional value and popular science education, reflecting the public's strong demand for cultural

identity and the educational functions of the heritage site. The historical and cultural values exhibit balanced performance, but cultural continuity outperforms historical longevity, indicating that the public is more concerned with the living transmission of heritage culture rather than mere historical antiquity. In terms of economic value, the scores for regenerative economic viability and related resource conditions are relatively high, suggesting that the park has certain potential to drive regional development. The ecological and scientific values are relatively lower, but ecological sensitivity and planning scientificity still perform well, indicating that there is already a foundation for protecting nature and scientific presentation, yet there is still room for improvement.

5.2. Analysis of questionnaire survey results

Ratings for dimensions such as historical importance, cultural diversity, and ecological sensitivity are concentrated on “relatively important”, showing a high level of public recognition for these core values. Regenerative economic viability has a relatively high proportion of ratings in the “very unimportant” category, indicating a divergence in understanding regarding economic sustainability. Planning scientificity has the highest proportion of ratings in the “very unimportant” category, reflecting a lack of recognition for planning scientificity among some respondents. Overall, ratings for historical, cultural, and social value dimensions are relatively concentrated, while recognition for economic, ecological, and scientific value dimensions is more dispersed, indicating that a value consensus is still in the process of formation.

6. Recommendations for protective development strategies of Chongqing’s Port-Opening Heritage Park

Based on the comprehensive value assessment results of Chongqing’s Port-Opening Heritage Park, the following reasons underpin the recommendations for its protective development:

Firstly, the highest social value score indicates a strong public demand for cultural identity and educational functions. Therefore, it is recommended to deepen cultural experiences and expand educational collaborations, such as developing immersive projects and customized research courses, to consolidate this advantage.

Secondly, while historical and cultural values are balanced, cultural continuity garners more attention, indicating the public’s preference for living heritage transmission over mere historical antiquity. Therefore, it is necessary to innovate historical narratives and plan activities to revitalize intangible cultural heritage, thereby enhancing cultural appeal. The tangibility of history can be strengthened through immersive theater experiences and collaborating with local cultural and creative enterprises to co-develop port-themed markets.

Although there is potential for economic value, the questionnaire reveals significant disagreement regarding the “economic viability of regeneration.” Thus, it is recommended to develop business formats with low interference and high cultural added value, balance development and conservation through regional collaboration and a revenue-reinvestment mechanism, and disclose data on regional economic impact.

Ecological and scientific values are relatively low, but ecological sensitivity is acceptable. Therefore, it is necessary to enhance public awareness through visual ecological interpretation and transparent scientific planning. The ecological value of the park should be improved by adding green corridors and plant species. By employing green infrastructure construction and intelligent display systems, the “visibility” and “perceptibility” of ecological and scientific functions can be enhanced. Finally, given the differences in value perception across dimensions, it is recommended to adopt targeted communication and dynamic feedback mechanisms to gradually foster a

consensus on values. Meanwhile, hierarchical protection and technical monitoring should be implemented to ensure that development does not compromise the safety of the site itself, ultimately achieving a win-win scenario of cultural preservation, public education, ecological protection, and sustainable economic development.

This study systematically applies the Analytic Hierarchy Process (AHP) and fuzzy comprehensive evaluation method to the multidimensional value assessment of the Chongqing Port Opening Heritage Park, constructs a six-dimensional indicator system with local cultural characteristics, and proposes differentiated conservation strategies based on public perception differences, enriching the quantitative research approach for port-type heritage sites. However, the study has limitations: the sample is primarily concentrated in Chongqing and does not fully represent other audiences; a dynamic feedback mechanism, such as regular questionnaires and big data monitoring, has not been established; and the development strategies do not address financial investment and institutional safeguard mechanisms, necessitating further exploration.

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Diatom Distribution Pattern in Surface Sediments of the Kara Sea and Adjacent Areas

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Abstract: Surface sediment samples from the Kara Sea and adjacent areas were analyzed to investigate diatom distribution patterns in high latitude regions based on species and their relationship with temperature. Samples from the deep Arctic Basin and Kara Sea primarily comprised pennate diatoms and centric diatoms, respectively. Rare Sea ice diatoms, including *Fragilariopsis oceanica* and *Fragilariopsis cylindrus*, were found in the northern regions of the Kara Sea, close to the Center Arctic Ocean. This region usually has sea ice and ice packs, which account for a relatively low surface temperature. Diatoms near Arctic regions, which are located south of the Kara Sea, included *Bacterosira bathyomphala*, *Thalassiosira antarctica borealis*, *T. antarctica*, *Dentonula confervaceae*, and *Porosira glacialis* resting spores. Melting of the Arctic sea with a rise in seasonal temperature has been observed in this region. Coastal Benthic diatoms, such as *Paralia sulcata* and *Delphineis*, were found near the surface runoff of the Yenisey, Ob, Pyasina, and Kara. Based on the findings, the distribution and growth of diatoms in surface sediments are strongly influenced by perennial sea ice in the Arctic Ocean regions.

Keywords: Diatoms; Distribution pattern; *Fragilariopsis*; Surface sediments; Kara Sea

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1. Introduction

Over the past few decades, the Arctic Ocean has experienced significant environmental changes. The decline in sea ice has influenced the production of marine phytoplankton and shifted their distribution patterns. Recent environmental changes, including sea ice reduction, increased water column, and stratification changes due to rising water temperature and decreased salinity, may have impacted the sedimentation processes and patterns in the Kara Sea and adjacent areas. In the Arctic seas, sedimentation has been conducted to understand the processes connected to climatic change and identify the trends in changes in the environment ^[1].

Diatoms, the most prevalent microfossils in Arctic Ocean and marginal sea sediments, are particularly valuable due to their well-preserved siliceous frustules. These remains act as proxies for reconstructing paleoenvironment conditions in high-latitude regions. Calcareous nannoplankton and foraminiferans are less abundant and more easily destroyed than diatoms. Analyzing the diversity and composition of diatom species in seafloor sediments is essential for making a detailed and reliable reconstruction of sedimentation conditions that can prove useful in predicting changes expected in the future.

Detection of diatom tanatocenoses at the bottom sediment surface reflects biocenoses and is key to the fossil diatom flora. In recent decades, diatoms in surface sediments of the Kara Sea have attracted considerable attention. These studies highlight the influence of various parameters related to surface sediments, such as ice cover, surface runoff, and current, on diatoms and their species.

The present study focuses on analyzing changes in the diatom distribution pattern in surface sediments of the Kara Sea and adjacent areas to understand how climate change has affected diatoms over recent decades in this ecosystem.

2. Materials and methods

2.1. Study area

The Kara Sea, a marginal sea within the Arctic Ocean, is situated off western Siberia (Russia). It is bounded by the Novaya Zemlya archipelago to the west, Franz Josef Land to the Northwest, the Severnaya Zemlya islands to the East, and the Eurasian mainland to the South (**Figure 1**). The sea is linked to the Arctic Ocean in the north, demarcated by conventional boundaries along the shelf edge. It also connects to the Arctic Basin to the north, the Barents Sea to the west, and the Laptev Sea to the east. The study region spans between 65°E–86°E and 71°N–86°N, covering an area of 340,000 square miles (880,000 square km). The sea has an average depth of 127 meters, with its deepest point reaching 620 meters.

Several deep inlets of the Kara Sea extend into the Siberian mainland. Major rivers such as the Yenisey, Ob, Pyasina, and Kara rivers discharge into the sea. These rivers are located in high-latitude regions, receive limited solar radiation, resulting in minimal radiant heating of the Arctic seas. The substantial freshwater input from these rivers plays a critical role in shaping the hydrological conditions of the Arctic seas ^[2–3].

As part of the Siberian shelf, the Kara Sea has a relatively shallow profile, with around 40% of its area having depths of less than 50 meters and only 2% exceeding 500 meters. The northern part of the shelf is cut by two deep-sea troughs: the Svyatoy Anny Trough, located east of Franz Josef Land with a depth of 620 meters, and the Voronin Trough, situated approximately 290 kilometers to the east, reaching depths of up to 450 meters.



Figure 1. Location of various study sites in the study area showing diatom distribution. Red stars indicate samples rich in diatom abundance, while red circles represent those with low diatom abundance

2.2. Methodology

Surface sediment samples were collected from the Arctic Ocean using a box-corer in 2018. Seven samples (Stations 1 to 7) from the Kara Sea and adjacent areas were analyzed. Stations 1–3 are located in central of Arctic Ocean, while Stations 4–7 are situated in the middle of the Kara Sea.

For light microscopy analysis, sample slides were prepared following a standard chemical treatment procedure involving hydrochloric acid (HCl) and hydrogen peroxide (H₂O₂)^[4]. Dried samples (2 g) were treated with 30% H₂O₂ to remove the organic matter, followed by the addition of 10% HCl to dissolve calcite matter. The samples were then rinsed with distilled water, and the process was repeated 5 times until all acids and part of the clay were removed. The remaining sediments were filtered through a 10-μm mesh, and the residue was collected. After the reaction was complete, the samples were carefully transferred using latex tubes. After the material was fully dried, cover slips were placed on top of the slides for microscopic analysis.

Diatom species were identified and counted using a Nikon Ni-E optical microscope at x400 magnification. 10 slides were prepared and analyzed to ensure accurate representation of diatom composition.

3. Results

Among the seven surface sediment samples analyzed, only a small number of diatoms (Station 1–3) were detected

in the high-latitude stations (**Figure 2**). These three stations are located within the region of minimum sea ice extent in the Arctic Ocean, an area characterized by perennial ice and snow cover, as indicated by data from the National Snow and Ice Data Center. In contrast, the remaining four samples (Stations 4–7), collected from a region south of the minimum sea ice extent near Novaya Zemlya, contained a significantly higher abundance of diatoms. The diatom counts ranged from 100 to 300 valves per sample on average, with a minimum of 128 and a maximum of 426 valves. In fact, diatom concentrations exhibited a marked increase in the central Kara Sea, particularly around the gulfs, the Yamal Peninsula, and the Belyeye Islands.

Analysis of the surface sediment samples revealed that Arctic diatom species can be categorized into three main groups: sea ice diatoms, Arctic diatoms, and coastal benthic diatoms.

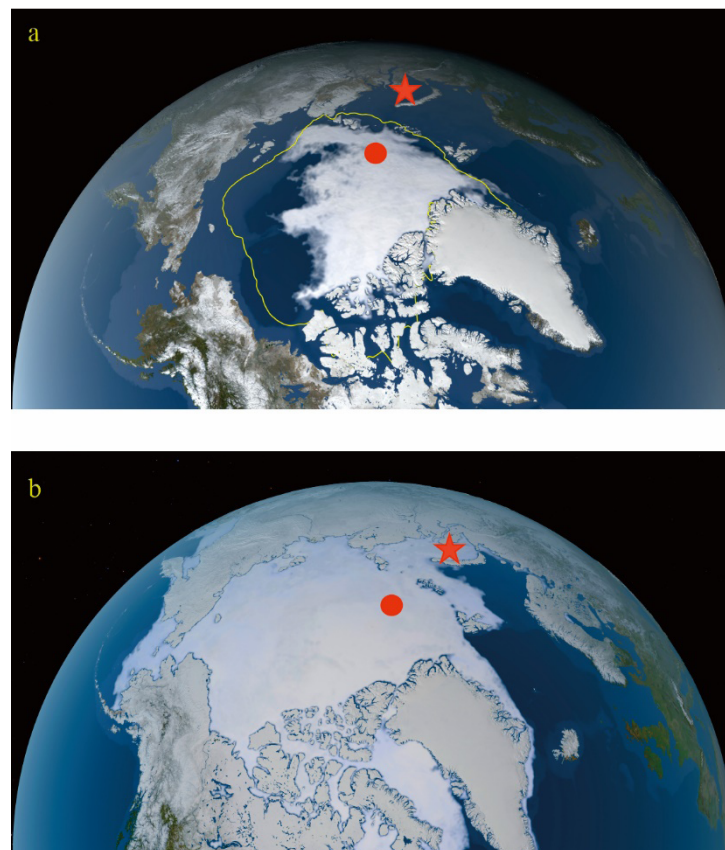


Figure 2. Arctic sea ice changes in 2023. a. Arctic sea ice minimum extent on September 19, 2023: 4.23 million km². It was the 6th smallest summer minimum on record. The yellow line shows the average from 1981 to 2010. b. Arctic sea ice maximum extent on March 5, 2023: 15.05 million km². Image from NOAA Climate.gov, based on data from the National Snow and Ice Data Center. The red star represents samples in the Kara Sea rich in diatoms (abundance), while the red circle represents samples in the Arctic Ocean with a low diatom count

3.1. Sea ice diatoms

Fragilariopsis oceanica and *F. cylindrus*, two closely related diatom species, were widely distributed in sea ice, being commonly found in the Arctic Ocean and the adjacent area. Previous studies indicated an abundance of those species in sediments from the Northern part of the Arctic Ocean, particularly along the minimum sea ice extent in the Kara Sea. This distribution pattern suggests that both species exist in environments characterized by low sea surface temperatures and high latitudes.

3.2. Arctic diatoms

The main diatom species identified in the Arctic water of the Kara Sea include *Bacterosira bathyomphala*, *Thalassiosira hyperborean*, *T. antarctica borealis*, *T. antarctica* resting spore, *Diploneis interrupta*, *D. stroemii*, *D. smithii*, *Nitzschia hybrid*, *Amphora laevis*, *Navicula kjellmanii*, as well as *Dentonula confervaceae* and *Porosira glacialis* resting spores. Their presence suggests a strong association with ice-free regions in the Arctic.

Resting spores were frequently observed in the Kara Sea due to their high preservation potential. The resting spores can be found in all samples, and they play a significant role in areas with minimal sea ice extent. The percentage of North-boreal species tends to increase with higher latitudes, including the resting spores (**Figure 3**).

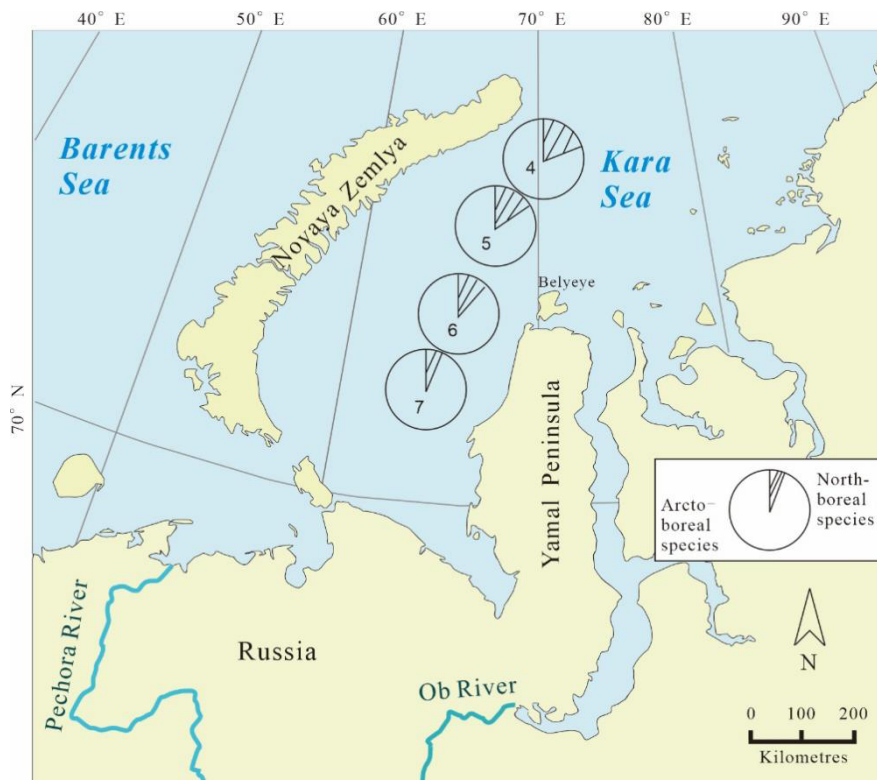


Figure 3. Biogeographical composition of diatom species in surface samples from the Kara Sea

B. bathyomphala and *T. antarctica borealis* were consistently observed in the central Kara Sea. *B. bathyomphala* was particularly abundant in coastal regions of Greenland, Laptev Sea, Okhotsk Sea, and the Bering Sea, spanning various depths from shallow coastal zones to deep basins. Meanwhile, *T. antarctica* exhibited a broad distribution, ranging from the Southern to the Northern Hemisphere. The highest concentration of Arctic diatom species was recorded in the deeper regions of the Kara Sea, while the lowest abundance was found near Western Siberia. This result indicates that diatom distribution is strongly influenced by coastal water dynamics, with changes in coastal currents playing a key role in shaping the spatial patterns of Arctic diatoms (**Figure 4**). In station 4, planktic diatoms dominated, accounting for 90.3% of the total diatom population, likely due to the effects of seasonal ice melt. In contrast, at Station 6, the proportion of littoral species increased by 32%, potentially driven by the growth of planktic and benthic species associated with ice flora.

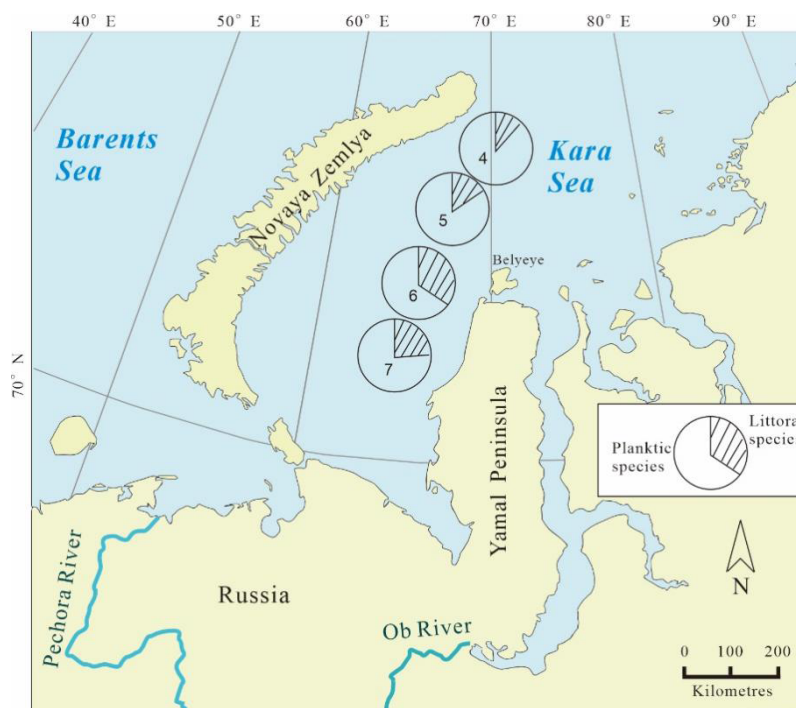


Figure 4. Composition of diatom species in surface samples collected from the Kara Sea according to the habitat

3.3. Coastal benthic diatoms

Coastal benthic diatoms were predominantly found in the coastal waters surrounding deltas, islands, peninsulas, and shorelines. Key species identified in the bottom of coastal regions include *Aulocoseira islandica*, *A. granulate*, *Paralia sulcata*, and *Delphineis*. Previous studies have highlighted that *Delphineis* is a unique diatom species usually found near islands or attached to sand grains and other particles, which could get mixed in turbulent waters.

The results reveal that the abundance of coastal benthic diatoms increased in the regions with surface runoff near the sediments. In contrast, diatom concentrations decreased in sediments located farther from shelves, estuaries, deltas, or islands. This finding indicates that river discharge and coastal currents play a crucial role in shaping the distribution of coastal benthic diatoms, as they provide abundant nutrients from the continent that support diatom growth.

4. Discussion

Diatom growth has been significantly impacted by the perennial sea ice covering the Arctic Ocean ^[4]. Over the past 43 years, the Arctic has been warming at a rate nearly four times faster than the global average, based on multiple observational datasets covering the region. At a regional scale, areas in the Eurasian Arctic have warmed even up to seven times faster than the global rate. Between 1979 and 2021, a substantial portion of the Arctic Ocean was warming faster than 0.75°C per decade, with a maximum warming in the Eurasian sector of the Arctic Ocean, particularly near Svalbard and Novaya Zemlya ^[5-6].

Surface sediment samples from high-latitude regions of the Arctic Ocean contained a relatively low concentration of diatoms. Silty sediments from high latitude regions (stations 1–3) have a poor diatom composition, while silty sands from stations 4–7 contain a rich composition of diatoms, including both Arctic and coastal benthic diatoms. In surface sediments, the authors identified 12 diatom taxa from the class *Centrophyceae*

and 8 taxa from the class *Pennatophyceae*. The dominant centric species included *T. gravis* (8.5%–18.7%), *T. Antarctica* (7.4%–16.4%), *T. hyaline* (2.1%–7.5%), *T. nordenskioldii* (9.3%–15.2%), *T. kryophila* (5.7%–15.8%), *Porosira glacialis* (6.9%–18.7%), and *Coscinodiscus oculus-iridis* (8.7%–11.8%). Other species, such as *Melosira arctica*, *F. oceanica*, *F. cylindrus*, *Nitzschia frigida*, and *Navicula directa*, were present in low amounts.

Samples with high species content were collected from regions near the Yamal peninsula and Novaya Zemlya islands. Samples taken from stations 1, 2, and 3 mainly comprised pennatic diatoms, while samples taken from stations 4, 5, 6, and 7, located in seasonal ice-free areas, were dominated by centric diatoms. *Fragilariopsis oceanica* and *Fragilariopsis cylindrus* were the diatom species dominating in the surface sediments of the Kara Sea and sediments under ice packs [3].

Sea ice and Arctic diatoms are marine diatoms, including *T. hyperborean*, *Achnanthes taeniata*, *A. brevipes*, *D. interrupta*, *D. stroemii*, *D. smithii*, *Nitzschia hybrid*, *Amphora laevis*, and *Navicula kjellmanii*. Freshwater species included *A. islandica*, *A. granulate*, and *Amphora ovalis*. All species were present in relatively low concentrations (Figure 5). The presence of brackish water diatom species might be influenced by freshwater from melting sea ice.

The distribution of brackish water species may be significantly affected by the effect of melting sea ice. The presence of freshwater diatoms in the Kara Sea stations indicates that the diatoms survive in sea ice formed in a proximal freshwater-dominated environment, followed by a drift to the open marine areas [7].

Samples from stations 6–7 were predominantly composed of neritic species. Panthalassic species, such as *Actinocyclus curvatulus*, *Coscinodiscus oculus-iridis*, rise slowly from station 7 to station 5 at a water depth of 20–50 meters. Littoral species increased to 30% at these stations. In shallow regions of the Kara Sea, among ice diatoms, benthic coastal species were dominant, while in deep waters, planktic sea ice diatom species were dominant. Samples from stations 7 and 6 near the Byrange Plateau, coastal areas, also contained bipolar planktic species. Diatom distribution is influenced by the strong water exchange between the land rivers and the Kara Sea. Lower seawater salinity may affect the environment and sedimentation patterns in coastal areas of the Kara Sea. Among the four stations in the Kara Sea, Station 7 exhibited the lowest diatom abundance (110 frustules per gram), likely due to the dissolution of diatom valves and strong bottom currents near the Pyasina Gulf [8].



Figure 5. Diatom species composition of surface samples from the Kara Sea according to facies types

In samples from stations 4–5 located near bordering waters, littoral diatom species were abundant. In contrast, surface sediment samples from high-latitude Stations 2–3 showed a low diatom content, while diatoms are absent from Station 1. The reason for the low abundance of sea ice diatoms may be due to the influence of sea ice. The content of sea ice diatoms (*F. oceanica* and *F. cylindrus*) results from a preference for sea ice and ice packs at relatively low surface temperature ^[9–10].

Previous research showed that the sea ice is a critical factor influencing diatom distribution in the Arctic Ocean, including Greenland, Kara Sea, Bering basin, Laptev Sea, and Chukchi Sea ^[11]. Diatom growth is significantly limited in areas north of the Arctic sea ice minimum extent, where sea ice persists throughout the year ^[2]. Sea ice diatoms dominate the area along the Arctic sea ice and the minimum extent, as in the Kara Sea. Arctic water diatoms were primarily distributed in the central and northern areas between the Arctic Sea ice minimum and maximum extent, while coastal benthic diatoms were found close to the Yamal peninsula, where surface runoff or coastal current provides nutrients from the continent.

5. Conclusion

Diatom distribution patterns vary based on samples collected from surface sediments from the Kara Sea and the adjacent areas. The deep Arctic basin mainly contained pennatic diatoms, while seasonal ice-free areas are dominated by centric diatoms. *F. oceanica* and *F. cylindrus* were dominant in the surface sediments of the Kara Sea.

Sea ice influences diatom distribution in the Kara Sea and adjacent regions. Surface sediment samples from high-latitude stations, which are typically covered by Arctic sea ice, showed an absence of diatoms. In contrast, Arctic water diatoms were primarily found in the central and northern parts of the Kara Sea, while coastal benthic species were concentrated near the Yamal Peninsula.

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Disclosure statement

The authors declare no conflict of interest.

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A Brief Analysis of the Cultural Roots of Substantive Justice and Procedural Justice

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Abstract: The world economy is developing rapidly nowadays, which has led to increasingly frequent international exchanges. Currently, the number of judicial cases worldwide is gradually increasing, and it is not uncommon to see cases with similar circumstances but significantly different judicial outcomes. This clearly shows that there is still a theoretical debate in the academic circle about how to understand the concept of justice, and the same is true in the practical field. Different cultures in different countries and regions have significant differences in their understanding and practice of “justice”, which affects the focus of each country and region in pursuing justice and leads to considerable differences in judicial practice. Therefore, reaching a consensus on legal concepts is undoubtedly an important measure for resolving international judicial cases. This article first lists the concepts of substantive justice and procedural justice, which represent the different legal emphases of the East and the West. Then it analyzes their differences, and finally explores the cultural roots of substantive justice and procedural justice in history, geography, religion, philosophy, etc. And it finally concludes that the two need to learn from and complement each other in the modern legal system.

Keywords: Substantive justice; Procedural justice; Cultural roots

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1. Introduction

The traditional civil law system represented by China emphasizes “substantive justice”, that is, the judgment is based on whether the result conforms to morality and substantive fairness. While the common law system represented by the UK and the US advocates “procedural justice”, that is, ensuring the fairness of the trial process through strict procedural rules. This article hopes to analyze the cultural roots that led to the emergence of substantive justice in China and procedural justice in the West by comparing the specific differences in legal concepts reflected in Chinese and Western dramas and real cases. The Chinese civilization can be traced back to the Xia Dynasty or even earlier, with a history of more than 5,000 years. The generally recognized Western civilization history starts from ancient Greece and is nearly 3,000 years. In the course of history, both China and the West have formed their own legal systems. After a simple review, the author finds that the legal systems of

China and the West have both been influenced by their respective history, geography, religion, philosophy, etc. It is hoped that through an in-depth understanding between China and the West, different countries and regions can reach a basic consensus on judicial concepts and practices. In the future, through global governance, international disputes can be resolved more easily, and the impact of international disputes on both sides can be minimized as much as possible.

2. Basic theoretical overview

2.1. Substantive justice

The comparison of the two judicial practices only needs to explore the differences between the two terms, namely “substance” and “procedure.” “Substance” is not an obscure word in both Chinese and Western contexts. Simply put, what can be seen and touched is substance. Substantive justice is the justice that everyone can see, and the most direct manifestation in judicial practice is the judgment result.

Substantive justice refers to the judicial subject determining, adjusting, and regulating the rights and obligations of the parties in the judicial practice process according to the good law that reflects the general justice of the substance, so that the judgment result is reasonable and moral. And by achieving individual justice in substance, a good social order is ultimately formed ^[1].

Overall, substantive justice not only pays attention to the legality of the judgment result but also has certain pursuits in terms of rationality. The majority of people believe that the court’s judgment should be recognized by the majority of the people, and the justice result should be obtained as it should be, so that “good people are rewarded and bad people are punished”, and the rights and obligations enjoyed by each person are proportional. The process of achieving this result is relatively secondary ^[2]. That is, it focuses on the substantive fairness of legal decisions and uses whether the result conforms to moral ethics and social justice as the criterion for judgment.

2.2. Procedural justice

“Procedure” is often understood in a general context as a specific process, a way or means to achieve a certain purpose. Procedural justice emphasizes that in judicial practice, the process of obtaining a certain judgment result must be legal, and the minor problems in the process should not be ignored in order to achieve efficient justice.

In his book *The Theory of Justice*, American scholar Rawls systematically described procedural justice. He believed that there is no independent standard for the legitimacy of results, but only an independent standard for the legitimacy of the process that leads to the results, that is, procedural justice. Legal procedures are established to safeguard procedural values such as participation, fairness, and human dignity, which are independent of the judgment results ^[3]. In the common law countries, the prevailing view is that they would rather enforce a harsh law through a fair procedure than enforce a lenient law through an unfair procedure ^[4]. The British legal maxim “Justice must not only be done but must be seen to be done” also confirms the importance of procedural justice in Western legal concepts.

In judicial practice, the specific manifestation of procedural justice is that judicial organs should apply the law in accordance with the prescribed rules and procedures, promote the litigation process, and ensure that the parties’ litigation rights are fully exercised and not improperly infringed upon during this process. Even if the litigation affairs are complex, there are many relevant personnel, and the types of rights are rich, the court must strictly follow the established procedures to conduct trial activities and pay attention to that each step has a basis in

existing legal regulations.

2.3. The concept of culture and its role in law

What exactly is “culture”? There are various opinions on this, and no consensus has been reached. The author draws on the views of several scholars to try to understand the profound connotation of the word “culture.” British scholar Raymond Williams believes that “culture is one of the two or three most complex words in the English language” ^[5]. Famous cultural anthropologist Bronisław Malinowski (also translated as “Malinovsky”) believes that “culture, culture. It is easy to talk about, but it is not easy to define and describe it correctly” ^[6]. The current broad definition of “culture” refers to all human spiritual activities and their products relative to the economy and politics, which shows the richness of its connotation. This is one of the reasons why the author chose only the four cultural sub-keywords of history, geography, religion, and philosophy.

When it comes to the role of culture in law, culture is not an “entity” like the things people can perceive with their senses now. Therefore, its influence on law is subtle. It is most appropriate to use Du Fu’s “good rain” to illustrate its effect — “moistening things silently.” Law is like bamboo shoots that break through the soil only after being nourished by the spring rain of culture.

3. The manifestations of procedural justice and substantive justice in Chinese and Western dramas and reality

3.1. Drama

If justice flashes into the minds of Chinese people, the next image that comes to mind for most people is likely to be Bao Qingtian. Bao Zheng, a famous official of the Northern Song Dynasty, was known for his “keen insight.” He did not adhere to procedures when making judgments and even relied on supernatural beliefs to obtain the truth (such as in “The Case of Chen Shimei”). Although lacking modern evidence rules, because the results met the people’s expectations of “retribution for good and evil”, Bao Zheng is still regarded as the embodiment of justice to this day. The characters based on this prototype are numerous in dramas. The plots of these dramas leave the impression on the public that the lawsuit can be settled without evidence presentation, court debate, presumption of innocence, or reasonable doubt. However, it seems that the “four no’s” are not important. In the minds of the people, as long as justice can be served and the bad guys can be punished, that is enough. Although there may be some fictional elements in films and TV series, people can still see from them that the Chinese have always pursued the goal of punishing evil and promoting good since ancient times.

Looking at the film “The Gua Sha Treatment”, which involves Western law, although it is also a dramatic work, the content it presents is quite different from that in China. The characters, without understanding the traditional Chinese treatment method “Gua Sha”, took the red marks as the result of domestic violence and insisted on protecting the child. After many twists and turns, they only recognized the case after experiencing Gua Sha themselves. The process of complicating a simple situation is not easily understood by the Chinese, and some people even think it is making a fuss over nothing. However, in the eyes of foreign people, it is quite normal and naturally regarded as “due process.”

3.2. Judicial examples

The case of She Xianglin in 1994 is a typical example of substantive justice. She Xianglin was a former security patrolman at the Madian Police Station of Jingshan County Public Security Bureau. A few days after his wife’s

disappearance, a female corpse was found in the local area. The timing was so coincidental that She Xianglin was suspected of killing his wife and was even criminally detained on suspicion of killing his wife. He was sentenced to death twice. But later, due to insufficient evidence, She Xianglin escaped the death penalty. However, he was eventually sentenced to 15 years in prison and deprived of political rights for 5 years by the Jingshan County People's Court for intentional homicide. After being imprisoned for 11 years, She Xianglin's wife suddenly returned to Jingshan on March 28, 2005, and the person who was originally "dead" appeared alive before everyone. On April 13 of the same year, the case of She Xianglin's "murder of his wife" was retried. And She Xianglin, who was originally convicted of the crime, was finally cleared. At that time, this case was jokingly called "the return of the dead." In the 1980s, China's "severe and swift" approach to punishing crimes did indeed deter criminal activities in the short term, but it also led to some wrongful convictions due to simplified procedures, such as the Hu Gejile case and the Nie Shubin case.

In contrast, the famous Simpson case in the West also occurred in 1994 and lasted for 474 days. On October 3, 1995, a jury composed mostly of blacks analyzed the testimonies of 113 witnesses and ultimately declared Simpson not guilty. How could such an apparently obvious case take so long to be tried? And after a series of rigorous procedures, was the result not guilty? One important reason is that several major mistakes by the police made the originally strong evidence invalid, and these pieces of evidence were legally excluded. Simpson was acquitted of criminal charges but was found civilly liable for the deaths of the two people. Due to the flaws in the chain of evidence, Simpson was acquitted, although the public generally believed him guilty. The principle of procedural justice led to the conclusion of not guilty. This case has become the most classic case in the United States and even the world to date that embodies the principle of "innocence until proven guilty" and the exclusion of illegal evidence. Similarly, the "Miranda v. Arizona" case in the United States established the "right to remain silent" rule, which is also a powerful force in procedural justice. It ensures the procedural rights of the defendant in the form of clear regulations and, to a certain extent, prevents the judicial system from becoming a tool of "tyranny of the majority."

4. Analysis of the cultural roots of substantive justice and procedural justice

4.1. Historical factors

In ancient China, the main body governing the country for a long time was the people, with the feudal monarch being the most representative. The concept of autocratic monarchy and centralization was passed down from generation to generation among the emperors. If there were people rebelling among the common people, it would surely pose a threat to the emperor's rule. For emperors, the top priority was to minimize or eliminate the social impact of incidents rather than to clarify the ins and outs of the rebellion. During the Western Zhou Dynasty, the idea of "matching virtue with heaven" (from *Shangshu Kanggao*) bound the authority of the monarch to moral cultivation, and law was regarded as an extension of "ritual." Confucius, a great Confucian scholar, further proposed that "proper norms should be observed to uphold peace", advocating maintaining order through moral education rather than coercive measures, which could also be said to rely as little as possible on law. In the Han Dynasty, Confucian scholars judged cases based on Confucian classics, focusing on whether the motives of the crime conformed to "benevolence and righteousness" rather than strict legal provisions. Although the Legalists advocated "governing the country by law" and made some attempts, such as Shang Yang's Reforms, the essence still served the autocratic monarchy, and the instrumentalization of law was prominent. Coupled with the long-

term influence of the patriarchal system and Confucian ethics, behaviors like “punishing one’s own kin for the greater good” were praised, and such social trends implicitly strengthened substantive justice while neglecting the significance of procedure.

The main governing body in foreign countries is the law, or they have been exposed to the rule of law earlier. In 1215, the Magna Carta of England established the principle of “the king is under the law”, laying a solid foundation for procedural justice. During the reign of Henry II, England systematized local customary law through the establishment of circuit courts and the jury system, forming the “stare decisis” tradition that continues to this day. The Enlightenment further strengthened individualism, advocating the advancement of the judicial process under the premise of safeguarding individual rights, undoubtedly placing more emphasis on procedural justice. In subsequent social governance, countries in the Anglo-American legal system are adept at using more rational tools to gradually reason through cases, and procedural justice has been gradually strengthened.

4.2. Geographical factors

China has a vast territory, mostly plains, and a suitable climate. Coupled with the influence of land dependency, most people are less concerned about events outside their own “three mu and a paddy field.” Additionally, due to geographical and family community consciousness, even major events can be basically determined within a certain range through relatively simple investigations, without the need to resort to law. Just as Mr. Fei Xiaotong described in *From the Soil*, the rural atmosphere in China leads to most conflicts being resolved through clan mediation rather than involving third parties outside the family.

In contrast, most Western countries have limited land, and some are close to the ocean, with limited access to production materials. For the survival and development of individuals and the country, they had to “leave” the continent and head to the ocean. As a result, the interpersonal relationships involved are more complex than in China. When encountering an incident, Western countries cannot determine the individuals involved in a short time, and even the scope cannot be narrowed down. The marine commercial civilization has fostered individual independence. For example, the *Twelve Tables* of ancient Rome already stipulated individual property rights, and modern law continues the “individualism” approach, such as the French *Civil Code*, which allows couples to agree on separate property systems. With more regulations, naturally, there are more disputes. Without strict legal procedures, the consequences for Western countries today would be unimaginable.

4.3. Religious factors

In China, the proportion of religious components is relatively small, and many doctrines mention the people. However, at that time, “the people” was more of a political concept, and disputes among the common people did not receive much attention from the rulers. They themselves also ignored the process of disputes; as long as the result was reasonable, the process seemed dispensable. Even if emperors and ministers intervened to mediate, it was only to maintain and consolidate their rule, without considering the respect and protection of individual rights in the process.

In Western countries, most members have religious beliefs. For example, the Christian concept of “all men are equal before God” has significantly enhanced people’s awareness of protecting their own rights. In such a religious environment, both organizations and individuals are well aware of the boundaries of their rights, and thus are more cautious when exercising them to avoid unnecessary trouble for themselves. Furthermore, the secular rational tradition in Roman law and the Protestant ethic have also subtly influenced the development of the capitalist rule

of law. Weber believed that formal rationalization is a prominent feature of Western society, especially in the legal field. A formally rationalized legal system has clear rules and procedures that are universally applicable and do not change due to the emotions or will of any individual. This legal system emphasizes logical consistency, efficiency, and predictability, enabling people to anticipate the consequences of their actions and plan accordingly.

4.4. Philosophical factors

China has been influenced by the Confucian concept of “family and state as one” for a long time, with emperors particularly emphasizing the foundation of social order. The Daoist concept of “harmony” supports mediation systems, where both parties reach an agreement and reconciliation either through their own efforts or with the help of a third party. This approach does not focus on sorting out the specific causes, processes, and results of events, nor does it pay attention to the concept of procedural justice.

In the West, the contract theory of Locke and Rousseau holds that law is the product of citizens’ transfer of rights, and the fairness of procedures is the prerequisite for the legitimacy of a regime. Kant’s theory of “human dignity” promotes the supremacy of individual rights. For instance, it cannot be recognized that the state infringes upon individual rights when exercising public power. From the above-mentioned theoretical propositions, it is not difficult to see that procedural justice in Western countries is deeply influenced by philosophical factors.

5. Conclusion

Emphasizing substantive justice can achieve the fairness and justice that the general public believes in relatively short time, and meet the moral demands of the majority of society members. However, subjective judgment has a significant influence on the trial process, and individual rights may not be given sufficient attention. Emphasizing procedural justice ensures that the judiciary remains as neutral as possible, prevents the abuse of public power, and keeps power within the cage of institutions. However, it may lead to an unjust outcome due to the prolonged trial process, tolerate crimes, and even help some people escape punishment. But substantive justice and procedural justice are not opposing sides; rather, they are like the two wheels of a car or the two wings of a bird. The differences in the focus of Chinese and Western laws ultimately stem from the divergence of cultural paths.

With the increasing frequency of cultural exchanges between China and the West, their legal concepts have influenced each other. The concept of “emphasizing substantive justice while neglecting procedural justice” in China has gradually weakened. In 2012, the *Criminal Procedure Law of the People’s Republic of China* was revised to introduce the exclusionary rule for illegally obtained evidence and restrict torture for confessions, demonstrating an increased emphasis on procedural justice. However, there may still be cultural resistance to the full development of procedural justice in China. Countries that prioritize procedural justice are also gradually considering substantive justice. For instance, to avoid excessive sentencing disparities, the United States has established sentencing guidelines, and the federal courts have restricted judges’ discretionary power through quantitative standards. The United Kingdom has a “public interest immunity” system, allowing the government to apply for non-disclosure of sensitive evidence in counter-terrorism cases to balance procedural justice and national security.

However, achieving a certain balance between the two still requires continuous efforts. Although the differences between substantive justice and procedural justice originate from cultural genes, in the era of globalization, a single model cannot meet the complex social demands. Substantive justice and procedural

justice should complement each other, and to achieve this goal, it is necessary to review traditions with historical rationality, incorporate substantive considerations into the procedural framework, and improve the procedure under the substantive goals. Through innovation, a cross-cultural legal dialogue that “seeks common ground while reserving differences” should be realized. China and foreign countries should learn from each other and jointly strive for a better legal blueprint. The legal systems of the East and the West should draw on each other, such as paying attention to the design of evidence rules and the consideration of judges’ discretionary power, to jointly promote the formation of a new judicial paradigm that takes substantive justice as the core and procedural justice as the means in the world.

Disclosure statement

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Study on Performance Evaluation of Process Management of State-owned Assets in Colleges and Universities

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Abstract: The performance evaluation of process management of state-owned assets is a key link in measuring the quality of asset management in colleges and universities. It is conducive to optimizing resource allocation, laying a solid foundation for the educational reform of colleges and universities, and promoting the high-quality development of higher education. This article expounds on the importance of optimizing the performance evaluation model for the process management of state-owned assets in colleges and universities, clarifies the evaluation indicators, and elaborates from four aspects: improving the performance evaluation system for state-owned asset management, defining performance evaluation indicators, cultivating a professional management team, and advancing digital transformation. The purpose is to improve the performance evaluation system for the process management of state-owned assets in colleges and universities and lay a good foundation for the educational reform of colleges and universities.

Keywords: Colleges and universities; State-owned assets; Process management; Performance evaluation

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1. Introduction

In 2021, the State Council promulgated the Regulations on the Management of State-owned Assets of Administrative Institutions, which clearly states: “All departments and their subordinate units shall establish a performance management system for state-owned assets in accordance with national regulations, improve performance indicators and standards, and carry out the performance management of state-owned assets in an orderly manner.” Against this background, colleges and universities should attach importance to the process management of state-owned assets, build a sound performance evaluation system for the process management of state-owned assets, conduct objective and scientific process-based performance evaluation on their state-owned assets (including current assets, external investments, fixed assets, intangible assets, and projects under construction), and implement the evaluation principles of scientificity, dynamism, and orientation. This will help

to timely identify and solve problems existing in the performance evaluation of state-owned asset management, and provide support for the management of state-owned assets in colleges and universities.

2. The importance of constructing a performance evaluation system for state-owned asset management in colleges and universities

2.1. Providing data reference for state-owned asset management in colleges and universities

Against the backdrop of the state's continuous increase in investment in higher education, the types and quantities of state-owned assets in colleges and universities have been constantly growing. State-owned asset management has thus exhibited characteristics such as complexity and dynamism, which have virtually increased the difficulty of managing state-owned assets in these institutions ^[1]. Therefore, constructing a process-based performance evaluation system for state-owned asset management is imperative. This system is conducive to the process-based management of state-owned assets in colleges and universities (including fixed assets and intangible assets), as it can objectively and comprehensively reflect the problems existing in the current process-based management. It further provides data reference for the management of state-owned assets in colleges and universities, helps school management clarify the direction of process-based management of state-owned assets, and ultimately enables the achievement of the goal of connotative development of higher education.

2.2. Optimizing the allocation of state-owned asset resources in colleges and universities

Process-based management of state-owned assets in colleges and universities refers to the dynamic management of assets throughout their full life cycle, from allocation and use to disposal. It involves gradually standardizing the management processes of each link, promptly addressing problems arising in the management process, and achieving efficient utilization, preservation, and appreciation of state-owned assets. Therefore, colleges and universities should base themselves on the characteristics of their own state-owned assets, develop tailor-made state-owned asset management plans, and leverage new technologies such as big data and artificial intelligence to realize dynamic management of state-owned assets. They should also ensure a good connection between various links of asset management to meet the needs of teaching, research, and other undertakings, thereby improving the quality of education and teaching ^[2].

2.3. Enhancing the risk prevention and control capacity of state-owned asset management in colleges and universities

Process-based management performance evaluation of state-owned assets enables systematic, comprehensive, and categorized supervision of state-owned assets in colleges and universities. By establishing performance evaluation indicators, it can accurately reflect problems existing in the processes of asset allocation, utilization, and disposal. This assists schools in promptly adjusting their state-owned asset management methods, thereby preventing the misappropriation or embezzlement of state-owned assets and enhancing the schools' risk prevention and control capacity for state-owned assets. Furthermore, process-based management performance evaluation can help schools reduce unnecessary costs and lower the expenses associated with state-owned asset management ^[3]. For instance, a school can formulate procurement plans based on its program offerings, as well as teaching, research, and academic needs, and dynamically adjust the amount of procurement funds. This avoids redundant procurement, ensures fund security, and contributes to promoting the sustainable development of colleges and universities.

3. Performance evaluation indicators for process management of state-owned assets in colleges and universities

The process management of state-owned assets in colleges and universities runs through the entire process of asset allocation, utilization, and disposal, enabling full-life-cycle and dynamic management. Therefore, the performance evaluation indicators for the process management of state-owned assets reflect characteristics such as dynamism, comprehensiveness, and systematization, including the following evaluation indicators:

3.1. Asset efficiency

Asset efficiency is a first-level indicator for the performance evaluation of state-owned asset process management in colleges and universities, which clarifies the direction of performance evaluation. From the perspective of asset efficiency, university management takes factors such as asset scale and structure, asset preservation, and asset utilization as performance evaluation indicators, thereby conducting a comprehensive performance evaluation of the allocation, utilization, and disposal processes of state-owned assets. Asset efficiency helps colleges and universities conduct objective evaluations on indicators such as the non-performing asset ratio, state-owned debt ratio, and fixed asset growth rate, thereby improving the quality of performance evaluation for the process management of state-owned assets in schools ^[4].

3.2. Asset benefits

When state-owned assets are invested in the educational management of colleges and universities, they generate certain economic benefits. For example, assets leasing and investment can help colleges and universities increase their economic income. Therefore, colleges and universities should incorporate the asset benefits of state-owned assets into the process management performance evaluation system, and evaluate their own disciplinary achievements, investment returns, and talent development. Through this, they can promote educational reform and improve the quality of talent development.

3.3. Financial management

For the performance evaluation of process management for state-owned assets in colleges and universities, financial management data should be selected. Emphasis should be placed on collecting and analyzing financial data during the asset use and disposal stages. Based on real data, indicators such as the utilization rate and return rate of state-owned assets are evaluated to dynamically adjust the management methods of state-owned assets and further improve the quality of state-owned asset management ^[5]. For example, colleges and universities should establish asset use management systems, clarify the asset use responsibilities of various departments, refine data related to asset registration and maintenance, conduct regular inventory checks, and implement asset sharing and common use, so as to avoid the idleness of state-owned assets. They should also strengthen supervision over the asset disposal stage: starting from links such as asset scrapping and transfer, they need to effectively supervise processes including asset evaluation, approval and filing, and accounting treatment, thereby improving the utilization rate of state-owned assets.

3.4. Budget management

Under the new situation, the integration of asset management and budget management in colleges and universities is an inevitable trend. The integration of the two enables real-time and full-process supervision over the process management of state-owned assets, allowing for the timely identification of existing loopholes in state-owned

asset management, thereby improving the quality of state-owned asset management. For instance, the financial departments of colleges and universities should conduct feasibility studies on asset allocation, effectively improve the utilization efficiency of state-owned assets, and control management costs. They must not only meet the needs of teaching, scientific research, and administrative work but also keep procurement costs under control. Additionally, they should standardize such links as procurement application, feasibility studies, budget formulation, procurement, and warehousing management, thereby avoiding the problem of state-owned asset waste ^[6].

4. Strategies for performance evaluation of process management of state-owned assets in colleges and universities

4.1. Improve the system for performance evaluation of process management of state-owned assets in colleges and universities

A sound performance evaluation system is a crucial guarantee for the effective implementation of state-owned asset management in colleges and universities, and also an important driving force for promoting the reform of teaching and scientific research. Therefore, colleges and universities should, based on their own needs for state-owned asset management, formulate a sound system for the performance evaluation of state-owned asset process management, clarify the principles and objectives of performance evaluation, comprehensively assess the needs of teaching, scientific research and administrative management, quantify performance evaluation indicators, and ensure the smooth implementation of the performance evaluation work for state-owned asset process management ^[7]. First, in the performance evaluation of state-owned asset process management, colleges and universities should adhere to the principles of dynamism and systematization. They should adjust performance evaluation indicators according to the process of allocation, use, and disposal of various types of state-owned assets, make real-time dynamic adjustments to performance evaluation indicators and methods, and gradually improve the performance evaluation system for state-owned asset process management. For instance, colleges and universities can establish a linkage mechanism between state-owned asset process management and budget performance management, analyze and evaluate data such as asset allocation, asset use, and budget execution, and enhance the scientific nature of the performance evaluation of asset process management. Second, colleges and universities should clarify the responsibilities for state-owned asset process management, link performance evaluation with the assessment mechanisms of various departments and individuals, and strengthen the awareness of state-owned asset process management among all departments and staff, thereby improving the quality of state-owned asset process management. For example, colleges and universities should define the responsibilities of financial departments, administrative departments, teaching and research sections, and individuals in the performance evaluation of state-owned asset process management. They should also link state-owned asset process management with departmental performance, individual performance, and professional title promotion, so as to stimulate the awareness of conservation among users and managers of state-owned assets and improve the utilization rate of state-owned assets.

4.2. Clarify performance evaluation indicators for process management of state-owned assets

Colleges and universities should formulate evaluation indicators in accordance with the principles and objectives of performance evaluation for the process management of state-owned assets, define such indicators for the three phases of asset allocation, utilization, and disposal, and refine the evaluation of processes, including

the procurement, utilization rate, return rate, and maintenance of state-owned assets. This enables the timely identification of problems in process performance evaluation, thereby providing accurate data support for the university's decision-making. First, colleges and universities should develop process management performance evaluation indicators based on the characteristics of the state-owned asset acquisition phase, taking the input dimension and process dimension as evaluation indicators. Among these, the input dimension mainly includes the budget execution rate for asset acquisition (actual acquisition amount / budgeted acquisition amount \times 100%) and the acquisition cost per unit asset (total acquisition amount of a certain type of asset / quantity of that type of asset acquired); the process dimension includes the completion rate of acquisition plans (quantity of assets actually acquired / planned quantity of assets to be acquired \times 100%) and the approval rate of feasibility studies (number of acquisition projects approved through feasibility studies / total number of acquisition projects \times 100%). Second, the performance evaluation indicators for the utilization phase of state-owned assets in colleges and universities cover four dimensions: input, process, output, and effectiveness. Among these, the performance evaluation indicators for the input phase are further refined into the proportion of asset maintenance costs and the allocation rate of asset management personnel; the process dimension of performance evaluation is refined into the completeness rate of asset registration, the accuracy rate of regular inventory checks, and the asset sharing rate; the output dimension of performance evaluation indicators is refined into the asset utilization frequency and the operation rate of large-scale instruments and equipment; and the effectiveness dimension of performance evaluation is refined into the satisfaction with asset utilization and the output rate of scientific research achievements. Third, the performance evaluation for the disposal phase of state-owned assets in colleges and universities covers three dimensions: process and output. Among these, the process dimension of performance evaluation indicators is refined into the compliance rate of disposal procedures and the timeliness rate of disposal approval; the output dimension of evaluation indicators is refined into the recovery rate of disposed assets ^[8].

4.3. Cultivate a professional team for state-owned asset management

A team of talents with solid professional skills, outstanding practical capabilities, and high professional ethics serves as a crucial guarantee for improving the level of state-owned asset management in colleges and universities. Therefore, colleges and universities should attach importance to the cultivation of talents in state-owned asset management. On one hand, they should proactively recruit and introduce professionals in fields related to state-owned asset management, establish an independent department for state-owned asset management, and coordinate the implementation of state-owned asset management work. On the other hand, the universities should actively organize relevant training on process management and performance evaluation of state-owned assets, systematically explain professional knowledge such as process management and performance evaluation, and enhance the state-owned asset management capabilities of relevant staff. For instance, a university may organize "online + offline" state-owned asset management training: online training mainly consists of expert lectures, where experts explain laws and regulations related to state-owned asset management, process management methods, and performance evaluation systems to heads of various departments, financial management personnel, and administrative staff, and answer relevant questions from the university's staff online to help them solve problems encountered in the process management and performance evaluation of state-owned assets ^[9]. Offline training focuses on "practical simulations", organizing state-owned asset management competitions among various departments to assess the capabilities of relevant departments and staff in state-owned asset management and performance evaluation. This helps strengthen the sense of responsibility and mission of the relevant staff,

deepen the reform of process management and performance evaluation of state-owned assets in colleges and universities, and lay a solid foundation for teaching reform and scientific research. In addition, universities should also incorporate state-owned asset management and performance evaluation into the professional title promotion of relevant departments and individual performance assessments. This measure aims to motivate the enthusiasm of relevant staff to learn professional knowledge in state-owned asset management and performance evaluation, promote the development of their comprehensive abilities, and enable them to be competent in the work of process management and performance evaluation of state-owned assets.

4.4. Promote digital reform of performance evaluation for state-owned asset process management

With the rapid development of new technologies such as artificial intelligence, big data, and cloud computing, the performance evaluation of state-owned asset process management in colleges and universities is gradually transforming toward intelligence and digitalization, which effectively improves the quality of state-owned asset management. First, colleges and universities should build a digital state-owned asset management platform to realize real-time supervision over the entire process of state-owned asset procurement, use, and disposal. This platform facilitates data sharing on asset usage and the submission of online applications among departments, including procurement, administration, teaching, and research, and scientific research. By enabling such data sharing, the platform ensures the authenticity of data related to state-owned asset process management and provides accurate data support for performance evaluation. Through the digital management platform, teaching and research sections, as well as laboratories, can submit applications for equipment procurement, maintenance, and scrapping. This allows relevant departments to conduct online approvals, simplifies the processes for equipment procurement, maintenance, and scrapping, and records data such as the asset utilization rate and maintenance rate of each department, laying a solid foundation for the performance evaluation of state-owned asset process management. Second, the state-owned asset management departments of colleges and universities can use big data to extract data from the digital platform, classify the data, and intelligently analyze the data of each department regarding the allocation, use, and disposal of state-owned assets. This enables objective performance evaluations, timely identification of existing problems, and supervision of relevant departments to rectify these issues. In turn, this improves the efficiency of state-owned asset management and prevents the waste and loss of state-owned assets^[10]. In addition, state-owned asset management personnel can set standard values for the allocation, use, and disposal phases of state-owned assets based on historical data. Once the actual data exceeds these standard values, the digital platform will automatically issue alerts, reminding relevant supervisors to review the state-owned asset management process. This facilitates more comprehensive performance evaluations and comprehensively enhances the quality of performance evaluation for state-owned asset process management in colleges and universities.

5. Conclusion

In conclusion, colleges and universities should attach importance to the process management of state-owned assets, establish a sound performance evaluation system, and implement the management philosophy of increasing revenue and reducing expenditure, as well as thrift and frugality. They should gradually improve the utilization rate and return rate of state-owned assets, lay a solid foundation for teaching reform, scientific research, and

administrative management, and promote the high-quality development of higher education. Colleges and universities need to improve the performance evaluation system for the process management of state-owned assets, clarify the principles and objectives of performance evaluation, scientifically divide the performance evaluation responsibilities of various departments, define the performance evaluation indicators for the process management of state-owned assets, refine and quantify the performance evaluation indicators, strengthen the training on state-owned asset management and performance evaluation, and cultivate a professional team for state-owned asset management. In addition, colleges and universities should promote the digital reform of performance evaluation for the process management of state-owned assets, use big data to realize real-time supervision of the process management of state-owned assets, conduct accurate analysis of data at various stages, identify existing problems, carry out targeted rectification, and comprehensively improve the quality of performance evaluation for the process management of state-owned assets in colleges and universities.

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The Impact of Social Media Use on Teens' Health: A Literature Review

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Abstract: This literature review examines the multifaceted impact of social media on adolescents' health, focusing on physical and psychological domains. Drawing from 36 peer-reviewed studies (2015–2025), the analysis reveals that excessive social media use is associated with sleep disruption (e.g., poor quality, reduced duration, and procrastination), sedentary behavior, and physical health complaints (e.g., headaches, neck pain). Psychologically, it correlates with heightened anxiety, depression, body image issues, and addictive behaviors, exacerbated by cyberbullying and Fear of Missing Out (FOMO). However, social media also offers benefits, such as social connectivity and educational resources. The review highlights interventions like digital wellness education, parental guidance, and policy measures to mitigate harms while preserving benefits. Limitations include cultural biases and rapidly evolving platforms, underscoring the need for cross-cultural and longitudinal research.

Keywords: Social media; Adolescent health; Mental health; Sleep disruption; Body image; Cyberbullying; Fear of Missing Out (FOMO)

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1. Introduction

Social media has become an integral part of modern adolescent life, with platforms like Instagram, TikTok, Snapchat, and YouTube shaping how young people communicate, learn, and perceive the world. Recent studies in the US indicate that most teens use social media and have a smartphone, and nearly half say they're online almost constantly, according to a new Pew Research Center survey of U.S. teens aged 13 to 17 conducted in 2024^[1]. While these platforms offer opportunities for self-expression, social connection, and educational engagement, their pervasive influence raises significant concerns about their impact on adolescents' physical, psychological, and social well-being.

Adolescence (ages 11–18) is a critical developmental period marked by heightened neuroplasticity, identity formation, and susceptibility to external influences^[2]. During this stage, excessive social media use has been linked to sleep deprivation, sedentary behavior, anxiety, depression, and body image issues^[3]. The addictive design of

social media, characterized by infinite scrolling, algorithmic personalization, and intermittent rewards, exploits adolescent neurobiology, reinforcing compulsive use ^[4].

Furthermore, the displacement hypothesis suggests that time spent online often replaces essential offline activities such as physical exercise, face-to-face social interaction, and restorative sleep ^[16].

The visual and comparative nature of platforms like Instagram and TikTok exacerbates mental health risks, as adolescents are frequently exposed to idealized, filtered representations of beauty and success, leading to social comparison and diminished self-esteem.

Additionally, cyberbullying and Fear of Missing Out (FOMO) contribute to heightened anxiety and depressive symptoms ^[5]. Despite these risks, social media also provides support networks, educational resources, and creative outlets for marginalized youth ^[6].

Given these far-reaching effects, this paper synthesizes recent research (between 2015 to 2025) to examine how social media impacts adolescents' health across the following two domains:

1. Physical health (sleep disruption, sedentary behavior, physical health complaints)
2. Psychological health (anxiety, depression, body image, addiction, and problematic use)

By analyzing these impacts, this review aims to identify interventions that can mitigate harm while preserving the benefits of digital connectivity.

2. Literature selection criteria

To ensure comprehensiveness, validity, and relevance to contemporary adolescent social media use, a rigorous selection process of the studies was implemented. Peer-reviewed articles published between 2015 and 2025 for research focusing specifically on adolescents aged 11–18 have been selected. Databases searched included PubMed, PsycINFO, and Google Scholar, using keywords such as “social media AND teen health”, “adolescent mental health AND Instagram”, and “social media effects on sleep AND teenagers.” A total of 36 studies have been selected.

3. Physical health impacts of social media use

3.1. Sleep

Sleep is a critical component of adolescent development, influencing cognitive function, emotional regulation, and physical health. However, the pervasive use of social media among adolescents has raised concerns about its negative effects on sleep quality, duration, and patterns.

3.1.1. Sleep quality

Frequent social media use, particularly before bedtime, has been significantly associated with poor sleep quality in teens ^[7]. The mechanisms of sleep disruption include the blue light emitted by screens disrupts melatonin production, a hormone essential for regulating sleep-wake cycles ^[8]. Studies also show that adolescents who use electronic devices before bedtime experience delayed melatonin onset, making it harder to fall asleep and reducing overall sleep quality ^[9].

3.1.2. Sleep duration

Studies also show that social media shortens sleep duration among adolescents. The obligation to remain

perpetually online fosters anxiety related to the “Fear of Missing Out” (“FOMO”), which compels adolescents to check their social media accounts repeatedly, even during late-night hours ^[5]. Behaviourally, FOMO may drive nighttime social media use, which delays bedtimes and restricts sleep opportunity. Cognitively, this underlying concern around the possibility of being missed out may also contribute to increased cognitive arousal before sleep (independent of how much an individual actually uses social media in bed), which further impacts sleep onset and duration.

3.1.3. Sleep procrastination

Research shows that adolescents often lose track of time while browsing social media, leading to delayed bedtimes and insufficient sleep ^[10]. In many countries, nonactive social media use among adolescents was associated with earlier bedtimes relative to active social media use ^[11]. Van den Eijnden et al. found that sleep procrastination is driven by the addictive nature of social media platforms, which are designed to maximize user engagement ^[10].

3.1.4. Health consequences of poor sleep in adolescents

Sleep deprivation and poor sleep quality have been associated with serious long-term health effects, including cognitive impairments of reduced attention span, poorer academic performance, and memory consolidation issues, increased mental health risks, including increased susceptibility to depression, anxiety, and emotional dysregulation, as well as physical health decline in relation to higher risks of obesity, insulin resistance, and cardiovascular problems due to metabolic disruptions ^[12].

3.2. Physical health complaints

Recent research highlights concerning trends in physical health complaints due to frequent use of social media among adolescents, particularly in Norway. Nilsen et al. observed a linear increase in physical health complaints, including neck or shoulder pain, headaches, and abdominal pain, among adolescents aged 13–18 ^[13]. Notably, girls reported significantly higher rates of these complaints than boys, suggesting potential gender differences in susceptibility or behavioural influences (screen use patterns, stress responses).

A related study by Frielingsdorf et al. further supports these findings by identifying a significant association between time spent on social media and daily headaches in adolescents ^[10]. This aligns with broader concerns that excessive digital engagement, particularly on platforms encouraging prolonged use, may contribute to physical strain (poor posture, eye fatigue) and stress-related symptoms.

3.3. Physical activity

The relationship between adolescent social media use and physical activity represents a complex, multidimensional phenomenon that continues to evolve with technological advancements. Current research demonstrates contradictory findings, revealing both positive and negative associations that appear heavily contingent upon several key factors: (1) the type of digital engagement (e.g., active vs. passive use), (2) intensity and duration of use, and (3) gender differences ^[14–16]. This paradoxical relationship challenges traditional displacement theories, suggesting instead a more nuanced interaction between digital and physical behaviors in adolescent populations.

3.3.1. Negative associations (Displacement Theory)

High frequency use of social media has been associated with reduced moderate-intensity physical exercise among

male middle-school students, pursuant to which, high engagement in these activities displaced time for physical activity among Korean adolescents, particularly in boys ^[16]. At the same time, problematic social media use (e.g., addiction-like symptoms) correlates with lower physical activity in the exercise domain among Canadian adolescents, suggesting displacement of voluntary activities like leisure-time workouts ^[15]. Problematic social media use would have lower odds of doing any physical activity, as well as lower odds of high engagement across all domains of physical activity ^[15].

3.3.2. Positive associations (Complementary effects)

In Canada, adolescents with intense but non-problematic social media use were more likely to meet national physical activity guidelines than those with either minimal or addictive usage patterns ^[15]. Explanations offered include that highly social individuals may use platforms to connect with peers who encourage active lifestyles (e.g., joining fitness challenges, sharing workout routines).

3.3.3. Gender differences

In Korea, boys who frequently played internet games or watched game streams had significantly lower physical exercise rates, whereas girls showed no association ^[16].

4. Psychological health impact of social media use

The rise of social media has significantly altered communication among adolescents, presenting both opportunities for connection and risks for mental health in various aspects. Studies indicate that excessive use of platforms like Facebook, Instagram, and Twitter correlates with higher rates of depressive symptoms and psychological distress ^[17].

4.1. Depression and anxiety

Extensive research has established a concerning link between social media use and increased rates of depression and anxiety among adolescents. A key factor in this relationship is the amount of time spent online, with studies showing that adolescents who engage with social media for more hours report significantly higher levels of psychological distress compared to those with more limited usage ^[18]. Excessive time spent on social media can contribute to feelings of loneliness, which exacerbate anxiety and depressive symptoms ^[17].

Research also highlights the role of cyberbullying in promoting mental health issues. Victims of online harassment report significantly higher levels of anxiety and depression compared to their peers ^[19].

4.2. Body image and self-esteem

Social media exerts a powerful influence on adolescents' body image perceptions and self-esteem development ^[20]. Platforms that emphasize visual content, such as Instagram and TikTok, are saturated with images promoting unrealistic beauty standards, often enhanced through filters and digital editing tools. For young people in the critical stage of identity formation, constant exposure to these idealized representations can lead to significant body dissatisfaction and disordered eating behaviors ^[21].

Appearance-focused activities on social media, including posting selfies, comparing oneself to influencers, and seeking validation through likes and comments, have been particularly associated with negative outcomes ^[22]. Research indicates that girls and young women are especially vulnerable to these effects due to societal pressures emphasizing female appearance ^[22].

4.3. Addiction and problematic use

The phenomenon of addiction problematic social media use has gained attention as a significant factor influencing mental health. Problematic social media use is characterized by an irresistible urge to use social media, leading to negative consequences in various life domains^[17]. Characterized by compulsive checking, withdrawal symptoms when offline, and neglect of real-life responsibilities, problematic social media use shares neurological similarities with substance addiction^[23–24].

Studies show that adolescents with high levels of social media addiction experience increased symptoms of depression and anxiety, often exacerbated by feelings of isolation and low self-esteem^[19].

FOMO serves as a primary driver of compulsive social media behaviors when adolescents constantly monitor their feeds to stay updated on peers' activities, creating a state of chronic hyper-awareness that can lead to significant stress and anxiety^[5].

4.4. Social connectedness

While social media can facilitate physical activity by enabling peer support for sports (e.g., organizing team events), social isolation from non-active users (those avoiding social media) correlated with lower activity levels, suggesting digital exclusion reduces access to active peer networks^[15, 25]. This is consistent with previous studies that one of the most well-known benefits of social media is social connection, in which 81% of students say it boosts their sense of connectedness to others and improves well-being. Social media can be used to increase acceptance or a feeling of community by providing adolescents with opportunities to connect with others who share their interests, beliefs, and experiences^[26].

5. Addressing the physical and psychological impact of frequent social media use on adolescents

The multifaceted challenges posed by social media to adolescent health demand a comprehensive approach that balances risk mitigation with the preservation of digital opportunities^[19]. Addressing these issues requires developmentally appropriate interventions at individual, familial, educational, and policy levels.

5.1. Physical health impacts

To address sleep disruption, adolescents should limit screen time before bedtime, as blue light from devices disrupts melatonin production and delays sleep onset^[8]. Tools like iOS Screen Time or Android Digital Wellbeing can help enforce boundaries, while blue light filters (e.g., Night Shift) may reduce eye strain and improve sleep quality^[27].

Schools and parents should educate teens about the risks of “sleep procrastination” caused by social media’s addictive design^[10]. Encouraging a “no-screen” rule an hour before bed and replacing social media with calming activities (e.g., reading) can further support healthy sleep habits.

For physical health complaints such as headaches and neck pain, ergonomic adjustments and regular breaks are essential. The 20-20-20 rule—looking at something 20 feet away for 20 seconds every 20 minutes—can alleviate eye strain^[28]. Additionally, promoting physical activity can counteract sedentary behavior linked to prolonged social media use. Research suggests that active engagement (e.g., fitness challenges) may increase physical activity, whereas passive scrolling displaces exercise^[15]. Schools can integrate movement breaks into daily routines to mitigate these effects.

5.2. Psychological health impacts

To combat depression and anxiety, mindful social media use is critical. Curating feeds to avoid negative content and scheduling digital detoxes can reduce psychological distress^[17]. Cyberbullying, a key contributor to anxiety, requires proactive measures such as school-based counseling and anonymous reporting tools^[19]. Encouraging offline social interactions may also lessen reliance on virtual validation.

Body image issues stem from exposure to idealized beauty standards on platforms like Instagram and TikTok. Media literacy programs can teach adolescents to critically analyze edited images, while promoting body-positive content may improve self-esteem^[22]. Parents and educators should emphasize self-worth beyond appearance and encourage hobbies that foster confidence.

Problematic use and addiction can be addressed through self-monitoring tools and behavioral changes. Studies compare social media addiction to substance dependence, noting similar neurological mechanisms^[24]. Encouraging teens to track usage and set limits can reduce compulsive behaviors, while tech-free zones at home can strengthen real-world connections^[7].

5.3. Systemic and policy level solutions

Schools should integrate digital wellness education into curricula, covering topics like healthy screen habits and online safety. Social media platforms must also take responsibility by implementing features that discourage excessive use, such as default time limits^[11]. Policymakers could advocate for regulations that protect adolescent users, while parents can utilize a monitoring app to guide usage without invading privacy.

6. Limitations of this review

While this review focused on studies published between 2015–2025, the rapid evolution of social media platforms (e.g., the rise of TikTok after 2018) means some findings may already be outdated. Longitudinal effects of newer platforms remain understudied.

The majority of included studies focused on Western, high-income populations, limiting generalizability to low-resource or non-Western contexts where social media use patterns may differ. For example, cultural norms around body image or sleep habits vary significantly across regions.

Study designs of the included studies vary (e.g., self-report surveys vs. objective screen-time tracking). Not all studies employed experimental or longitudinal designs to establish causality.

7. Directions for future research

Further research may explore the cross-cultural impacts of social media use by examining how cultural values (e.g., collectivism vs. individualism) moderate social media's effects on self-esteem or sleep. Studies may consider including underrepresented regions (e.g., Africa, South Asia) to address current biases in research.

Protective factors, including moderating variables that buffer against social media's negative effects, are currently understudied. This can include an examination of how different parenting styles (e.g., active co-viewing vs. restrictive monitoring) may influence the impact of social media use on adolescents.

Disclosure statement

The author declares no conflict of interest.

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From “Streamlining Administration” to “Good Governance”: “Credit +” Reform Empowers Modernization of Government Services and Grassroots Governance in Zhucheng City

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Abstract: This article takes the “Credit +” reform in Zhucheng City as an example to explore how the social credit system promotes the optimization of government affairs and the modernization of governance. This research, in line with the national requirements of “streamlining administration, delegating power, improving regulation and upgrading services” and the construction of the credit system, through case and literature analysis, summarizes that it is based on the credit platform and achieves approval reconstruction, environmental optimization and social co-governance through measures such as credit commitment, classified supervision and “credit-based lending.” Although the reform has improved efficiency, it still faces challenges such as data privacy and the fairness of punishment. It is suggested that a hierarchical data governance, precise punishment, and intelligent approval mechanism be established to provide a reference for other regions.

Keywords: Social credit system; Modernization of national governance; Reform of “streamlining administration, delegating power, improving regulation and upgrading services”

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1. Introduction

1.1. Research background

A person without credibility is not to be known. Honesty and integrity play a crucial role in the operation of the market economy and the formation of social order. Improving the social credit system is not only of great significance for promoting the development of the market economy and strengthening and improving grassroots social governance, but also a key link in advancing the reform of government services and building a law-based government. In 2014, the State Council issued the “Outline of the Social Credit System Construction Plan (2014–2020)”, which put forward top-level design requirements and clearly elevated the social credit system to the

status of a national governance tool. In January 2024, the State Council issued the “Guiding Opinions on Further Optimizing Government Services, Enhancing Administrative Efficiency, and Promoting ‘Efficiently Completing One Thing’”, making strategic arrangements for further improving the quality and efficiency of government services. The reform of government services has entered a new stage.

1.2. Research significance

In recent years, Zhucheng City has focused on the pain points and difficulties faced by enterprises and individuals in handling affairs and starting businesses, actively deepened the “streamline administration, strengthen regulation and improve services” reform, promoted the in-depth integration of credit and administrative approval, and deepened the application of credit information. Credit plays a significant role in grassroots governance. It can not only optimize the approval process and enhance administrative efficiency, but also make governance more efficient and convenient. It can also enhance governance efficiency, strengthen trust between the government and all sectors of society, and stimulate social vitality. This article takes the “credit + approval” reform in Zhucheng as an example to provide a reference for other regions.

2. Theoretical basis and literature review

2.1. The concept and connotation of credit

The social credit system is a key institutional innovation in modern governance, with “credit” at its core. The cultural roots of the concept of credit in China and the West are different: In traditional Chinese culture, “keeping promises and fulfilling commitments” is regarded as an ethical criterion, which internally constrains and regulates behavior. The West emphasizes the guarantee of credit for transaction contracts and has developed technical rationality. This has influenced the contemporary theoretical construction. Zhou Ronghua and Li Xin proposed a three-dimensional credit analysis framework, and Wu Jingmei expanded the broad credit theory, dividing it into dimensions of integrity, compliance, and contract fulfillment^[1-2]. In the modernization of social governance, the functions of the credit system are complex. Li Xin confirmed that its incentive and restraint mechanism can promote the internalization of rules^[3]. The construction of China’s social credit system is unique. It not only inherits the governance wisdom of “credit as the foundation”, but also integrates technologies such as big data. Zheng Hangsheng advocated for the construction of a localized path, and Han Jiaping further deepened the “dual-wheel drive” theory to build a collaborative ecosystem^[4-5]. Ma Xianguo’s three-dimensional credit engineering theory integrates the integrity system, credit management, and transactions into the system, providing a methodology for the challenges of data governance^[6].

2.2. Social capital theory

Social Capital is an intangible resource embedded in social relationship networks, covering trust, reciprocal norms, etc. It can enhance the efficiency of collective actions, reduce transaction costs, and generate economic and social benefits. Bourdieu first systematically proposed this concept, emphasizing its instrumental nature, that is, individuals profit through relationship networks^[7]. Coleman believes that it is a social structural attribute with the characteristics of public goods, such as community norms that restrain members^[8]. Putnam brought it to the mainstream, pointing out that it is a combination of citizen participation networks, reciprocal norms, and trust, which is related to governance effectiveness^[9]. Fukuyama proposed the “trust radius” theory, arguing that the level of social capital depends on trust differences^[10].

2.3. The meaning of “streamlining administration, delegating power, improving regulation, and upgrading services”

The “streamlining administration, delegating power, improving regulation and upgrading services” reform is a systematic project to promote the transformation of government functions, mainly including three aspects: “Streamlining administration and delegating power” emphasizes streamlining institutions, reducing approval and administrative intervention, and promoting the transformation of the government towards macro management and supervision; The “combination of delegation and regulation” focuses on strengthening mid - and post-event supervision, and building a new mechanism based on credit, with “dual randomization and public disclosure” as the basic means and key supervision as a supplement. “Optimizing services” requires the government to enhance its service awareness, innovate service methods, and promote “Internet + government services” to provide efficient and convenient services for enterprises and the public.

3. The background of the “Credit +” reform in Zhucheng City

3.1. The political drive for deepening the “Streamline Administration, Improve Regulation, and Upgrade Services” reform

The state is promoting the “streamlining administration, delegating power, improving regulation and upgrading services” reform to stimulate market vitality. Zhucheng City’s “Credit +” reform responds to the guiding opinions of the State Council in 2019, replacing administrative intervention with a credit mechanism, reconstructing the relationship between the government and the city, and using it to replace approval materials to achieve “reducing certificates and facilitating the people.” At the same time, relevant regulations should be implemented to build a new regulatory model. As one of the first batch of provincial demonstration zones in 2018 and the fourth batch of national demonstration zones in 2023, Zhucheng shoulders the responsibility of exploring county-level credit governance.

3.2. The transformation demand of traditional governance models

Zhucheng City has launched a “credit commitment system” reform, offering “tolerant acceptance” and “simplified approval” for trustworthy enterprises, and shortening the approval time limit for 238 items. Implement differentiated credit supervision in 53 fields to enhance efficiency and reduce costs. Innovate “Credit Easy Loan” to solve the problem of difficult financing. The full-chain credit empowerment optimizes the business environment and forms a new model for high-quality development of county economies.

3.3. Technological empowerment for digital transformation

Driven by digital transformation, Zhucheng City has built a comprehensive credit governance system through technological empowerment. It has integrated over 14 million pieces of public credit information from 46 departments, solving the problem of “data silos.” It has provided real-time credit profiles for over 100,000 enterprises, with credit scores directly applied to 48 scenarios, achieving the principle of “the better the credit, the easier the business.” The credit module has been embedded in the smart urban management system, using AI to identify violations and automatically deduct points, triggering a full-process credit supervision mechanism of “SMS warning - deadline for rectification - credit repair review.”

4. Reform measures of “Credit +” in Zhucheng City

4.1. Streamlining administration and delegating power: Reducing administrative burden through credit substitution for approval

To address the issue of “information silos” in the “streamlining administration, delegating power, improving regulation and upgrading services” reform, Zhucheng City has established a public credit information platform featuring “one network, three databases, one platform and two applications”, which connects 46 departments and the provincial, municipal and county levels, and has collected over 14 million pieces of data. Zhucheng City has implemented the “credit + approval” model, introduced implementation measures, and provided real-time credit rating inquiries to facilitate A-level and above entities. Zhucheng City has also released the first batch of 238 “credit commitment” simplified approval items list to enhance approval efficiency.

4.2. Combining delegation and regulation: Precise credit-based, graded, and categorized supervision

The city has implemented “credit + supervision” in 53 fields, carrying out classified and graded supervision as well as targeted supervision. The results of credit risk classification are combined with “dual randomization and public disclosure”, and the proportion and frequency of spot checks are dynamically adjusted. Strengthen full-chain supervision and joint punishment, collect and record acts of bad faith in real time, restrict the access of bad faith entities to convenient services, and enhance regulatory efficiency.

4.3. Optimizing services: Universal release of credit benefits

Promote “credit + finance”, explore the value of credit data related to enterprises, build a financial product matrix, and establish a digital finance empowerment platform to solve the financing problems of enterprises. As of 2024, credit lines totaling 17.099 billion yuan have been granted to 381 enterprises through the “Credit Easy Loan” platform.

5. The achievements of the “Credit +” reform in Zhucheng City

5.1. Approval efficiency revolution: From “material proof” to “credit proof”

In credit governance, the government neutrally collects, manages, and discloses public credit information, providing convenience for the approval of trustworthy entities. Zhucheng City has launched the “Credit +” reform, established relevant mechanisms, relied on the platform for dynamic evaluation, taken credit ratings as the core approval basis, replaced materials with “credit endorsements”, improved efficiency, and transformed the role of the government.

5.2. Business environment optimization: Credit capitalization and market order reconstruction

Credit governance reshapes the market ecosystem through differentiated regulation and incentive compatibility mechanisms. In terms of supervision, credit classification and grading management breaks the “one-size-fits-all” approach, and does not disturb trustworthy entities without cause, reducing administrative costs and interference with business operations. Strengthen punishment for untrustworthy entities and curb opportunistic behavior. Meanwhile, financial innovations such as “Credit-based loans” have transformed credit data into credit capital, solving the financing problems of small, medium, and micro enterprises and promoting the allocation of financial

resources to shift from “collateral-dependent” to “credit-driven.”

5.3. Activation of social participation: From “government-led” to “multi-party governance”

The “Credit Plus” reform in Zhucheng City encourages social entities to participate in credit construction through an open and transparent public credit information platform. Market entities take the initiative to regulate their behaviors and participate in information sharing and punishment. Personal credit scores transform public welfare behaviors into credit capital, forming a social governance pattern where “those who keep their word benefit while those who break their word find it hard to act.”

6. Conclusion

The practice of the “Credit Plus” reform in Zhucheng City has provided important inspiration for promoting the modernization of national governance. This case demonstrates that the reform based on credit information sharing and with credit commitment and classified supervision as the core mechanism can effectively solve traditional governance problems, such as low approval efficiency and misallocation of regulatory resources, and significantly optimize the business environment and the efficiency of social governance. The key to its success lies in the deep integration of credit empowerment with government services, financial inclusiveness, and grassroots governance. This model provides a replicable and scalable practical path for other regions to promote the “streamlining administration, delegating power, improving regulation and upgrading services” reform and build a new regulatory service system based on credit.

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The author declares no conflict of interest.

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Practical Dilemmas and Practical Paths of Community Elderly Care Empowered by Digital Technology

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Abstract: At present, China has entered an aging society and shows a continuously accelerating trend. As an external supplement to family-based elderly care, community elderly care has gradually attracted attention from the academic community in recent years. With the rapid development of digital technology, new practical paths have emerged for community elderly care to meet the diversified needs of the elderly. However, in the process of practical operation, community elderly care is faced with such problems as insufficient digital literacy among the elderly, a lack of elderly-friendly product design, and inadequate data security and privacy protection, leading to insufficient empowerment of digital technology for community elderly care. In response to these issues, this study proposes practical paths from the aspects of publicity and education, institutional guarantees, product upgrading, and talent support, aiming to provide a certain reference for relevant researchers.

Keywords: Digital technology; Community elderly care; Practical dilemmas; Practical paths

Online publication: October 29, 2025

1. Practical dilemmas of digital technology empowering community elderly care

1.1. Inadequate digital literacy of the elderly

Against the backdrop of the digital age, the lack of digital literacy among the elderly not only easily leads to “derailment” in their personal social life but also restricts the improvement of community elderly care quality. Firstly, this is because the elderly have insufficient ability to accept new things and are at a loss when faced with a wide variety of emerging digital technologies. Surveys show that most elderly people cannot proficiently master various smart elderly care devices and online elderly care service platforms available on the market. For instance, smart health bracelets, which focus on real-time monitoring of the elderly’s health, can theoretically upload the elderly’s physical information (such as pulse and blood pressure) to smart clients in real time for their children

or doctors to access. However, in reality, the elderly often put these devices aside due to issues like complex connections and inconvenient operation, preventing them from fulfilling their intended functions ^[1]. Secondly, the elderly have relatively few channels and opportunities to learn digital technologies. Although some social sectors occasionally organize training activities related to digital technologies, these activities are limited by the number of participants and coverage scope, making it impossible for the elderly to acquire truly systematic and in-depth knowledge. Meanwhile, as the elderly age, their physical functions gradually decline, making them more prone to feelings of frustration when learning new knowledge. This significantly undermines their patience and confidence in learning, ultimately affecting the learning effect ^[2].

1.2. Insufficient elderly-friendly product design

Currently, although the ultimate purchasers and users of digital products for elderly care are the elderly, the designers and sellers are mainly young people. This leads to an asymmetry between supply and demand in product design, widening the digital “divide” for the elderly. Some scholars point out that, first of all, the design of operation interfaces for current digital products for elderly care is relatively complex and cumbersome—they simply enlarge the font size without resetting the logic. Secondly, their function design is rather flashy and impractical; some functions are added merely for the sake of gimmicks, while the real needs of the elderly in terms of basic functions are not met ^[3]. In addition, there is also a lack of elderly-friendly services for these products. After-sales service hotlines usually do not have dedicated service channels for the elderly, making it difficult for the elderly to obtain timely and patient answers and guidance when they encounter problems. Moreover, instruction manuals of the products often use professional terminology, and the lack of intuitive explanations makes it hard for the elderly to operate the products ^[4].

1.3. Inadequate data security and privacy protection

Existing digital technologies can obtain the elderly’s personal characteristics, financial information, and health data in real time from both hardware and software perspectives. They then use big data technology to build accurate profiles for the elderly, thereby accurately identifying the elderly’s community elderly care needs. However, in reality, on the one hand, the elderly lack data protection awareness, and on the other hand, service institutions lack sound data security protection mechanisms—this has led to the repeated occurrence of personal information leakage incidents involving the elderly. In recent years, cases of the elderly suffering from telecom harassment and telecom fraud have surged sharply, from which it is not difficult to see the current situation of insufficient data security and privacy protection faced by the elderly ^[5]. At the same time, some digital elderly care service providers lack standards and transparency in terms of data use and sharing. They may use the elderly’s personal data for commercial purposes, such as precision marketing, without fully informing the elderly. Due to their limited knowledge of digital technologies, the elderly often find it difficult to detect the improper use of their data. Additionally, in the process of data sharing, there is a lack of a clear definition of responsibilities and supervision mechanisms. Once data security incidents occur, it is difficult to hold the relevant parties accountable ^[6].

1.4. Inadequate construction of collaborative mechanisms

The collaborative supply mechanism for digital technology-empowered community elderly care is a systematic mechanism in which multiple subjects (including the government, social organizations, enterprises, communities, and the elderly) provide effective services to the elderly in communities within a standardized institutional

framework. The construction of this mechanism requires systematic thinking: in accordance with the basic principles of collaborative governance, a multi-agent collaborative engine with clear positioning and close connections among subjects should be built through the institutional design of cooperation, competition, and assessment, as well as internal vertical and horizontal information networks, covering links such as collaborative environment, collaborative motivation, collaborative process, and collaborative outcomes. This will thereby promote the transformation of digital technology-empowered community elderly care from disorder to order. In practice, however, this mechanism should cover the entire process of community elderly care. The government, based on the current development reality, should conduct corresponding collaborative actions with multiple subjects, integrate the advantages of funds, technology, and skills among these subjects, establish communication networks, coordinate interest conflicts, and ensure the satisfaction of the elderly's needs through the construction of a systematic and sound mechanism. Nevertheless, from the perspective of the current institutional design of community elderly care, it fails to give full play to the effectiveness of digital technology, resulting in the development of the community elderly care system tending to be in a static state rather than forming a dynamically collaborative mechanism with orderly circulation. Therefore, the lack of systematic thinking among responsible subjects makes it impossible to achieve overall and systematic arrangements, and essentially, it is difficult to form collaboration and coupling among multiple subjects in the supply process. The inadequate construction of collaborative mechanisms is also reflected in the uneven development of the same type of community elderly care against the backdrop of digital technology equity.

2. Practical paths for digital technology-empowered community elderly care

2.1. Strengthening digital literacy education for the elderly

First, develop diversified digital literacy training courses. As the “main coordinator” of community elderly care, communities should take the initiative to connect with relevant service institutions, senior universities, and support teams to regularly offer digital skills improvement classes for the elderly, helping them use electronic devices and online apps. For elderly people with mobility difficulties, home-based or online teaching methods can be adopted ^[7]. Second, focus on enhancing the practicality and interestingness of training. Communities can organize interactive activities such as case discussions and group competitions based on the training content to create an interesting training atmosphere, fully arouse the elderly's enthusiasm for participation, and help them effectively master and understand digital tools. In addition, the training content should be combined with the actual needs of the elderly, enabling them to truly feel the convenience brought by digital technology and improving their learning effectiveness ^[8]. Finally, to sustainably enhance the training effect, communities should timely monitor and provide feedback on the elderly's training progress, accurately understand and grasp the actual situation of the elderly using digital technology, and adjust and optimize the training content and methods in a targeted manner based on feedback. Furthermore, communities should encourage the elderly to communicate and share experiences with each other, fostering a positive learning atmosphere within the community ^[9].

2.2. Optimize and innovate the design of elderly-friendly products

The design of elderly-friendly products is an issue that most institutions or enterprises must pay attention to as society enters an aging phase (with a growing population of advanced age). First, regarding the design concept of elderly-friendly products, relevant institutions or enterprises should adhere to the people-oriented principle—

they need to put themselves in the elderly's shoes when thinking about issues, understand the real needs of elderly end-users, and clarify the underlying logic of design. Second, in terms of innovating elderly-friendly products, relevant institutions or enterprises should move beyond the traditional reliance on simple measures such as enlarging images or fonts. Instead, they should design functions tailored to different scenarios. For example, through the combination of smart wearable devices and home sensors, fall warning devices for the elderly can be developed: once an elderly person falls, the device will immediately issue a warning and send feedback to emergency contacts, ensuring that relevant responsible entities can provide timely rescue. Finally, in terms of after-sales services for elderly-friendly products, considering that the elderly may have declining learning abilities and insufficient ability to adapt to new things, relevant institutions and enterprises should provide comprehensive after-sales support. They should proactively offer after-sales solutions for the elderly, such as instructional videos (on product use), on-site services, and remote assistance ^[10].

2.3. Improve the data security assurance mechanism

In the actual operation of community-based elderly care services, the following measures should be taken: First, relevant responsible entities should formulate strict system access authorization standards, define the scope and level of operations for staff, and stipulate that only authorized personnel can query, operate, and use data within the specified scope. For instance, community doctors can only access information related to the elderly's health care, while community managers can only view service records and relevant basic information ^[11]. Second, institutions and enterprises providing elderly care services should actively adopt cutting-edge encryption technologies. Whether for data transmission or data storage, all data must be stored and transmitted in the form of ciphertext. Meanwhile, a sound data backup and recovery mechanism should be established. Third, communities should set up a data security emergency response mechanism. When a data security incident occurs, the emergency response process can be activated promptly, and effective measures can be taken to address the issue. Relevant personnel should be notified in a timely manner; the scope of impact and severity of the incident should be assessed; and corresponding measures should be implemented for remediation and prevention—all to minimize the impact of data security incidents on the rights and interests of the elderly and the operation of community-based elderly care services ^[12].

2.4. Establishing a systematic and efficient collaborative mechanism

As a basic-level public affair, digital technology-empowered community elderly care involves multiple subjects, including the government, communities, society, and the elderly. To advance this initiative, it is necessary to accurately grasp the connotation of grassroots governance. The author believes that the collaborative governance concept from the field of new public management can be introduced to build a collaborative mechanism for community elderly care ^[13]. This mainly includes four steps: establishing a collaborative motivation mechanism, improving a multi-subject decision-making mechanism, formulating a multi-dimensional incentive mechanism, and setting up a supervision and feedback mechanism. Firstly, the motivation for each subject to participate in community elderly care stems either from the pursuit of their own interests or the need to safeguard public interests. However, their specific interest demands vary across different contents and links, resulting in differences in what satisfies their needs. Therefore, the establishment of the motivation mechanism must focus on three key aspects: collaborative goals, interest incentives, and resource integration. Secondly, community elderly care concerns all members of the community. To achieve a pattern of multi-subject collaborative supply, it is essential

to develop a sound multi-subject decision-making mechanism, which includes an information sharing mechanism, a communication and negotiation mechanism, and a decision-making coordination mechanism. Thirdly, only when the participation of various subjects in elderly care service provision is encouraged and recognized can their sustained motivation to participate be maintained. Thus, targeted incentive measures should be adopted based on the nature and characteristics of different participating subjects. Finally, a systematic and efficient collaborative mechanism cannot function without supervision and feedback. Efforts can be made to build this mechanism by focusing on the development of both a supervision mechanism and a feedback mechanism^[14].

2.5. Attracting professional teams to participate

Community elderly care emphasizes the participation of multiple subjects. Against the backdrop of empowerment by digital technology, community elderly care projects should involve professional organizations in the specific design of operations. Professional organizations possess extensive industry-related backgrounds, project experience, and digital knowledge and skills. In practical operations, they can not only carry out project implementation well but also effectively help communities reduce potential risks. In the early stage of project operation, on-site research and learning from domestic and international experience should be conducted, which mainly includes collecting elderly residents' demands for elderly care services, analyzing project recognition, and predicting residents' participation. Based on these efforts, a preliminary operational framework for community elderly care should be established, internal and external resources integrated, and a community elderly care system truly suitable for the local community built, starting from the actual needs of community residents^[15]. Currently, the knowledge level and understanding of elderly care among most practical providers of community elderly care still remain in the traditional mindset. Therefore, the professional teams brought in should strengthen digital skills training for service providers, so as to improve the service quality of these providers and better meet the elderly's needs for community elderly care.

3. Conclusion

To sum up, digital technology has brought new opportunities and possibilities to community elderly care, but it also faces many practical dilemmas, and there is no way to solve them overnight. Therefore, under the joint attention of the entire community, it is necessary to take the following measures: first, strengthen digital literacy education for the elderly to help them integrate better into the digital age and enjoy the convenience brought by digital technology; second, optimize and innovate elderly-friendly product design to make digital elderly care products better align with the actual needs of the elderly and enhance their real user experience; third, improve the data security assurance mechanism to eliminate the "digital crisis" faced by the elderly due to information leakage; fourth, establish a systematic and efficient coordination mechanism to stimulate the synergetic force for promoting the precision, digitalization, and intelligentization of community elderly care; fifth, attract professional teams to participate, so that more elderly people can enjoy professional and high-quality elderly care services under the background of digital community elderly care. However, empowering community elderly care with digital technology remains a long-term and arduous task. It requires the participation of multiple stakeholders, as well as their persistent efforts and exploration. Only by identifying and solving problems in practice can feasible paths be summarized, which will provide sustained impetus for the high-quality development of community elderly care. In this way, the elderly in the new era can enjoy the convenience brought by digital technology and live a happy and healthy old age.

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Construction and Practice of a Multi-Agent Collaborative Mechanism in Grassroots Smart Governance Based on Actor-Network Theory

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Abstract: Under the policy background of digital transformation, the issue of multi-subject collaboration in grassroots smart governance has become the key to improving governance efficiency. This article applies the Actor Network Theory (ANT) and takes the “Quancheng Office” platform in J city as the research object to systematically analyze the construction path and practical effectiveness of its multi-subject collaboration mechanism. Research has found that grassroots smart governance requires the integration of heterogeneous actors through translation, forming a governance network that synergizes technology and institutions. Further research reveals the current practical difficulties and proposes optimization paths, providing a reference for the theory and practice of grassroots smart governance.

Keywords: Actor-network theory; Grassroots smart governance; Multi-stakeholder collaboration

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1. Introduction

With the rapid development of information technology, smart governance has become a key path to enhance the modernization level of grassroots governance. Against the backdrop of the country’s strong advocacy for digital transformation and governance innovation, various regions are actively exploring smart governance models. As one of the first batch of smart city pilot cities in China, City J is typical and progressive in smart governance. As a local government service platform, the “Quancheng Office” integrates numerous government service matters, involving multiple departments and entities, and has made active explorations and practices in promoting the collaboration of multiple entities in grassroots smart governance. This study adopts a case analysis method to deeply explore the “Quancheng Office” platform in J city, and uses actor network theory to analyze its multi-subject collaboration mechanism. The relationship, interaction process, and collaboration effect between each subject are analyzed in detail, revealing the essence and laws of the multi-subject collaboration mechanism of grassroots smart governance. At the same time, countermeasures and suggestions are provided for optimizing the

collaboration mechanism of “Quancheng Office” and similar platforms.

2. Literature review

2.1. Exploration and research on the practice of grassroots smart governance

In recent years, foreign countries have made many beneficial explorations in grassroots smart governance. The United States has widely applied technologies such as big data in grassroots governance through the “Smart City” program to improve the efficiency and quality of public services ^[1]. The Netherlands strengthens information sharing and collaborative governance among regions through the “Digital Delta” plan ^[2].

Under the promotion of policies, the practice of grassroots smart governance in China has developed rapidly. Wang Yimin emphasized the “urban brain” built by Hangzhou to achieve intelligent and refined urban governance ^[3]. Chen Shaoqiang pointed out that through the “I Shenzhen” app, government services can be “one-stop” ^[4]. Cities such as Shanghai and Beijing are also exploring the construction of smart communities and smart streets, using digital means to enhance grassroots governance capabilities ^[5]. Zhang Lirong believes that in the field of smart government, digital platforms have become an important medium for connecting government departments, enterprises, and the public ^[6]. Liu Hong believes that in the construction of smart communities, analyzing the network can reveal the power relationships and collaborative barriers between various actors, providing a basis for optimizing community governance ^[7].

2.2. Research on actor network theory

The theory of actor networks was initially proposed by French sociologist Latour (B.) and has been widely applied in the field of governance research in recent years ^[8]. Scholars gradually realize the important value of this theory in analyzing the complex relationships among multiple subjects in the governance process. In environmental governance research, ANT is used to analyze the interactive relationships between actors such as government, businesses, social organizations, and the public ^[9]. Research has found that building heterogeneous actor networks can break down departmental barriers, promote resource sharing and collaborative cooperation, and thus improve environmental governance effectiveness.

3. Theoretical basis

3.1. Actor-network theory (ANT)

The actor network theory was proposed by Bruno Latour, Michel Caron, and John Law, advocating the deconstruction of social phenomena through the dynamic connections and “translation” mechanisms of “heterogeneous actors.” This theory uses “mixed ontology” to dissolve the binary opposition between humans and non-human beings, nature and society in traditional sociology, emphasizing that human and non-human actors have equal agency in the network, and their roles are dynamically generated through interactive relationships. The core mechanism of “translation” integrates multiple actors into a common goal network through steps such as problemization, benefit allocation, recruitment, and mobilization, forming a decentralized and dynamically evolving collaborative structure.

3.2. Grassroots intelligent governance

As an innovative form of deep integration between digital governance theory and grassroots governance practice,

grassroots smart governance presents theoretical characteristics that surpass traditional hierarchical systems. This concept was first systematically explained by domestic scholar Tan Chenghua, referring to a new governance model that integrates the governance resources and capabilities of multiple entities such as government, enterprises, social organizations, and the public through technological means such as the Internet of Things, big data, and artificial intelligence, to achieve precise perception, intelligent decision-making, and collaborative action in grassroots public affairs ^[10].

4. Case background: Innovative governance practices of J City’s “Quancheng Office”

“Quancheng Office” is an integrated smart governance platform launched by J City in 2019, which has gone through three stages of development. From 2019 to 2020, as a tool stage, we will focus on the online provision of government services, integrate high-frequency service items, and achieve “one-stop service.” From 2021 to 2022, it will enter the platform phase and integrate hotlines and community grid management systems, forming a dual wheel drive of “government services+social governance.” From 2023 to present, it is the ecological stage, introducing multiple entities, developing new functions such as “Quancheng Code”, and building an open and shared governance ecology. As of 2025, the “Quancheng Office” has integrated more than 2000 application services from 29 departments, with over 5.6 million registered users and an average daily activity of 600000 people, becoming the core hub of grassroots governance in J city.

5. Construction of collaborative mechanism: Analysis of translation process based on ANT

5.1. Problem-oriented: Establishing a mandatory entry point for “technology empowering grassroots governance”

The J municipal government defines “fragmented governance of bureaucratic systems” as the core issue — under the traditional model, departmental data silos lead to delayed response to livelihood issues and scattered channels for public participation. To solve this dilemma, the government has designated “Quancheng Office” as a “mandatory access point” requiring all grassroots governance matters to be accepted, circulated, and receive feedback through the platform, forming a governance paradigm of “unified entry, standardized processes, and centralized data.”

5.2. Benefit endowment: Constructing incentive-compatible mechanisms for heterogeneous entities

The platform designs empowerment strategies for different stakeholders interests and demands: the government uses intelligent allocation of work orders and data decision-making to improve efficiency, meeting assessment and innovation needs; The enterprise has obtained value-added services for the development of government data interfaces, with revenue from derivative services exceeding 200 million yuan in 2023; Social organizations obtain project information through platforms and prioritize promotion. By 2024, they will undertake 376 government projects, resulting in a 60% increase in resource acquisition efficiency. The public can enjoy “one-stop” services to reduce costs, participate in governance, and earn rewards such as points. The active participation rate will increase threefold compared to the initial stage in 2023.

5.3. Recruitment: Clarify the role allocation of diverse subjects

The platform clarifies the governance roles of each entity through institutional and technological means: government departments are “rule executors+resource allocators”, and need to transmit data, process work orders, and coordinate resources according to standards, such as the Housing and Urban Rural Development Bureau updating the progress of old community renovation in real time; As a “technology solution provider+system maintainer”, technology enterprises need to comply with admission standards, ensure data security, and participate in iterations, such as Inspur Group submitting optimization solutions every quarter; The public has the identity of both service users and governance participants, and needs to authorize data and provide feedback on issues. Their rights and obligations are clearly defined in the user agreement; Social organizations serve as “grassroots governance collaborators” and use platforms to connect projects and recruit volunteers.

5.4. Mobilization: Release of network efficiency in dynamic collaborative scenarios

The platform has created a “front-end one window acceptance, back-end classification processing” mode. After the application for enterprise establishment is submitted, it automatically flows to the market supervision, taxation, human resources, and social security departments for parallel approval. The approval time has been reduced from 3 working days to 4 hours. In 2023, a total of 2.13 million business transactions were processed, and cross-departmental collaboration efficiency has been improved by 67%. The synergy between technological systems and institutional rules weaves previously dispersed departmental approval behaviors into a unified network.

6. Real-world dilemma

6.1. Structural lag and imperfect collaborative governance model

Currently, there is a structural lag in the smart governance of J City’s “Quancheng Office”, and the collaborative governance model among multiple entities has not yet been fully established. The actor network theory emphasizes dynamic translation and interest coordination among multiple subjects, but in reality, the connectivity and interaction among multiple subjects, such as government, enterprises, social organizations, and residents, are weak, and collaborative governance channels are hindered. In the process of promoting the construction of smart cities, although the “Quancheng Office” has integrated some resources, it lacks systematic top-level design and legal guarantees, resulting in the insufficient effectiveness of collaborative governance.

6.2. Insufficient supporting environmental protection

The actor network theory points out that collaborative governance requires a good supporting environment, but J City’s “Quancheng Office” faces the problem of relatively lagging environmental protection in the process of smart governance. The data sharing mechanism has not been fully established, and the opening and integration of basic data resources still need to be further promoted.

6.3. Weak interaction among multiple subjects

The lack of interconnectivity and interaction among diverse entities is a major bottleneck in the current smart governance of “Quancheng Office.” The actor network theory emphasizes the formation of a symbiotic and evolving actor network through the allocation of benefits and the embedding of responsibilities. However, in reality, the government-led administrative power is disconnected from the grassroots governance model, and the participation of social organizations and residents is low, making it difficult for collaborative governance to form a

joint force.

7. Optimize the path

7.1. Improve collaborative governance structure and build a symbiotic and evolving actor network

According to the ANT, the roles of government, enterprises, social organizations, and residents should be clearly defined to construct a symbiotic and evolving actor network. Specifically, the government should play a leading role in coordinating and coordinating resources from all parties; Enterprises provide technical support and solutions; Social organizations and residents participate in the improvement of smart governance through feedback mechanisms.

7.2. Establish a sound supporting environmental protection mechanism

To address the issue of insufficient environmental protection, it is necessary to strengthen top-level design and improve the legal protection system. At the same time, promote the construction of data sharing mechanisms, break down information silos, and achieve one-time collection and multi-party sharing of data resources.

7.3. Enhance the connectivity and interactivity of diverse subjects

Enhance the connectivity and interaction among diverse subjects through the allocation of benefits and the embedding of responsibilities. The “Quancheng Office” can establish a mechanism for coordinating interests, clarify the rights and obligations of all parties, and enhance the participation enthusiasm of social organizations and residents through incentive measures.

8. Conclusion

This article takes the “Quancheng Office” in J City as the research object and applies Actor-Network Theory (ANT) to systematically explore the construction and practice of a multi-stakeholder collaborative mechanism in grassroots smart governance. The study finds that through translation processes such as problematization to establish mandatory checkpoints, interessement to create incentive compatibility, enrollment to clarify roles, and mobilization to unleash network effectiveness, it is possible to effectively integrate heterogeneous actors, including the government, enterprises, social organizations, and the public, thereby constructing a governance network that synergizes technology and institutions. The operational effectiveness of the “Quancheng Office” also confirms the feasibility of this mechanism. At the same time, the study reveals challenges such as structural lag and insufficient interaction among actors, which need to be addressed through optimizing the collaborative structure and improving safeguard mechanisms. This research can provide a reference for the deepening of grassroots smart governance theory and the construction of similar platform collaborative mechanisms.

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The Logic and Pathways of Stringent Financial Regulation Empowering Corporate ESG Practices

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Abstract: Against the backdrop of high-quality development, ESG has become a key guideline for corporate sustainability. Taking the New Asset Management Regulation introduced in 2018 as a representative policy, this paper systematically explores the internal logic, practical pathways, and challenges of how strong financial regulation empowers corporate ESG practices. From the perspective of internal logic, strong financial regulation can enhance the motivation and ability of corporate ESG practice by lowering financing costs, curbing managerial myopia, and intensifying product market competition. From the perspective of practical pathways, the New Asset Management Regulation has effectively advanced corporate ESG practices through measures such as breaking rigid payment, prohibiting multi-layer nesting, and strengthening asset maturity mismatch management.

Keywords: ESG; Strong financial regulation; The New Asset Management Regulation; Sustainable development

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1. Introduction

To strengthen the regulation of asset management (AM) activities, China implemented the Guiding Opinions on Regulating the Asset Management Business of Financial Institutions (hereinafter referred to as the “New Asset Management Rules”) on April 27, 2018. The core content of the reform includes breaking the implicit guarantee of principal and returns, restricting leverage, addressing asset–liability maturity mismatches, dismantling channel businesses and multi-layered nesting, and differentiating between standardized and non-standardized assets. The policy aims to establish unified regulatory standards and a comprehensive supervisory framework to effectively prevent financial risks and guide social funds toward the real economy. According to relevant reports, since the implementation of the New Asset Management Rules, principal-guaranteed wealth management products have been completely phased out, and multi-layered nested products have been largely eliminated. Meanwhile, the net asset value (NAV)-based management of products has been strengthened, leverage ratios and channel businesses have been significantly reduced, and the scale of shadow banking has declined ^[1]. As a result, capital idling

and financialization detached from the real economy have been fundamentally reversed, while the quality and efficiency of the asset management industry in serving the real economy have been markedly enhanced.

At the same time, greenhouse gas emissions are exacerbating climate change and environmental challenges, exerting increasingly significant impacts on global socioeconomic systems^[2]. The concept of sustainable development has gained wide recognition. As the primary actors in a market economy, corporations play an essential role in promoting high-quality and sustainable economic development through their environmental, social, and governance (ESG) performance^[3]. ESG represents a new development paradigm emphasizing environmental, social, and governance outcomes. Its requirements for corporate energy conservation, emission reduction, and green sustainable development align closely with the goals of carbon peaking and carbon neutrality, thereby serving as an effective instrument for enterprises to implement sustainable strategies. The Third Plenary Session of the 20th Central Committee of the Communist Party of China reaffirmed that Chinese modernization should achieve the organic unity of economic development and ecological civilization. Consequently, how to guide enterprises in balancing the pursuit of economic returns with social responsibility and environmental governance, thereby enhancing ESG performance, has become a critical issue for the “14th Five-Year Plan” period and beyond.

Against this backdrop, financial regulatory policies not only bear the responsibility of preventing systemic financial risks and improving financial services to the real economy, but are also entrusted with the mission of channeling resources toward green, low-carbon, and high-quality development. The goals and policy logic of stringent financial regulation and corporate ESG practices thus exhibit a convergence, making their interlinkages worthy of in-depth analysis. This study examines the theme of stringent financial regulation empowering corporate ESG practices, taking the New Asset Management Rules as the first unified regulatory framework in the asset management sector. It focuses on the internal logic, practical pathways, and real-world challenges of this policy, and explores how financial regulation can improve corporate ESG performance by lowering financing costs, curbing managerial short-termism, and enhancing external collaborative governance effects.

2. The internal logic linking stringent financial regulation and corporate ESG

2.1. Transaction cost logic

Transaction cost theory posits that enterprises face costs in searching for information, negotiating contracts, and monitoring execution in market transactions, which directly affect decision-making efficiency. By reducing transaction costs, firms can allocate resources more effectively. Financially stringent regulation can mitigate information asymmetry, guide the decline of risk-free interest rates, and direct funds toward the real economy, thereby lowering corporate financing costs and enabling greater investment in ESG.

First, alleviating information asymmetry helps reduce financing costs. On one hand, when information asymmetry is high, creditors and shareholders, unable to accurately assess a firm’s true value and risks, often demand higher returns to compensate for uncertainty. Improved information transparency reduces perceived risk, lowers risk premiums, and directly decreases the cost of debt and equity financing. On the other hand, transparent firms enjoy higher stock liquidity and stronger investor trust, which reduces the cost of equity capital. Enhanced transparency therefore optimizes the financing environment, creating a resource base for ESG practices^[4].

Second, declining risk-free interest rates lower financing costs. As a key component of lending rates, the fall of the risk-free rate directly reduces bank lending costs for firms. Simultaneously, lower expected returns on risk-free assets encourage investors to reallocate capital into riskier assets, such as corporate bonds and equities,

seeking higher yields. This shift compresses the risk premium demanded from firms, further lowering financing costs. Thus, declining risk-free rates reduce costs via both bank credit and capital market channels, providing robust resources for ESG investment.

Finally, directing funds into the real economy reduces financing costs. By curbing speculative flows into real estate and financial arbitrage, stringent financial regulation lowers systemic risk, reduces risk premiums, and decreases financing costs. In addition, greater capital allocation toward real-sector businesses increases the availability of funds for corporate ESG activities, thereby fostering sustainable development.

2.2. Behavioral constraint logic

The separation of ownership and control in modern corporations generates agency conflicts and information asymmetry, often leading to distorted managerial incentives and short-termism. Behavioral constraint theory suggests that external norms and regulations shape organizational behavior, guiding decision-making toward long-term interests and social responsibility. Stringent financial regulation can restrict financial investment channels, raise financial investment risks, and enhance transparency, thereby constraining short-termism and promoting ESG-oriented strategies.

Specifically, stringent regulation reduces opportunities for short-term financial arbitrage, compelling managers to prioritize long-term ESG investment. Furthermore, under portfolio theory, rational managers balance risk and return across investment options. As financial regulation increases the risk of financial investments, managers are incentivized to pursue sustainable growth. Lastly, by improving information transparency, stringent regulation weakens corporate financialization and agency conflicts, encouraging long-term ESG investment over short-term profit-seeking.

2.3. Market competition logic

Market competition theory argues that competitive environments generate information effects and liquidation threats, shaping managerial investment behavior. Stringent financial regulation curtails firms' ability to earn profits and expand through financial investments, forcing them to refocus on core operations and intensifying competition. This, in turn, incentivizes better information disclosure and provides favorable conditions for ESG advancement.

More specifically, stringent regulation diverts corporate capital away from financial speculation and back into core business activities, heightening industry competition. Firms are thus motivated to enhance innovation and operational efficiency. At the same time, restrictions on leveraging financial products for expansion compel companies to compete on productivity and governance. In this context, firms improve transparency and ESG performance to secure stakeholder trust and maintain competitiveness. High ESG performers are more likely to gain stakeholder support, whereas firms with poor ESG practices risk marginalization or liquidation. Hence, intensified market competition under financial regulation strengthens both information and liquidation effects, motivating firms to improve ESG outcomes.

3. Pathways of stringent financial regulation empowering corporate ESG practices

3.1. Reducing financing costs and optimizing resource allocation

The New Asset Management Rules mitigate information asymmetry, guide risk-free rates downward, and direct funds into the real economy, thereby lowering financing costs and easing ESG underinvestment. First, by imposing

look-through supervision on trust products and channel businesses, the rules restrict corporate financialization, thereby reducing information asymmetry and enhancing external financing availability. Second, breaking the rigid repayment guarantee and transitioning from amortized cost to NAV accounting improves risk reflection, adjusts market expectations, and lowers the risk-free rate, reducing financing costs^[5]. Third, prohibiting multi-layered nesting and strengthening maturity mismatch management, redirecting capital from high-yield sectors such as real estate and local government financing vehicles toward standardized assets and the real economy, further lowering costs.

3.2. Limiting arbitrage and strengthening ESG strategic orientation

The New Rules restrict channels for financialization, increase financial investment risks, and promote transparency, thus constraining managerial short-termism. Before their implementation, listed firms often relied on nested channel businesses to participate in financialized investments. The rules, through look-through regulation of ultimate investors and underlying assets, sharply curtail such practices. Moreover, by eliminating implicit guarantees, firms bear risks themselves, raising investment risks and discouraging speculative behavior. Finally, unified regulation across products reduces agency costs, enhances transparency, and steers managerial focus toward long-term ESG strategies.

3.3. Enhancing external governance pressure and driving sustainable transformation

The New Rules constrain firms' use of financial instruments for profit and expansion. Measures such as NAV-based management, the abolition of implicit guarantees, leverage restrictions, and prohibitions on capital pooling and nesting suppress high-risk, high-yield financial operations. Restrictions on structured M&A fund leverage and the prohibition of non-proprietary funds for asset management product investment further limit over-leveraged expansion. As a result, firms are compelled to reallocate resources to core business operations, intensifying competition and strengthening external stakeholder governance, which enhances ESG investment and performance.

4. Conclusion

As exemplified by the New Asset Management Rules, stringent financial regulation dismantles implicit guarantees, prohibits excessive nesting, and strengthens maturity mismatch management, thereby lowering financial market risks and channeling funds into the real economy through unified and look-through supervision. For corporate ESG practices, stringent financial regulation reduces financing costs, optimizes resource allocation, and enhances ESG capabilities; curtails arbitrage incentives, fostering ESG-oriented strategies; and intensifies market competition, reinforcing external governance pressure and motivating ESG commitment.

Nevertheless, practical challenges persist, including incomplete ESG disclosure frameworks, inconsistencies in ESG ratings, and tensions between ESG's long-term value creation and short-term performance assessments. These limitations restrict the effective empowerment of corporate ESG strategies by stringent financial regulations.

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Exploration of Embedded Service Models in Urban Communities from the Perspective of Good Governance

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Abstract: With the acceleration of urbanization, the service system of urban communities plays an increasingly crucial role in enhancing residents' quality of life and promoting sustainable urban development. This study, based on social embeddedness theory, constructs an analytical framework from four dimensions: structural embeddedness, relational embeddedness, functional embeddedness, and cognitive embeddedness. Using S Street's pilot community as an example, this study delves into the operational logic, main challenges, and optimization paths of embedded service models in urban communities. The research reveals that this model faces issues such as insufficient resource integration, coordination difficulties, weak trust, and imprecise demand response. Therefore, it proposes measures such as strengthening party organization leadership, promoting multi-subject collaboration, optimizing resource allocation, and disseminating value concepts to provide theoretical and practical references for modernizing grassroots governance.

Keywords: Community services; Social embeddedness; Embedded services; Operational challenges

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1. Introduction

According to data from the National Bureau of Statistics, from 2000 to 2023, China's urbanization rate increased from approximately 36% to 66.16%. The growing urban population has made community service demands more diverse, personalized, and refined. However, the traditional community service model is gradually revealing its limitations in meeting these new demands, becoming a bottleneck restricting residents' sense of gain. To deepen urban refined management, in December 2021, the State Council Office issued the "14th Five-Year Plan for Urban and Rural Community Service System Construction", explicitly proposing to improve the urban and rural community service system, promote the socialization, professionalization, and marketization of community services, and encourage the development of embedded community services. By integrating various services within or around the community, it aims to achieve precise alignment between service supply and residents' demands.

2. Literature review and theoretical framework

2.1. Literature review

China's early community services were mainly undertaken by neighborhood committees, focusing on basic welfare services ^[1]. With social structural changes and residents' demand upgrades, community services began to emphasize professionalization, diversification, and personalization ^[2]. The government's role gradually shifted from "comprehensive provider" to "guide, purchaser, and supervisor", encouraging social organizations, market forces, and community residents to jointly participate in service provision ^[3].

As a new type of service model, embedded services transcend the singularity and fragmentation of traditional community services, emphasizing the "embeddedness" of service facilities ^[4]. They integrate multi-functional, multi-layered services within or around the community, achieving seamless connections between services and residents' daily lives ^[5]. This model is not only an innovation in service supply but also an exploration of community space utilization, resource integration, and social relationship reconstruction, aiming to enhance community resilience and residents' well-being.

2.2. Theoretical framework

2.2.1. Social embeddedness theory

Social embeddedness theory emphasizes that economic behavior and social behavior are not isolated but deeply embedded in social structures and relationships. In community governance, Evans' (1995) "embedded autonomy" theory reveals the dynamic balance between government and social forces ^[6]. Zukin and DiMaggio's four-dimensional framework divides embeddedness into cognitive, cultural, structural, and political dimensions, providing a tool for multi-dimensional analysis. Then, many scholars have also begun to build a framework to study community service from multiple dimensions ^[7-9].

2.2.2. Good governance principles

Good governance principles emphasize cooperation and coordination among multiple subjects, including the government, market, and society, aiming to enhance the effectiveness, legitimacy, and fairness of public governance and achieve the maximization of public interests ^[10]. Its core elements include responsiveness, participation, transparency, accountability, and fairness. The embedded service model, as an innovation in public service supply, aligns closely with the concept of good governance.

3. Case analysis

3.1. Structural embeddedness dimension

In terms of party organization construction, various community party committees in S Street actively play a leading role, establishing multiple specialized service teams and coordinating the participation of enterprises, social organizations, and other forces in embedded services, jointly creating a community medical and nursing service center. Some developed social organizations, such as the "Shunhua Care" volunteer service team, play an important role in community elderly care and disability assistance. In terms of resident self-governance organizations, communities universally establish neighborhood committees and residents' councils, strengthening residents' self-service and self-management.

3.2. Relational embeddedness dimension

In terms of trust relationship building, some service providers have won residents' trust through long-term stable services. In terms of interaction mechanisms, communities actively design various online and offline interaction activities, providing a platform for residents to communicate and interact. In terms of emotional connection cultivation, communities promote exchanges and interactions among residents through various themed activities.

3.3. Functional embeddedness dimension

In terms of resource integration, S Street has established a community resource-sharing platform, comprehensively sorting out and integrating fields, funds, and talents within the jurisdiction. In terms of service precision, communities have established a resident demand research mechanism, regularly understanding residents' needs through questionnaires and home visits. In terms of functional coordination and synergy, the government, social organizations, and residents actively play their respective advantages in community services.

3.4. Cognitive embeddedness dimension

In terms of value concept dissemination, communities propagate good governance concepts and the value and significance of embedded services through various channels such as propaganda columns, public accounts, and community broadcasting. In terms of cultural identity shaping, communities deeply explore and inherit their own cultural characteristics, transmitting excellent traditional culture. In terms of consensus formation, communities have established a residents' deliberative consultation system, fully discussing and democratically deciding on important service matters through residents' meetings and hearings.

4. Operational challenges of embedded service models in urban communities

4.1. Structural embeddedness imbalance

Community party organizations and social organizations rely heavily on government resources but often face uneven resource allocation. Some communities located in remote areas receive relatively few government funds and policy support, affecting the implementation of embedded services. The participation of multiple subjects in community governance increases the complexity of organizational coordination. Different subjects have different interest demands, leading to coordination difficulties and low governance efficiency.

4.2. Relational embeddedness deficiency

Service providers and residents often face information asymmetry, with residents being unfamiliar with service content and processes, leading to misunderstandings and distrust. Communities may also face communication barriers when introducing new service projects due to inadequate publicity. Communities lack activities and platforms to promote emotional exchanges, resulting in weak emotional connections among multiple subjects. Although communities organize some cultural and sports activities, their forms and content are relatively single, unable to meet residents' diverse interests, making it difficult to form deep emotional connections.

4.3. Functional embeddedness difficulties

Community resources are scattered among different subjects, lacking a unified coordination mechanism, leading to low resource integration efficiency. Some idle commercial properties within the community, due to property rights belonging to enterprises and individuals, face difficulties when communities coordinate their transformation into

public service venues. Although communities adopt various methods to research residents' needs, they still lack professional talent and data analysis tools, resulting in an inaccurate grasp of residents' needs. When organizing community cultural activities, they fail to fully understand residents' preferences for activity types, leading to low participation.

4.4. Cognitive embeddedness insufficiency

Communities have insufficient propaganda and education efforts in value concept dissemination and cultural identity shaping, resulting in low resident awareness and a sense of identity. The forms of community propaganda activities are relatively single, mainly focusing on distributing leaflets and posting posters, lacking interactivity and interest, making it difficult to attract residents' attention. Then, communities lack the excavation and inheritance of local culture and are relatively backward in cultural innovation, making it difficult to form a distinctive community culture. Some historical buildings and cultural heritage within the community have not been fully protected and utilized, and their historical and cultural values have not been effectively excavated and inherited.

5. Optimization paths for embedded service models in urban communities

5.1. Optimizing structural embeddedness to solidify governance foundations

Establish a Sound party organization-led, multi-party participation, deliberation, and coordination mechanism, incorporate service projects into the party organization's key task list, and establish a party member volunteer service team to strengthen the party organization's leading role in services. Establish a long-term and stable cooperation mechanism between communities and social organizations, clearly define cooperation models, rights and responsibilities, and evaluation mechanisms to ensure effective service alignment with community needs. Then strengthen the standardized construction of neighborhood committees and other resident self-governance organizations, and enhance residents' awareness and ability to participate in public affairs through community education and cadre training. Build residents' deliberation halls and online deliberation platforms to safeguard residents' rights to information, participation, and expression in the design, implementation, and supervision of embedded services.

5.2. Deepening relational embeddedness to enhance community vitality

Adhere to the principles of openness and transparency, regularly disclose service information, and fund usage. Establish a smooth resident feedback and complaint handling mechanism to promptly respond to residents' concerns and resolve misunderstandings. Leverage modern information technology, develop community apps or mini-programs with user-friendly and information-rich features, providing information dissemination, service reservation, feedback, and online deliberation functions to enhance residents' convenience in participating in community affairs. Then encourage and support the formation of resident informal groups and social networks: Strengthen emotional connections and community identity through joint actions.

5.3. Optimizing functional embeddedness to improve service efficiency

Build a multi-party participation resource-sharing platform, comprehensively sort out and register fields, talents, funds, and information within the community. Establish a regularized community demand research mechanism, use questionnaires, home visits, and big data analysis to accurately identify the personalized and diverse needs of different groups. Then clarify the functional positioning, rights and responsibilities, and cooperation methods

of the government, community organizations, social organizations, market entities, and residents in embedded services. Establish a regular negotiation and communication mechanism to promptly resolve conflicts during service provision.

5.4. Strengthening cognitive embeddedness to build community consensus

Integrate good governance concepts and the value of embedded services into community propaganda, cultural activities, and resident education. Use platforms such as community propaganda columns, broadcasting, public accounts, and short videos to disseminate service concepts, policy information, and typical cases in a vivid manner, raising resident awareness. Organize cultural activities with community characteristics: Enhance residents' cultural identity and pride. Encourage residents to participate in the creation and dissemination of community cultural brands, forming a positive and cohesive community spirit. Then, establish and improve the community deliberative consultation system, discuss and democratically decide on important embedded service matters through residents' meetings, hearings, and roundtable meetings, forming a broad consensus on community development and service optimization.

6. Conclusion and prospects

This study analyzes the embedded service model in urban communities from the perspective of good governance, using social embeddedness theory's four dimensions. The research shows that the model faces many challenges in practice, covering structural, relational, functional, and cognitive levels, which restrict service efficiency improvement. Based on this, the study proposes a series of optimization paths based on good governance principles.

However, this study has certain limitations, mainly relying on theoretical analysis and literature review, and lacking systematic empirical data support. Future research should focus on conducting empirical studies through questionnaires, in-depth interviews, and case analysis to deeply validate the challenges and optimization paths proposed in this study. Additionally, close attention should be paid to the implementation effects and influencing factors of relevant policies to provide a more solid theoretical and practical basis for constructing a new urban community service system.

Disclosure statement

The author declares no conflict of interest.

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Research on the Historical and Cultural Connotations and Tourism Development Strategies of the Huai'an Prefecture in Jiangsu Province

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Abstract: Ancient architecture represents a vital tourism resource for travel destinations, offering visitors a dual experience of visual aesthetics and spiritual pleasure through its architectural artistry and humanistic historical connotations. Huai'an City boasts a long history of urban establishment and is rich in ancient architectural resources, including significant ancient architectural relics such as Hexia Ancient Town, the Ruins of the Water Transport Governor's Office, Qingyan Garden, and the Huai'an Prefecture. Among them, the Huai'an Prefecture is one of the two surviving original buildings of prefectural government offices in China, imbued with rich historical and cultural connotations and significant potential for the development of ancient architectural tourism. However, compared to similar scenic spots in Huai'an City, its popularity and tourism conditions do not match, presenting issues such as a lack of synergy with related scenic spots, a single tourism product offering, and insufficient promotion and publicity. In light of this, this paper discusses the problems encountered during the development of ancient architectural tourism at the Huai'an Prefecture and proposes corresponding tourism revitalization strategies, aiming to promote the development of the ancient architectural tourism industry in Huai'an City.

Keywords: Huai'an Prefecture; Ancient architectural tourism; Tourism revitalization; Huai'an City

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1. Introduction

The art of ancient Chinese architecture is splendid and time-honored, with architectural relics found in many regions, serving as significant historical, cultural, and tourism resources. With the continuous development of the tourism industry and the ongoing integration of culture and tourism, the market for ancient architectural tourism has been heating up, prompting regions with ancient architectural relics to place greater emphasis on harnessing the potential of ancient architectural tourism. Huai'an City boasts a long history of urban development and rich tourism resources in ancient architecture. Ancient architectural attractions such as Hexia Ancient Town, the Ruins of the Water Transport Governor's Office, Qingyan Garden, and Huai'an Prefecture continue to exude vitality in

tourism. However, there are significant disparities in visitor numbers among these attractions, particularly Huai'an Prefecture, whose tourism popularity does not align with its inherent tourism conditions. The academic community has long taken an interest in Huai'an Prefecture, with scholars such as Guo Huayu studying its architectural form, and Wang Jianian specifically exploring the cultural aspects of Huai'an's prefectural government offices^[1-2]. However, few studies have focused on the tourism development of the Huai'an Prefecture Government Office. Therefore, this paper will take the Huai'an Prefecture Government Office as the research object, sort out its historical and cultural connotations, analyze potential issues that may arise during its tourism development, and explore corresponding paths for tourism revitalization, with the aim of promoting the development of the ancient architecture tourism industry in Huai'an City.

2. Historical and cultural connotations of Huai'an Prefecture

The prefectural government office, also known as the prefectural yamen, was the official residence and administrative center of prefectural-level administrative units in ancient China. Although there are currently multiple architectural relics of yamen buildings nationwide, only two original ancient prefectural government offices remain: Huai'an Prefecture and Nanyang Prefectural Government Office. Located in Huai'an District, Huai'an City, Jiangsu Province, Huai'an Prefecture is a national key cultural relic protection unit. Its architectural history can be traced back to the Wutong Temple during the Southern Song Dynasty. In the third year of the Hongwu reign in the Ming Dynasty (1370), Yao Bin, the then-prefect, constructed a new Huai'an Prefecture using the Wutong Temple and the Yuan Dynasty's Yitan Military Governor's Office as the architectural foundation. This office remained in use until the end of the Qing Dynasty, undergoing multiple repairs and renovations over the years. The main building has been well-preserved to this day, "serving as a symbol and witness to Huai'an's historical status" and embodying rich historical and cultural connotations^[3].

2.1. Architectural and cultural connotations

As a remnant of ancient government office architecture, the Huai'an Prefecture holds significant value in the study of ancient architecture, serving as a unique cultural carrier of ancient architectural heritage. The Huai'an Prefecture boasts a considerable scale, covering an area exceeding 50,000 square meters. It comprises over 50 buildings with more than 600 rooms, neatly arranged and orderly. The layout can be broadly divided into three sections: east, central, and west, with the most important buildings located in the central section. The central section is further divided into front and rear segments. The front segment includes the Ceremonial Door, Main Hall, Six Sections, and the Secondary Hall, while the rear segment serves as the residence for the prefect and his family. The west section houses the Military and Police Office, featuring administrative bodies such as the Waiting Room, Torture Room, Forensics Court, the table for cutting the body of the criminal in two at the waist, Leather Field Temple, Warehouse, and Fire Fighting Bureau. The east section is primarily used for welcoming guests and hosting banquets, with structures like the Stage, Zanhou Temple, and Bao Han Tang, distinguishing it from other solemn office spaces. Additionally, the Main Hall of the prefectural government office, covering over 500 square meters, is the largest among all prefectural government offices nationwide. The architectural complex of the prefectural government office not only embodies local characteristics of Huai'an but also reflects the regulatory requirements for prefectural government architecture during the Ming and Qing dynasties. "Studying it aids in our understanding and mastery of the types, patterns, and form characteristics of ancient Chinese architecture, as well

as the architectural culture and technology influenced by Huai'an's unique geographical location”^[4].

2.2. Political and cultural connotations

The Huai'an Prefecture was an important administrative institution in ancient northern Jiangsu, boasting the largest jurisdiction in the province. The buildings within the prefectural government premises served different administrative functions, offering insights into the connotations of traditional political culture in ancient times. For instance, the main hall was where the prefect issued decrees, held significant ceremonies, and conducted public trials; the secondary hall was used for preliminary case hearings or handling other affairs. The Six Departments were located in the front section of the central path mentioned earlier. The Department of Personnel oversaw the selection and transfer of officials; the Department of Revenue managed household registration, land taxes, finance, and taxation; the Department of Rites was responsible for education, examinations, sacrifices, and propaganda; the Department of War handled military affairs, public security, and military examinations; the Department of Punishments dealt with justice and penal affairs; and the Department of Works oversaw construction projects. The various institutions within the Military and Police Office provided detailed insights into the ancient penal system, offering valuable references for studying the daily operations and administrative functions of ancient prefectural governments. Additionally, the Huai'an Prefecture preserved numerous couplets related to officialdom, such as the couplet on the Holy Edict Stone Archway: “Your salary and benefits come from the sweat and blood of the people; the common folk are easy to oppress, but Heaven is hard to deceive”, and the couplet inside the secondary hall: “Only by having a connection with the common people do I come here; I hope to have a clear conscience and not let the people down.” These provide unique insights into the culture and political culture of prefectural governments during the Ming and Qing dynasties.

2.3. Folk cultural connotations

The Huai'an Prefecture is rich in historical stories and cultural legends. For example, the famous Yuan Dynasty play *The Injustice to Dou E* by Guan Hanqing is set in Chuzhou, which is present-day Huai'an, and the trial of Dou E took place at the Huai'an Prefecture. Today, there is a Dou E Lane to the north of the Huai'an Prefecture, which, according to local legend, is where Dou E once lived, and the lane is named in her honor. Another example is that the Huai'an Prefecture was also the site where the Li Yuchang famine relief case, one of the four great mysteries of the Qing Dynasty, was tried. In the 13th year of the Jiaqing reign of the Qing Dynasty (1808), a flood occurred in Huai'an, and Li Yuchang was sent by Tiebao, the governor-general of the Two Jiangs, to investigate famine relief in Shanyang County, Huai'an. He was brutally murdered by Wang Shenhan, the corrupt county magistrate of Shanyang, who embezzled famine relief funds. Wang Gu, the then-prefect of Huai'an, was bribed and ruled that Li Yuchang had committed suicide, hastily closing the case. Later, Li Yuchang's uncle, Li Taiqing, went to the capital to expose the suspicious case, and Li Yuchang's name was finally cleared. This case had a tremendous impact at that time and in the years that followed. People not only detested the corrupt and evil deeds of the corrupt officials but also admired Li Yuchang's integrity and uprightness. Even today, literary and film and television works based on this case continue to emerge. These historical stories that took place in the Huai'an Prefecture had a significant impact on the people, becoming a part of folk culture and adding more historical and cultural connotations to the Huai'an Prefecture.

In summary, it is evident that the Huai'an Prefecture is rich in historical and cultural connotations and serves as an important physical relic from ancient times. It helps people gain a deeper understanding of the architectural

and cultural connotations of ancient government offices, the political and cultural connotations behind local administrative institutions, as well as related folk cultures. Due to these significant historical and cultural connotations, the Huai'an Prefecture has garnered increasing attention from tourists in recent years. However, compared to other ancient architectural attractions in Huai'an City, the tourism potential of the Huai'an Prefecture still needs to be further developed.

3. Problems in the tourism development of the Huai'an Prefecture

Despite its rich historical and cultural connotations and advantageous tourist location, the Huai'an Prefecture lags in popularity compared to other ancient architectural tourist attractions in Huai'an City. For instance, in 2024, the Huai'an Prefecture received approximately 590,000 visitors throughout the year, while Hexia Ancient Town alone welcomed 607,000 visitors during the National Day holiday in 2024. Another example is Qingyan Garden, a garden with a government office cultural background also located in Huai'an City, which has consistently ranked among the top ten attractions in Huai'an City for the number of visitors during holidays in the past two years, while the Huai'an Prefecture has failed to make it onto the list of popular tourist destinations. From the perspective of urban planning in Huai'an City, the Huai'an Prefecture is situated on the central axis of Huai'an District, connecting southward with the ruins of the Grand Canal Administrative Office and Zhenhuai Tower to form an ancient architectural complex, and facing the Zhou Enlai Memorial Hall one kilometer to the north, located in a popular tourist area. Additionally, with its long history, the Huai'an Prefecture is one of only two complete prefectural government office relics in the country, possessing significant potential for ancient architectural tourism. However, based on relevant tourism data, the Huai'an Prefecture is not considered a "hot" tourist destination in Huai'an City, and its popularity does not match its inherent tourism conditions. The reasons for this may include the following issues.

3.1. Lack of synergy with relevant scenic spots

The synergy among different scenic spots can attract more tourists and enhance tourism popularity. However, the tourism market of the Huai'an Prefecture Government Office is relatively independent, lacking synergy with relevant scenic spots, which makes it difficult to expand the tourist market. Huai'an City boasts numerous tourist attractions. As of 2024, there are 40 national A-level tourist attractions, 21 4A-level tourist attractions, and 1 5A-level tourist attractions in Huai'an City. Many of these attractions have formed effective synergies, achieving mutual benefits and win-win results. For example, the scenic spots under the administration of the Zhou Enlai Memorial Site Management Bureau include three locations: the Zhou Enlai Memorial Hall, Home of Zhou Enlai, and Zhou Enlai's Childhood Reading Office. Although these three scenic spots are located in different places, they are all related to Comrade Zhou Enlai, thus forming a synergy that attracts a large number of tourists to visit them successively. Another example is the China Water Transport Museum, which includes the site park of the Ruins of the Water Transport Governor's Office, also creating a synergistic effect. In contrast, Huai'an Prefecture Government Office has failed to jointly create a tourism brand for ancient architectural complexes with the nearby site park of the Grand Canal Transport Department and Zhenhuai Tower. It has also not engaged in joint promotion with Qingyan Garden, which shares a similar cultural background to yamen (official residence) culture. Due to the lack of systematic tourism planning, it is "fighting alone" and finds it difficult to generate significant influence in the tourism market.

3.2. Monotonous tourism products

Currently, Huai'an Prefecture Government Office primarily focuses on architectural appearances and internal displays, emphasizing the use of text to introduce the functions of various buildings and relying mainly on ticket sales for revenue. The tourism products are monotonous and cannot meet the diverse needs of tourists. As an ancient architectural tourist attraction, the Huai'an Prefecture Government Office only provides a brief introduction and a panoramic view of the office in the promotional materials at the scenic spot, informing tourists of the architectural layout of the office. However, it does not provide detailed explanations of the architectural styles, forms, internal structural frameworks, or the connotations of the spatial layouts of various buildings, leaving tourists with only a cursory glance and unable to leave a lasting impression. In terms of displaying items inside the buildings, the focus is on display, lacking interaction with tourists or the creation of situational simulations, resulting in limited entertainment value. The live-action performance programs established in recent years, such as "A Fleeting Dream — Huai'an Prefecture in the Ming Dynasty", represent, to a certain extent, innovations in tourism products. However, they have not yet "broken through" to achieve significant influence, indicating that there is still room for the development of new tourism products in the future.

3.3. Inadequate publicity and promotion efforts

According to relevant data released by the Huai'an Municipal Bureau of Statistics, Huai'an's tourism market has shown a positive development trend over the past two years. In 2023, Huai'an's tourism industry experienced a robust recovery, with total revenue reaching 51.259 billion yuan, marking a 104.9% increase from 2022. The city received 45.045 million domestic and international tourists, an 85.4% increase ^[5]. In 2024, Huai'an's tourism sector continued to heat up, with total revenue reaching 57.513 billion yuan, a 12.2% increase from 2023, and the number of domestic and international tourists reaching 52.2533 million, an 16% increase ^[6]. However, despite the overall growth in Huai'an's tourism sector, the reputation of Huai'an Prefecture Administration is largely confined to the local area, with limited awareness among tourists from outside the region. There remains a significant market of non-local tourists to be tapped into. For instance, during the 2024 New Year's Day holiday, Huai'an received a total of 709,800 tourists, with Huai'an Prefecture Administration only accounting for approximately 4,500 of these visitors. This indicates that Huai'an Prefecture Administration has not yet achieved widespread recognition and influence, highlighting the need for the scenic area to improve its publicity efforts. By seizing the favorable opportunity of the rapid development of the tourism market, it can develop a broader tourist market.

4. Tourism development strategies for Huai'an Prefecture administration

4.1. Strengthen the collaboration between scenic spots and create a tourism brand

Huai'an Prefecture Administration is a traditional Chinese ancient architectural site, attracting primarily enthusiasts of ancient architecture. Leveraging its identity as a destination for ancient architecture tourism, Huai'an Prefecture Administration can enhance its collaboration with nearby attractions such as the China Water Transport Museum (which includes the site park of the Ruins of the Water Transport Governor's Office) and Zhenhuai Tower. Relevant administrative departments should formulate a unified tourism development plan and suitable tourist routes to connect these three attractions, offering a tourism program for ancient architectural complexes. This will increase the attraction for tourists, extend their visiting time in the area, and provide a richer tourism experience. In addition to collaborating with surrounding attractions, Huai'an Prefecture can also focus on the culture of yamen (official residences and offices in ancient China) and collaborate with the two scenic spots imbued with yamen

cultural backgrounds—the Ruins Park of the Office of the Governor-General for Water Transport and the Qingyan Garden. This collaboration can emphasize the promotion of Huai'an's yamen culture, create a more distinct cultural tourism brand, enhance the popularity of Huai'an Prefecture and even Huai'an tourism as a whole, achieve resource complementarity among scenic spots, and foster mutual benefits and win-win outcomes.

4.2. Delving into cultural connotations and enriching tourism products

Huai'an Prefecture boasts rich historical and cultural connotations, with potential for further exploration. For instance, in terms of architectural culture, a professional team specializing in ancient architecture and historical culture research can be organized. By combining architectural artifacts with relevant historical documents, the styles, forms, layout characteristics, and cultural connotations behind each building within the prefectural government office can be clarified. Subsequently, detailed interpretive handbooks or promotional materials on architectural culture can be compiled, enabling visitors to gain a comprehensive understanding and deepen their appreciation of this significant historical and architectural site, thus avoiding a superficial and forgettable experience.

In the realm of political culture, the advantages of Huai'an Prefecture can be leveraged to create situational simulations. For example, visitors can don official robes in the main hall and simulate the trial of cases by the prefectural magistrate, with professional actors portraying the individuals involved to enhance interactivity and realism. Alternatively, based on the functions of the six departments, different situational modes can be designed, allowing visitors to simulate the handling of official duties by ancient officials. Moreover, in the military and police office area, simulations of ancient punishments can be staged, providing visitors with a profound experience through scene reconstruction, prop displays, and explanations that reveal the types, enforcement methods, and underlying legal culture and social perceptions of ancient punishments.

Regarding folk culture, existing live-action performances such as "A Glimpse of Grandeur: Huai'an Prefecture in the Ming Dynasty" can be deeply optimized, with a strong focus on the historical and cultural background of Huai'an Prefecture. Additionally, literary and historical experts can be organized to further unearth historical figures and events related to Huai'an Prefecture, developing new situational performance programs that incorporate more authentic historical events, characters, and cultural elements, making the performances more vivid and rich in content. Simultaneously, enhancing interactions between actors and visitors, such as inviting visitors to participate in certain scenes, play the roles of the crowd, or assist in completing situational tasks, can heighten visitors' sense of participation and immersion.

4.3. Broadening publicity channels and intensifying promotional efforts

To enhance its popularity, Huai'an Prefecture Mansion must broaden its publicity channels and intensify its promotional efforts. In terms of online promotion, social media platforms such as WeChat Official Accounts, Douyin, Weibo, and Xiaohongshu can be utilized for publicity and promotion. High-quality graphic and video content, such as introductions to scenic spots, historical stories, cultural interpretations, and previews of tourism activities, should be regularly published to attract the attention and sharing of tourists. Additionally, collaboration with online travel platforms like Meituan, Ctrip, and Qunar can be pursued. When launching ticket reservation services, efforts should be made to display relevant information about Huai'an Prefecture Mansion prominently on the platform's homepage, recommended pages, etc., to increase the exposure of the attraction and offer appropriate ticket discounts.

In terms of offline promotion, Huai'an Prefecture Mansion should aim to extend its influence from Huai'an to

Jiangsu Province and even nationwide. Within budget constraints, advertisements can be placed in transportation hubs, commercial centers, and other locations in surrounding cities, such as subway platform advertisements, bus stop advertisements, and outdoor billboard advertisements, showcasing the unique attractions, cultural connotations, and travel routes of Huai'an Prefecture Mansion to attract the attention of potential tourists. Furthermore, participation in domestic and international tourism and cultural exchange activities, strengthening cooperation with travel agencies and other tourism enterprises, or inviting media for publicity can be pursued to effectively promote Huai'an Prefecture Mansion, enhance its popularity, and attract tourists to visit.

5. Conclusion

In summary, as an important architectural relic of ancient prefecture mansions, Huai'an Prefecture Mansion possesses rich connotations of architectural culture, political culture, and folk culture, with significant potential for ancient architectural tourism. However, its current popularity is limited, and the tourism market needs to be expanded. The tourism enthusiasm does not match its inherent tourism conditions, with issues such as a lack of synergy with related attractions, a single tourism product offering, and insufficient publicity and promotion. To address the main issues in tourism development, Huai'an Prefecture Mansion can leverage its unique characteristics, strengthen collaboration among attractions, and create a tourism brand; delve deeper into cultural connotations to enrich tourism products; broaden publicity channels and intensify promotional efforts, thereby enhancing its tourism competitiveness and driving the development of the local tourism industry.

Disclosure statement

The author declares no conflict of interest.

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The Symbiotic World of Humans and Animals: An Interpretation of the Dog Imagery in *A Village of One's Own*

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Abstract: Liu Liangcheng's first prose collection, *A Village of One's Own*, was published in 1998 and quickly attracted widespread attention in the literary circle. In this work, assuming the identity of a "rural philosopher", he employs a multitude of animal imageries to convey his unique insights into life. Particularly, the imagery of dogs occupies a prominent position in the text. It not only showcases his distinctive artistic style but also profoundly embodies the depth of his thoughts. Through diverse narrative techniques and the interweaving of memories and reality, Liu Liangcheng depicts the rich and three-dimensional life of dogs. Meanwhile, via this imagery, he presents the close yet complex relationship between animals and human life. Additionally, influenced by the geographical and cultural features of the borderland, Liu Liangcheng also reveals in-depth reflections on bioethics and the human living condition. These reflections encompass the relationship between humans and all things in nature, with "dogs" serving as a vivid carrier.

Keywords: Liu Liangcheng; *A Village of One's Own*; Dog imagery; Bioethics; Rural changes

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1. Introduction

The academic community has accumulated fruitful achievements in the research on animal imageries in Liu Liangcheng's prose, *A Village of One's Own*. As early as 2001, He Xiongfei described Liu Liangcheng as a "Son of Nature", laying a humanistic foundation for the research on his animal portrayal. Subsequently, Wei Zhiguo and Song Shaojing delved into the aesthetic and cultural values of animal imageries, while Li Yongzhen's research further focused on the life philosophy embodied in the "dog" imagery. These studies not only enrich our understanding of Liu Liangcheng's works but also provide a new perspective for us to examine the relationships between humans, nature, and animals. Therefore, the dog imagery in Liu Liangcheng's works is not merely a literary symbol but also a mirror for observing the rural social structure and the relationship between natural

ecology. Humans and all things in the world are interconnected. Humans do not exist solely in human society but more so in the natural world shared by all creatures. Liu Liangcheng describes this ideology of harmony and unity in his works: “The death of any tree is the death of humans, and the chirping of any insect is the chirping of humans.”^[1] This implies that to understand the animals in his works, a broader perspective that integrates “society” and “ecology” is required. This study adopts an interdisciplinary approach that integrates literary analysis with cultural ecology to explore the symbiotic relationship between humans and nature.

2. The group of animal imageries with “dogs” as the focus

In *A Village of One's Own*, Liu Liangcheng constructs a unique world where humans and animals coexist. In this world, animals are no longer mere backgrounds or tools but living beings equal to humans. The village he portrays is a vibrant ecosystem, and a vivid group portrait is composed of various animals. Before delving into the core imagery of dogs, it is necessary to first examine the common group of animal imageries in the village to understand the overall context of his animal portrayal.

2.1. The group of animal imageries in the village

Traditional Chinese villages are production communities primarily characterized by agricultural production. Livestock such as cattle, sheep, pigs, and dogs are indispensable means of production for the villages. Unlike the mass replication mode featured in large-scale socialized production, the breeding of livestock in these villages involves mutual dedication of labor and affection. Many livestock become members of the family in daily life. Farmers even place them in very important positions in the family to ensure the smooth progress of field production^[2]. For instance, in *The Postman, the Mountain, and the Dog*, the old postman entrusts the dog, his old companion, to guide the young postman; in *To Live*, Fugui and the old ox depend on each other for survival; in some literary works, animals serve as vivid imageries to express human emotions—for example, the dog in Zhang Xianliang's *Uncle Xing and His Dog* symbolizes the kindness of human nature; in Hai Zi's poems, “lonely horses” frequently appear to express the individual's spiritual state and emotional experiences. Some literary works even go a step further by directly adopting the animal perspective for narration. For example, in *Mo Yan's Life and Death Are Wearing Me Out*, a variety of animal imageries, such as donkeys, cattle, pigs, dogs, and monkeys, is used to reveal social changes. Here, animals have become imageries endowed with unique aesthetic connotations. These animal imageries are no longer just biological figures in the natural world; writers have endowed them with profound meanings, transforming them into literary imageries with unique aesthetic value and rich implications.

In *A Village of One's Own*, Liu Liangcheng devotes a large amount of writing to depicting the animals in the countryside. In the first section, “A Village Where Humans and Animals Reside Together”, he describes animals such as the donkey in “The Man Who Understands Donkeys”, the horse in “The Escaped Horse”, the insects in “Sleeping with Insects”, and the wolf in “The Remaining Matters.” These animal imageries in literature transcend the traditional roles of symbols or fables and demonstrate their value and vitality as independent living beings. Their existence and behaviors no longer merely serve human needs or carry in-depth symbols but reflect the independent value of their own lives. For example, “When I returned after searching for the donkey the entire afternoon, the donkey was standing in the yard, looking as if it had been waiting for me the whole time. The donkey stared at me, and I stared back at the donkey”^[3]. “Horses must have their own things to do. When horses come into this world, their purpose is definitely not just to pull carts or serve as mounts for humans”^[3].

2.2. The prominent dog imagery

Among numerous animal imageries, the “dog” imagery is particularly prominent. The imagery of “dogs” runs through the entire book, appearing repeatedly and closely intertwined with human life. Taking the version of *A Village of One's Own* published by Jiangxi Publishing House as an example, dogs are mentioned 382 times in the book. Among all livestock, dogs can be said to have the closest connection with humans. Most writers have had inextricable ties with dogs in their life experiences. For example, Zhang Xianliang once stated: “The first animal I came into contact with was a dog... I have had a deep affection for dogs since I was a child... The first novel I attempted to write was *Uncle Xing and His Dog*.” Chi Zijian also mentioned dogs when recalling her childhood life; dogs, as her good companions in childhood, have always remained in her memories^[4]. In contrast to dogs, Liu Liangcheng mentions in the article “The Escaped Horse”: “I have never had a long-term close contact with horses, not even a simple experience of riding a horse from one village to another”^[3].

Dogs frequently appear as childhood companions, and their imageries often serve as an emotional carrier for individuals to recall their childhood days. Within this framework, dogs are no longer just simple animal figures but important bridges connecting the past and the present, innocence and growth. For example, in rural society, it seems to be a common, trivial matter for children to be bitten by dogs, but these unforgettable experiences often leave a deep impression throughout one's life and become triggers for memories in adulthood. In the chapter “Chasing Dogs”, the author points out that almost everyone in the village grows up amid the barking and chasing of dogs, thus giving rise to many interesting childhood stories related to dogs. Liu Liangcheng also mentions in the text that the black dog in his hometown became his “mentor” and accompanied him during his growth. In Liu Liangcheng's prose, it is not difficult to find that whenever childhood memories are mentioned, there are always the figures or barks of dogs, which have become an indispensable part of childhood life.

People's feelings toward dogs are rather complex, and dogs themselves are full of contradictions. For instance, in the book, dogs can act as the most loyal servants of their owners. “In the eyes of a dog, any face other than its owner's must be unfamiliar and dangerous”^[4]. The loyalty of dogs makes them objects of human reliance, while also revealing the submissive and subordinate status imposed on them. “In the countryside, every household ties a dog at the door, and the purpose is clear: to guard the house. The door of humans is controlled by dogs, as if the house belongs to the dog. Visitors do not come to see the dog, but they first have to confront the dog for a while”^[3]. In “Huangshaliang”, it is also mentioned that when people in the village work in the fields during the day, they only look up at the sound of dogs barking and then continue with their work. “No one would drop their hoes and run back to the village to check what was happening just because a dog barked a few times. People confidently leave the entire village in the wilderness during the daytime”^[3]. This fully reflects people's trust in dogs.

With their loyal and selfless nature, these dogs have become companions that villagers firmly trust and deeply rely on. When facing external visitors, dogs are the first to “confront” them; only when they confirm that the visitors are harmless will they allow them to pass. Dogs are not only loyal guardians of the village; their role goes beyond guarding the home, and they have established unique and profound emotional connections with every resident in the village. In the article “A Village Where Humans and Animals Reside Together”, there is a sentence: “Dare you say that Zhang San's dog does not recognize you, Li Si? It just cannot call your name.”^[3]. The barking of dogs may implicitly contain people's names, although people may not be aware of it. The status of dogs in the village is completely different from that of other animals. The original purpose of people raising dogs is not for food but to guard the home and provide protection, which fully demonstrates the unique role and status of dogs in village life.

However, dogs are also very likely to arouse people's disgust. "The shadow of the dog is always scurrying before our eyes, and the barking of the dog can be heard from time to time during conversations, making the visitors feel uneasy"^[3]. "When I was a child, I would be so scared that I would run away whenever I encountered a dog"^[3]. The understanding nature of dogs is their greatest strength, but it can also be their weakness. Lin Yutang once bluntly stated: "The reason why I dislike dogs is precisely because they are so understanding"^[5]. It is also mentioned in the chapter "Chasing Dogs": "As soon as a dog sees a person crying, it stops barking. The dog knows that as soon as a child cries and shouts, an adult will immediately come with a stick, so the dog has to quickly choose a direction to run away"^[3].

People often endow dogs with certain cultural connotations based on their biological characteristics. Therefore, dogs possess dual meanings, such as loyalty and servility, kindness and evil, and even more.

3. The narrative discourse represented by "dogs"

The profound connotation of the dog imagery stems not only from its rich symbolic meaning but also from Liu Liangcheng's exquisite narrative art. Instead of depicting in a straightforward manner, the author employs multi-dimensional narrative strategies, including language, perspective, and structure, to jointly construct a "dog" discourse world filled with philosophical thoughts and emotions. Among these, the exquisite and poetic narrative language serves as the foundation, directly endowing dogs with spirituality and depth.

3.1. Narrative language

Through meticulous and poetic narrative language, *A Village of One's Own* endows dogs with depth and a soul. Liu Liangcheng's words not only capture the appearance and behaviors of dogs but also convey the profound emotional bond between dogs and humans between the lines. For example, "A dog chases a cloud that looks like a dog, running wildly on the sand dune"^[3].

Huangshaliang, as a relatively primitive natural land, provides a vast space and freedom for dogs, enabling them to demonstrate their autonomy. In this context, the similarity between the imagery of a dog and a cloud is cleverly used as a symbol, endowing the dog with human emotions and behavioral characteristics. On the vast Huangshaliang, a dog regards a cloud similar in shape to itself as its kind and chases after it. This behavior not only indicates the loneliness of the dog but also emphasizes the desolation of this land. In "The Pace of Spring", Liu Liangcheng, with his delicate writing style, demonstrates the different living states of dogs and cattle. He meticulously depicts the tranquility of dogs when they are basking in the sun, enjoying their leisure time. Such descriptions not only showcase the peace and ease of dogs but also subtly express an attitude toward life of conforming to nature and being content with one's lot.

In addition, Liu Liangcheng skillfully enriches the language level and expressiveness of the work through the descriptive use of dog imagery. He describes people falling asleep peacefully to the barking of a dog, uses "running like a dog" to depict the surging of clouds and mist, and even vividly describes the size of a hole as "big enough for a dog to pass through." This ingenious use not only adds interest to the work but also allows readers to gain a deeper understanding of the philosophical thoughts and emotional world that the author intends to convey.

3.2. Narrative perspective

Through the well-designed switching of multi-dimensional narrative perspectives, *A Village of One's Own*

skillfully endows the “dog” imagery with vivid and three-dimensional vitality. This narrative technique enables the imagery of dogs to deeply touch the readers’ hearts from multiple dimensions and perspectives.

“An old dog that has endured years of hardship will eventually have the iron chain binding it rusted and broken without struggling. The owner who raised it also enters old age”^[3]. When describing the intimate relationship between dogs and their owners, Liu Liangcheng adopts the first-person narrative perspective, depicting the imagery of dogs through his own observations and experiences. This narrative method allows readers to more directly feel the author’s emotional attitude and concern for the living conditions of dogs, thereby enhancing the appeal of the work.

Liu Liangcheng also employs the third-person perspective to present the behaviors and characteristics of dogs in a more objective manner. This narrative method provides readers with an overall view, making the imagery of dogs more three-dimensional and rich. For example, he mentions: “In the eyes of a dog, any face other than its owner’s must be unfamiliar and dangerous”^[3]. When revealing the loyalty and trustworthiness of dogs, Liu Liangcheng adopts the third-person narrative perspective to objectively observe and describe dogs. In the author’s writing, dogs are no longer ordinary livestock for guarding the door; they are endowed with the qualities of tenacity, endurance, generosity, and loyalty. This narrative perspective allows readers to more objectively understand the characteristics and qualities of dogs, thereby triggering in-depth thinking about the relationship between dogs and humans.

In “The Life of a Dog”, the author comprehensively demonstrates the role and emotional significance of dogs in human life from a human perspective. For example, it is written in the text: “It is really not easy for a dog to live to an old age. Being too fierce is not good, being too timid is not good, and neither is being understanding nor too understanding”^[3]. Here, requirements are put forward for the character of dogs from a human perspective, reflecting that in people’s minds, dogs need to possess qualities that meet human expectations to survive. This embodies humans’ scrutiny and expectations of dogs.

Furthermore, Liu Liangcheng adopts the animal perspective narrative method, allowing dogs to tell their own stories. For example, in the article “Two Dogs”, the author presents the difficult life of a dog after being abandoned from the dog’s perspective, highlighting the dog’s loyalty and tenacity. In this narrative method, dogs are not only participants in the story but also become the “narrators” of the story, presenting the story world and characters through their eyes and feelings. The innovation of this narrative perspective lies in that it provides a new perspective for observing and understanding the human world, thereby increasing the depth and complexity of the work.

3.3. Narrative structure

In the depiction of dogs in *A Village of One’s Own*, a variety of narrative techniques are employed. In the chapter “The Life of a Dog”, Liu Liangcheng adopts linear narration, meticulously depicting the life journey of a dog from birth to old age in chronological order. He captures the playfulness of puppies when they are young, the loyalty of adult dogs, and also meticulously portrays their frailty and dependence in old age. This chronological narrative method allows readers to systematically track the life trajectory of the dog and personally experience the twists and turns of its life.

“I stood dumbfounded in the snow, watching the fire grow bigger and bigger. The huge fire dragon surged and rolled from south to north, as if it was going to devour everything. I do not know how long I stood there in a daze. Finally, the fire died down, and the night once again enveloped the blackened wilderness. The village was

still quiet; no one woke up, no dog barked, and no chicken crowed”^[3].

In “The Great Fire on the Horizon”, the silence of dogs symbolizes the sleeping state of the villagers. The author attempts to wake the villagers by setting a fire, but ultimately fails, which shows the symbolic meaning of the author as an awakened person. At the same time, through the description of dogs, Liu Liangcheng also subtly metaphors the human living conditions and social interactions. “Those who wanted to be village heads each gathered a group of people, canvassing votes all night long, knocking on doors from house to house. The commotion made the dogs bark all night. Many dogs died of exhaustion before the village head was elected.”^[3]. The status and fate of dogs in the village reflect the complex aspects of human society, including the praise of loyalty, the abuse of power, and the attitude toward life. This symbolic narrative strategy makes the description of dogs go beyond a mere portrayal of animal life and become an in-depth reflection on human behavior and social norms.

This narrative method allows readers to clearly feel the growth, aging, and eventual lonely death of dogs, reflecting the fragility and inevitable demise of life. Throughout the book, dogs appear repeatedly as symbolic beings, forming a circular structure. For example, in different chapters, plots such as the barking of dogs, the guarding of dogs, and the abandonment of dogs by their owners appear repeatedly, forming a symbolic narrative of village life. This circular narrative makes dogs not only exist as animal imagery but also become a part of village life, symbolizing the guardianship and loneliness of the countryside.

The depiction of dogs in *A Village of One's Own* skillfully combines linear narration and symbolic narration, endowing the text with the authentic texture of life and injecting profound metaphorical meaning. The application of this narrative technique greatly enriches the literary connotation of the work, making it a memorable literary piece.

4. The spiritual dimension centered on “dogs”

It is worth noting that since the new era, the trend of animal narrative in literary creation has become increasingly intense, and dogs have been endowed with multiple symbolic meanings. Writers such as Mo Yan, Jia Pingwa, Chi Zijian, Yang Zhijun, and others have all used dogs as the main imageries to construct the meaning of their texts. Literature is about humans; the depiction of “dogs” actually points to humans, covering the dual dimensions of human relationships and the relationship between humans and animals^[4].

The animal narrative perspective has demonstrated unique flexibility and depth in literary creation, such as Zhang Chengzhi's *Black Steed* and Wang Xiaobo's *A Unique Pig*. Within this narrative framework, another noteworthy attempt is to construct stories through the perceptions and experiences of animals themselves. For example, the section “The Man Who Understands Donkeys” in a certain work takes the interaction between humans and donkeys as the starting point, profoundly revealing the parallel yet conflicting life rhythms of the two: “It was the busy season for humans to sow seeds, and also the crucial period for donkeys to be in heat (male donkeys are in heat all year round, just like men). These two extremely important matters coincided. When humans needed to use the donkeys, the donkeys were also busy with their own business, which was even more tiring for the donkeys than pulling carts and plowing fields”^[3].

This direct description of the sexuality of donkeys not only reflects the natural attribute of animals driven by instinctive desires but also indirectly explores the complex aspects of human nature through a metaphorical approach. If such a direct description of low-level desires were applied directly to humans, it might imply a

certain derogation of human nature, comparing humans to “livestock that cannot even control their basic desires.” Therefore, the adoption of the animal perspective for narration not only avoids the narrative limitations that may be encountered when directly starting from the human perspective but also explores the commonalities and differences between humans and animals, as well as the subtle and ineffable aspects of human nature, in a novel and insightful manner.

Liu Liangcheng has stated more than once that what he writes about is an “idle person.” From the unique perspective of this idle person, he uses poetic brushstrokes to meticulously depict the natural scenery in a village—plants, animals, and those intangible yet deeply felt elements such as wind, night, moonlight, and dreams. Within this framework, the state of the “idle person” becomes a spiritual catalyst: when the body is at leisure, the mind and spiritual world begin to become active, seeking satisfaction. This sense of dissatisfaction does not stem from material scarcity but from a deep spiritual desire. Precisely because this “idle person” does not work in the fields all day long like ordinary farmers, he has ample time for thinking and introspection, thus cultivating the spiritual wasteland and opening up spiritual territories that are sparse yet full of imagination.

Furthermore, with this perspective, Liu Liangcheng constructs a village world that is both real and transcendent. It not only includes the existence of a physical space but also endows the creatures in the village with souls. In addition, the unique literary characteristics brought about by the vast and barren land of Xinjiang—“On the vast land of Xinjiang, large areas of barren land surround scattered patches of green space. The distribution of human culture is isolated, scattered, and sparse. Isolated villages, isolated towns, isolated cities, and small groups of or single-family ‘independent houses’ have loose connections and scarce communication. The time spent communicating with nature is far more than that spent communicating with members of the same species.” In such an environment, the communication between humans and the natural world becomes frequent and in-depth, far exceeding that between humans ^[6].

Therefore, in Liu Liangcheng’s writing, animal imageries are inevitably endowed with humanistic characteristics. They are not only part of the natural world but also carriers of the author’s emotions and thoughts, reflecting the complex relationships between humans and the environment, and between humans and themselves. Through these “humanized” animals, Liu Liangcheng explores the profound themes of loneliness, the meaning of existence, and the harmonious coexistence between humans and nature, presenting readers with a literary world that is both real and philosophical.

4.1. The contrast between humans and dogs

From the very beginning, dogs have been carefully shaped as animal imageries with strong humanistic traits. Their existence goes beyond simple biological descriptions and becomes a profound carrier for exploring human nature, life, loneliness, and social changes. In “The Life of a Dog”, the life of a dog is described as follows: “When a dog lives to an old age, its life becomes relatively safe. This is not because the dog has gained any life experience... At this time, the dog is very much like an elderly person who has gone through many vicissitudes of life. The world can no longer do anything to it, so it has to let go and leave the dog to time and fate.” ^[3]. This description not only reveals the life trajectory of dogs but also implies similarities with the fate of humans. Although Liu Liangcheng clearly points out that dogs do not accumulate capital for their old age when they are young, a deeper analysis reveals that the fate of dogs bears a striking resemblance to that of the broad masses of people at the bottom of society. For these people, the future is full of uncertainties, and they can only focus on the present and struggle for a living. Young people sell their labor and are exploited by capital and society. When they grow old and weak, and

their surplus value is completely extracted, no one will pay attention to their existence anymore. The remaining years can only be spent in “waiting for death.” Here, the fate of dogs becomes a mirror of human fate, reflecting the hardships and helplessness of survival.

The text further describes: “An old dog that has endured years of hardship will eventually have the iron chain binding it rusted and broken without struggling... It is really not easy for a dog to live to an old age.”^[3] These words not only express the hardships and confusion of a dog’s life but also reflect humans’ confusion about the meaning of life and their deep feelings about the hardships of life. As a symbol of guarding the home, dogs cannot even ensure their own safety, and the fragility of their lives is fully demonstrated here. Liu Liangcheng uses the humility and helplessness of dogs to symbolize the predicament and living conditions of the people at the bottom of society. Through this imagery, he reveals the reality of humans being oppressed and exploited.

In “The Life of a Dog”, Liu Liangcheng shows the life course of a dog from birth to death from the dog’s perspective. This dog witnesses the changes in the village and the rise and fall of its owner’s family. It loyally guards the home but is abandoned in its old age due to frailty. The life of this dog reflects the hardships and helplessness of farmers’ lives, and also reflects the living conditions of the people at the bottom of society.

4.2. The exposure of the essence of life

Ordinarily, people’s understanding of dogs is limited to their external behaviors and interactions with humans, and they rarely delve into the life course of dogs and the state and significance of dogs at different stages of life. Liu Liangcheng’s focus on the natural death of dogs goes beyond the simple understanding of dogs and explores deeper issues such as the impermanence of life, the inevitability of aging, and the value and mode of existence of life at different stages. Here, dogs also represent the information about life and death throughout a lifetime. This theme is exquisitely demonstrated through the living state and end of dogs, profoundly reflecting humans’ fear of the fragility of life and death, as well as their contemplation on the essence of existence. The work points out that although the fate of dogs is subject to human will, it is even more difficult for them to escape the laws of nature. The concept of birth, old age, illness, and death not only applies to dogs but also is a profound reflection of the common destiny of all living beings. In “Two Dogs”: “The black dog died. It died in its kennel. My father said it died of old age. At that time, I did not know what kind of death was death from old age. I thought it died of starvation or loneliness. It often did not come out, and sometimes we even forgot to feed it when we were busy.”^[3] When dogs are unable to continue living due to illness or old age, the only fate awaiting them is death. Regardless of the circumstances, whether they are noticed by humans or not, death is the only path. For dogs, this situation profoundly reflects the fragility and impermanence of life, as well as the powerlessness and inevitability of all living beings in the face of death. Therefore, the author naturally raises a question about the meaning of life here: “Is there any meaning in us living like this?”^[3]

Natural death is inevitable, but the hardships of life are even more tormenting. The opening of *A Village of One’s Own* takes “It is really not easy for a dog to live to an old age” as the prologue, subtly setting the tone for the entire work^[3]. This sentence reveals the distinct contrast in living conditions between rural guard dogs and urban pet dogs, and at a deeper level, reflects the fragility of life in harsh environments. The living state of guard dogs is portrayed as a marginalized existence. They cannot be too fierce to the extent of threatening humans, nor can they be too timid to lose their value as guard dogs. Their lives and deaths often hang by a thread, thus highlighting the fragility and unpredictability of life itself.

Human civilization is dominated by individuals, and this concept is reflected in the attitude toward living

beings, which is the so-called “species discrimination.” Therefore, the reflection on humanitarianism initially starts from revealing the painful situation of animals. However, this work mainly demonstrates the humanistic care for animals, and its emotional influence exceeds rational thinking. When the focus of creation is placed on the experiences of animals, the attention naturally falls on the essence of humans. Animals are used here as a medium for humanitarianism and human nature, but the emphasis is on “human nature” rather than the “nature of dogs” itself.

Faced with the death of the black dog, Liu Liangcheng has a profound question about the meaning of life. Although humans and dogs share the same sunshine and go through the process of birth, old age, illness, and death together, humans cannot judge whether their own lives are meaningful from the perspective of dogs. This part of the content prompts readers to reflect on the value and purpose of life, and also makes us think about how the meaning of life is defined and perceived in the interaction between humans and animals.

From the author’s perspective, the existence of dogs and their attitude toward human life may not be related to the complexity of human life, but more about the simple pursuit of survival instincts. It is more of a revelation of the fragility of life, which belongs not only to dogs but also to humans. As Liu Liangcheng reflects: “I think when I grow old, I will gradually understand what it means to be old”^[3]. He connects the death of dogs with the human life process, demonstrating the universality and inevitability of aging and death.

4.3. An important carrier of social and historical changes

Dogs are not only livestock raised by humans during the day but also the “occupants” of the night. At night, the village becomes a world of dogs. “As soon as humans fall asleep, the village becomes a world of dogs. After a day of noise, humans have no more words to say. Both the land and humans are tired. At this time, the barking of dogs fills the air, and the sound of dogs drifts back and forth in the night sky, connecting villages far and near together”^[3]. At this time, humans become secondary existences. Hearing the barking of dogs at night is the most important feature that well represents the existence of this village. Dogs, with a history of thousands of years, can undoubtedly represent the social changes of a village. They have witnessed the passage of time and carried the memories and stories of the countryside. As witnesses of time, dogs have witnessed the changes in the village. For example, “This dog walks back and forth, its eyes filled with the old events and past scenes of people from many years ago”^[3].

In traditional rural society, dogs are not only animals that guard the home but also important guardians of the order of village life. “A long time ago, dogs were not tied up. Except during the mating season, dogs generally did not run around randomly. They lay at the door all day long, each guarding their own courtyard”^[3]. This passage reflects the well-ordered role of dogs in the village in the past; they independently take on the responsibility of guarding the village. This order symbolizes the stability of the rural society at that time and the harmonious relationship between humans and animals. Dogs do not require human restraint and maintain the safety and order of the village by virtue of their instincts. This social model relies on the close integration of humans and nature, reflecting the tranquility and stability in the traditional life of the village.

However, with the advancement of modernization, the process of urbanization has led to the decline of the countryside. Coexisting with the fate of the countryside, the role of dogs has gradually changed. From being the maintainers of the original village order, they have gradually been marginalized by society and become silent witnesses of changes. They are not only a part of the village but also symbolize the loneliness and decline of the village in the process of modernization. In the chapter “Huangshaliang”, Liu Liangcheng further reveals

the connection between the fate of dogs and the village: “Throughout the day, only the elderly and dogs are left guarding the empty village. The sun moves step by step over the treetops and rooftops”^[3]. Dogs and the elderly jointly guard the empty village, becoming silent symbols in the process of social and historical changes, reflecting the decline of the village and its marginalized status in society. The silence of dogs and the emptiness of the village reflect each other, expressing the loneliness and loss of village life.

The political and social changes brought about by modernization have made the fate of dogs even more tragic. Liu Liangcheng mentions in “All Dogs Died from Exhaustion”: “Every three years, when it comes to the village head election, a batch of dogs will die from exhaustion”^[3]. The death of dogs is no longer just a biological event but a victim of the traditional village order in the power struggle. The fate of dogs is closely intertwined with the political conflicts of the village. In the power struggle of modernization, the traditional, simple human feelings are consumed by interests. As the thing that best represents the traditional village culture, dogs will naturally also be consumed, which indicates the demise of traditional culture and values in the process of modernization. The death of dogs not only symbolizes the breakdown of social connections in the village but also represents the gradual disappearance of rural culture in the process of modernization. The disappearance of dogs reflects the collapse of the traditional way of life and values in the village, becoming a symbol of the loss of rural culture.

When the social structure changes, dogs will naturally face the survival dilemma brought about by the new environment. “The dog knows that it has neglected its duty, so it raises its head and howls at the sky as if crying”^[3]. In this description, the dog fails to fulfill its duty of guarding and feels helpless, which symbolizes the collapse of the old order of the village and the sense of powerlessness brought about by social transformation. The dereliction of duty and predicament of dogs not only reflect the deepening of individual loneliness but also reveal the marginalization of rural society and the impact of modernization.

In the chapter “Kengwa Di”, the imagery of dogs further deepens the theme of cultural inheritance: “It is not easy for a village to have a good dog, just as it is not easy to have a capable person... Generally, a village produces two capable dogs every thirty years and one outstanding person every three hundred years”^[3]. Here, dogs not only symbolize the guardians of the village’s history and culture but also become witnesses of collective memory. Through the description of dogs, Liu Liangcheng expresses his deep memory of the village’s social history and cultural heritage, demonstrating the loss of collective emotions in the process of social changes.

The fate of dogs not only symbolizes the loneliness of individuals but also reflects the social collapse and cultural decline of the entire village under the impact of modernization. Through the imagery of dogs, Liu Liangcheng reveals the breakdown of the rural social structure and the complex relationships between humans and the environment, and between tradition and modernization. In his writing, dogs are not only the guardians of the village but also important carriers of social and historical changes, bearing the memories and loneliness of rural society.

5. Conclusion

Through the dog imagery in *A Village of One’s Own*, Liu Liangcheng profoundly reflects the complexity of rural life and the impermanence of individual fate. Here, dogs are not only an animal imagery but also a complex cultural symbol formed through the accumulation of Chinese civilization over thousands of years. Dogs are not only loyal guardians of the village but also contain multiple dimensions of social contradictions, cultural changes, and human emotions. Through delicate narration, Liu Liangcheng endows dogs with profound philosophical

significance, making them a key carrier for understanding life and death, loneliness, and the predicament of human nature. From a deeper social-ecological perspective, the fate of dogs is closely intertwined with the fate of the village. The changes in their roles are not only a microcosm of the marginalization of traditional rural culture in the process of modernization but also a direct response to the ecological ethics issue of “the coexistence of humans and nature” in modern society.

Disclosure statement

The authors declare no conflict of interest.

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Sustainable Renewal of the Old City: Planning Practices and Institutional Innovation in Suining, China

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Abstract: In recent years, the state has placed great emphasis on the construction of ecological civilization and has launched a new exploration of territorial space planning and construction in all places. At present, there are problems in functional layout, infrastructure, features, system management, etc. It is necessary to play a leading role in planning to solve the problems left over by history in the development of the old city. Suining city is surrounded by mountains and rivers, with beautiful urban scenery and a long history of old city construction. Therefore, Suining city insists on taking ecology as the core and promotes renewal with ecology, forming a road of old city renewal with Suining characteristics. This paper focuses on summarizing the experience and mode of urban renewal in Suining City, and it also puts forward some suggestions for future urban planning and development.

Keywords: Old city renewal; Renewal planning; Ecological governance; Smart city

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1. Introduction

1.1. Research background

In recent years, the state has placed great emphasis on the construction of ecological civilization, and tries to restore and improve the city with systematic ecological management means, drive the sustainable development of the city, and promote the vitality of the city. In 2022, the Ministry of Ecology and Environment and 18 other departments jointly issued *the Opinions on Promoting Functional Departments to Do a Good Job in Ecological and Environmental Protection*, which again put forward the policy of further strengthening the ecological and environmental governance system with clear rights and responsibilities, coordination and linkage, and joint management. As an important part of the city, the old city has faced many problems restricting the development of the city, such as insufficient supporting facilities, low construction quality, insufficient innovation vitality,

insufficient supervision and management, and old systems and policies. In the 20th National Congress of the Communist Party of China requirements, the government must build a modern industrial system and promote regional coordination. At the same time, the government must implement urban renewal actions to build livable, resilient, and smart cities. Therefore, it is extremely necessary to implement the renewal of the old city, solve the problem of urban renewal, and break the dilemma in the development of small and medium-sized cities.

Suining city riverside, attaches great importance to the construction in planning and ecological civilization construction, since the pilot “sponge city” in 2015, “city double repair” concept as the core, to carry out the ecological civilization construction at the same time, began to explore the road of Suining city ecological civilization construction, and gradually formed the characteristics of ecological environment protection with Suining planning system, and has achieved good construction effect. In recent years, Suining city has been exploring the planning path and way of its old city, and has walked out of a road of ecological renewal belonging to Suining.

1.2. Research on the renewal of the old city in China

In recent years, there has been a lot of research on the renewal of old cities in China, and the problem of old cities is also quite common. In order to clarify the direction of advanced research in related fields in China, articles with relevant funding projects over the past 10 years were selected as the background, and the keyword “old city” was selected and sorted by relevance. The top 500 articles were selected for research and analysis. As is seen in **Figure 1**, in recent years, key research has shown a stable trend. In 2016, due to the impact of “housing does not stir fry”, relevant research decreased, but gradually rose to a peak in 2021. Afterwards, due to the impact of the epidemic, there was a slight decrease (2022 data is currently incomplete). It can be said that China’s research on the renovation of old urban areas has been relatively comprehensive.

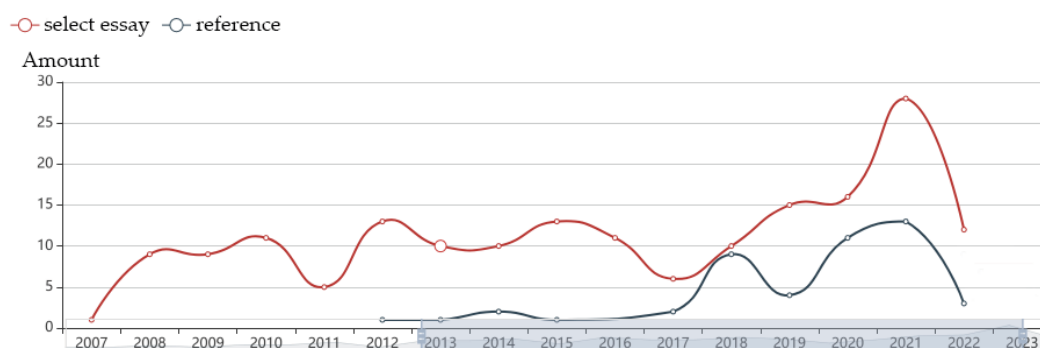


Figure 1. Amount of research on the direction of urban renewal in China in recent years (Source: Self-drawn)

Through data analysis and understanding in **Table 1**, the keywords in the old city are relatively close, and the main summary is made. Nanjing, Shanghai, and Guangzhou are the main urban representatives. There are many trivial Spaces in the reconstruction of the old city, with industrial plants still abandoned, and the elderly are also the population group of the old city. The transformation of its space cannot be separated from the improvement of infrastructure and the shaping of open space. Therefore, the integration of industry and city, space construction, space accessibility, pension facilities, and landscape gardens are the main research topics of the old city renewal.

Table 1. Keyword analysis by Citespace

Keyword	Begin	End	Strength
Industry and city integration	2013	2016	1.283
middle-sized and small cities	2013	2014	0.9996
Protection	2014	2016	1.7098
Influencing factor	2015	2019	1.4431
Urban space	2016	2017	1.282
Nan Jing	2017	2019	1.8362
Landscape architecture	2019	2021	1.9357
Shared bike	2019	2020	0.9331
Spatial syntax	2020	2021	2.8392
Urban renewal	2020	2021	1.1458

From the perspective of the authors, there are many authors in China whose relationship and research trend can be seen in **Figure 2**, so although the keywords are closely related and the theme direction is clear, the authors are independent of each other. With the research circle of Zheng Zhicheng, Zhou Chunshan, Shen Zitong, and other academic experts as the core, the relevant research has certain reference value.

Bian Yan, Zhou Chunshan, and Gao Junbo et al. study the old city population change, spatial evolution, housing selection, basic services, based on the update of Guangzhou is given priority to, the study puts forward an aging population will continue to spread to urban center, urban public service facilities spatial distribution overall low, and overall comprehensive fair level is lower than most of the single class facilities comprehensive fair level, system, location factors, family environment influence to buy a house, but to buy a house also has a certain centripetal ^[1-4].

Zheng Zhicheng and others focus on the accessibility of the core public service facilities in the old city, such as landscape, medical treatment, while taking full account of carbon emissions, Zhang Lijun, Zheng Zhicheng, and Rong Peijun et al. based on the research of Arcgis, POI capture and walk score algorithm, it is proposed that the spatial distribution mode of daily facilities is quite different, and the uniform distribution, circle distribution and gradient distribution coexist, and the standard of large composite in hospitals ^[5-8]. Urban villages, returning communities, and communities used in mixed residential and industrial sections are the focus of optimization and adjustment of the accessibility of daily service facilities. Finally, his research on the carbon emission of travel will bring a good reference to the reconstruction of the urban living space environment.

Zhou Suhong, Xie Miao, and Fu Chenbo et al. study the old city commercial space and consumption activities is given priority to, the city center and the original unit community aging and old city reconstruction and the new development zone of different elderly space agglomeration migration is the main motivation, built environment is the primary factor affecting the retail business center, commercial network density, land use mix density, bus and subway station density, commercial center location characteristics, distance to the city center variables to the formation of various types of commercial center ^[9-12].

Wang Yueqi, Wang Shaodong, Yao Chong, and Peng Xiaosong et al. conducted research to improve the degree of intelligent service in the old city ^[13-17]. From multiple perspectives, it discusses how to embody the

friendly design in public facilities at three levels: material-friendly, environment-friendly, and people-friendly. The integrated development of smart industry and smart city is reflected in the integration of influencing elements, process integration, spatial integration, and strategic integration between smart industry and smart city. From the national, local governments, the practical operation of the three levels of solutions.

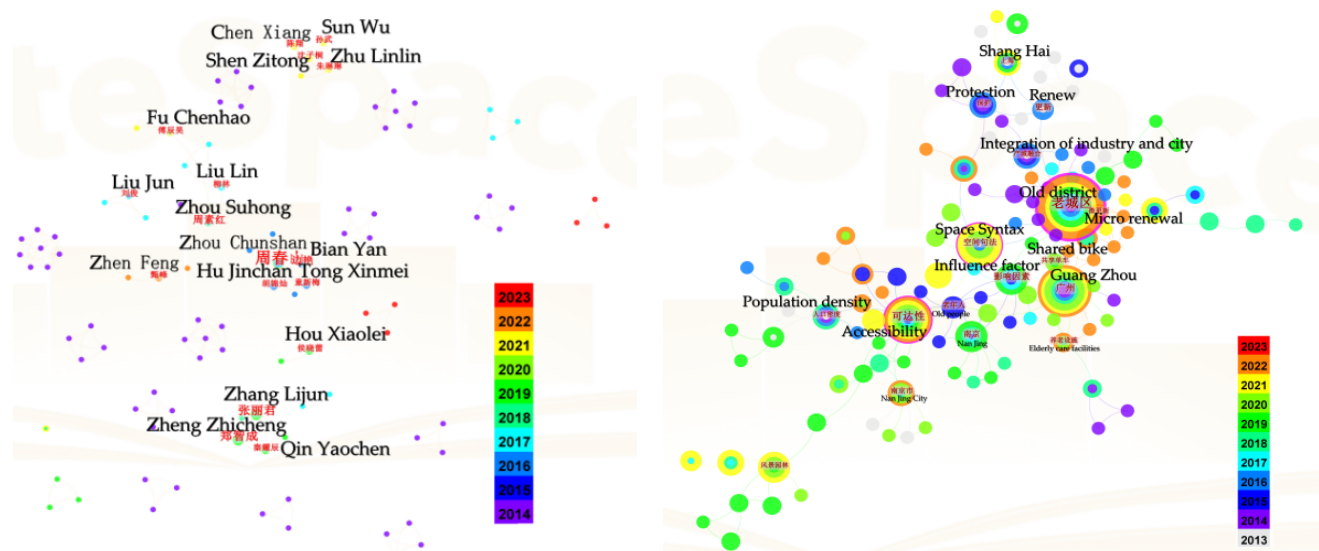


Figure 2. Amount of research on the direction of urban renewal in China in recent years (Source: Self-drawn)

2. Materials and methods

2.1. Methodology

The study adopted a mixed methodology. The study mainly uses the literature collection method, expert analysis method, and field investigation method. Using the subjective and objective comprehensive research and judgment, the main problems and the main indicators of the construction of the old city are identified. Collecting and screening the urban and rural planning and technical documents compiled by the government in the past decade were collected and screened. Based on CITESPACE literature analysis, the latest research field and achievements in China analyzed the advantages and disadvantages, and existing problems in Suining. At the same time, according to the basic drawings and drawings of CAD, satellite map data and field research and analysis were collected to think about the spatial accessibility, infrastructure service function, and the effect of urban green space planning and construction, using the hierarchical analysis method to comment on its construction performance. The effect of stratified discussion was adopted, the urban construction characteristics of Suining were interviewed by experts and citizens, and the keywords were selected to interpret and analyze relevant conclusions.

2.2. Description of the study area

Suining is located in the east of Sichuan province, covering an area of 5,325 square kilometers. It is about 150 kilometers away from both Chengdu and Chongqing, taking about one hour by high-speed rail, which is an important node city and a secondary comprehensive transportation hub between Chengdu and Chongqing. The Fu Jiang River runs across the city, and two mountains are on the left and right sides of the city, which brings beautiful scenery and forms two core scenic spots. Suining is a hilly low mountain area in the middle of the Sichuan Basin, rich in rivers, creatures. Suining is actively building a strong green economy city, and tries its best to form an eco-

environmental protection system. Suining City has a beautiful natural environment, and it's a city with beautiful scenery surrounded by mountains and rivers. The Sichuan Provincial Government has added Suining to the Chengdu Economic Circle and clearly supports constructing Suining to build a strong green economy city on the main economic axis of Chengdu-Chongqing.

3. Results and discussion

Under the leadership of successive Party committees and governments in Suining, with the goal of building a national ecological civilization demonstration city, Suining City has been approved as “National Sponge City Construction Pilot”, “Provincial Park City Construction Pilot”, “Provincial City Organic Renewal Pilot”, and so on. At the same time, it took the lead in the construction of a landscape garden city, with green development through planning and construction. The warm and pleasant natural ecological environment, colorful riverside park, and comfortable and livable cultural environment are praised by tourists. At present, a number of planning and construction implementation plans have been completed in the old city, focusing on the improvement of residential areas, sponge construction, improving the quality of parks, and park construction, road sponge, and shantytown reconstruction in an orderly manner.

3.1. Forming an ecological planning, construction, and construction management system at the core of the ecological construction system

“Ecology”, as the core, runs through the whole process of the construction and management of renewal. The systematic overall management of ecological and environmental protection governance is the spiritual basis of the city's green meaning and deep memory of tourists, and it is also the top priority of urban renewal. Through the planning and design of different levels, constantly improve the ecological space of urban and rural space in the central urban area, highlighting the characteristics of “ecological” of urban and rural space. Since 2014, Suining City has completed 27 ecological coordination planning projects related to the municipal and central urban areas. According to the division groups of the master plan of the central urban area, there are 58 projects of green space at each group level. Besides, a total of 62 major urban park and road landscape renovation projects have been completed. In 2020, the requirements for the renovation and upgrading of urban and rural stock space have greatly increased, with the number of block adjustments for urban detailed planning projects reaching a total of 64. The outline of the main work is shown in **Figure 3**. Although these projects are not directly related to the green space, their space directly affects the continuity of the green space system, so statistics are made on this basis. Detailed data can refer to **Figure 4**, the data from 2023 until October 31.

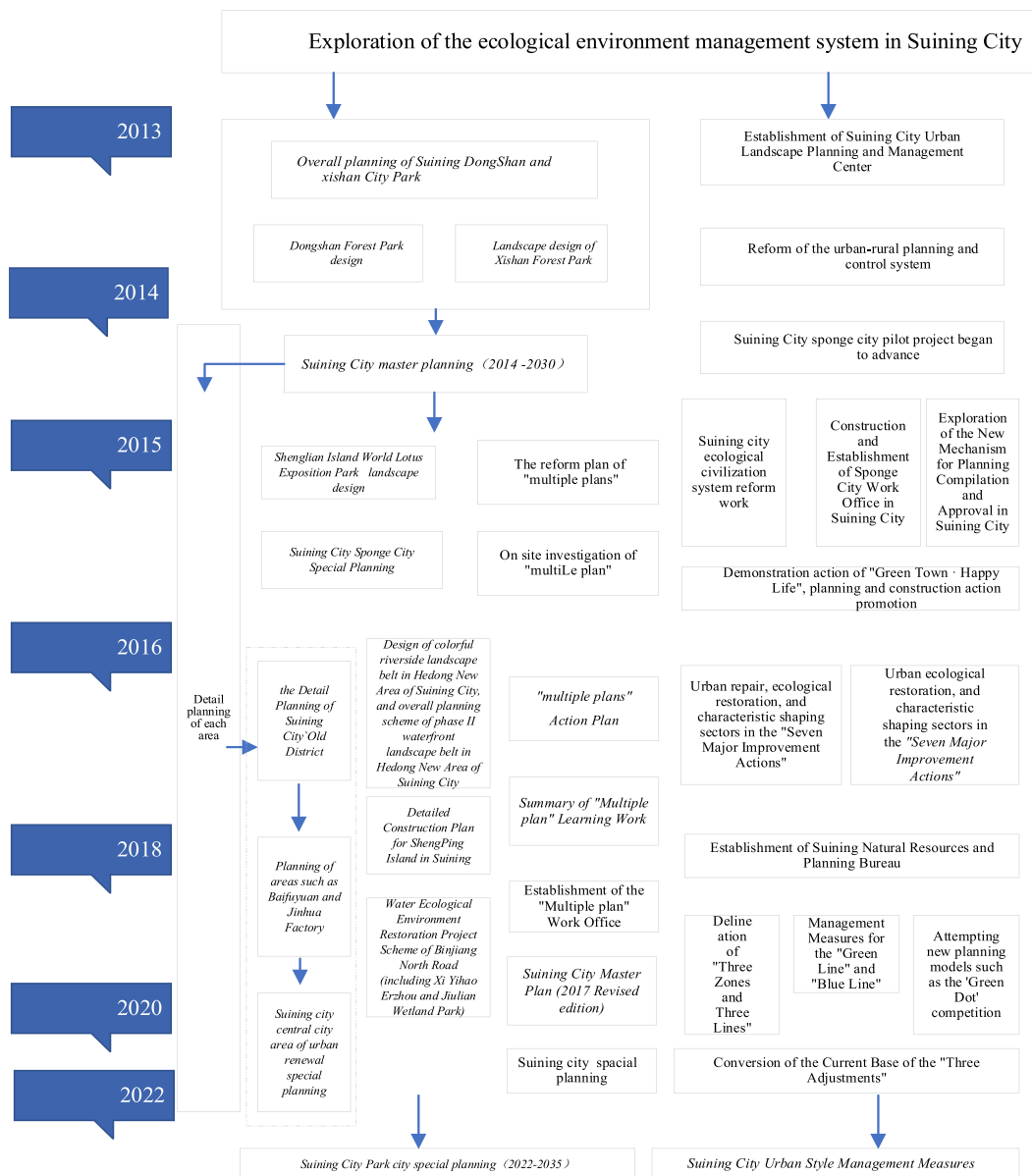


Figure 3. The exploration of ecological environment system governance in Suining City (source: Self-drawn)

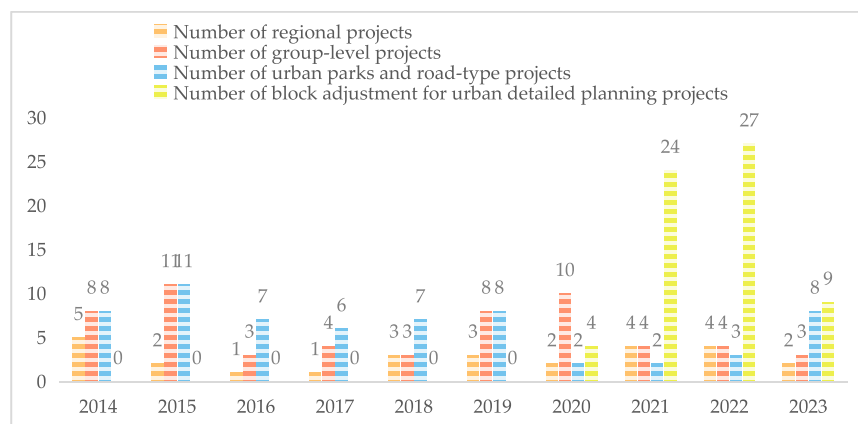


Figure 4. Statistical map of Suining Ecological space related planning in 2014–2023 (source: Self-drawn)

3.2. Forming a park system covers the whole city, and creating a “point, line, and surface” three-level full coverage of high accessibility of the charm of the old city

As an important key, parks play a vital role in shaping the urban landscape and restoring the ecological environment of the old city. Based on this, Suining City, holding on to the perspective of park city construction, fully excavates the ecological and natural landscape pattern, and carries out the park construction. Through the layout of the three-level park of point, line, and surface, it has injected new vitality and charm into the old city of Suining.

First of all, Suining City extends the coverage of the core landscape area to the surrounding adjacent area. Xishan Park, adjacent to the old city, has been built, and the system of Shenglian Island, Xiwu Erzhou, Binjiang Road, and South and Shengping Island Guanyin Lake Park has been planned and improved. Suining completed the landscape planning and design of the old city of Suining City, to build the park green space with high-quality standards. At the same time, *Suining to the Shenglian island planning for the international lotus expo park, the planning for national 4A level scenic spots* (Figure 5), with high standard design, has created this piece of green space, with its vast coverage surrounding the old city, making it so a citizens can easily touch and appreciate the urban landscape. As the landscape area of the core of the city, Shenglian Island has been built and perfected, and has become the best choice for citizens to travel. At present, Xiwu Erzhou, Binjiang North Road, and other important surface green spaces have been fully built. In the park, Suining City has improved the basic functions of sightseeing and rest, such as a children’s recreation area, fitness equipment area, leisure square, etc., to meet the diverse needs of citizens. In terms of design, it pays attention to the ecology and sustainability of surface parks, and adopts technical means such as rainwater collection and sponge city to improve the efficiency of resource utilization.



Figure 5. Rendering diagram of the core landscape area of Suining City (source: *Shenglian Island World Lotus Exposition Park landscape design, Detailed Construction Plan for ShengPing Island in Suining*, sohu network)

Secondly, connecting the green space of the old city of Suining through the park greenway, trying to build a livable urban greenway integrating leisure, fitness, and education. Through *the detailed planning of Suining City*

Old District and *Special Planning of Suining Central City Slow Traffic System* and other special planning, the greenway vein of the old city is fully connected, and the extensive greenway system is used to form the walking vein of the slow urban life. Public art spaces, such as calligraphy, painting, and poetry, are set up in the old city and Binjiang North Road Park, which can not only show the history and culture of Suining to the citizens. In addition, the publicity and education role of the park greenway promotes the greenway to become a functional area bearing the history, culture, ecology, and scientific and technological knowledge characteristics of Suining. For example, the explanation content of the sponge city is set up in the display board on the greenway. This can not only enable the citizens to better understand and cherish the old city, but also promote the cultural tourism and scientific and technological innovation in Suining. In addition, Suining city has also built several recreational and dynamic walking paths with waterfront characteristics in the city, and various characteristic flowers and trees have been planted along the way to enhance their popularity and vitality.

Finally, Suining fully excavates the point green space resources in the old city and the gray space in the city, which made a plan, defined as an open green space. Through the three-level park system of point, line, and surface, Suining has realized the full coverage of city parks, so that citizens can feel the beauty of nature no matter where they are. In order to study the achievements of the construction of the green space system, the accessibility analysis of 45 residential areas, such as Parkson Home in the old city, was conducted. Because there is more linear green space, the green space in some areas is also in the linear green space, so the accessibility to the riverside, canal, river, and other intersections as the endpoint statistics. At the same time, it emphasizes the accessibility of Suizhou Middle Road and Jinhua Garden Park, and finally considers a total of 78 traffic endpoints. Walking mainly considers the surrounding environment, but not the location of Hedong New Area, and only considers 44 Hexi green end points. Cycling, bus, and car traffic are considered for the whole region. In addition, because the short-distance bus is not of significance for park travel, only the bus situation of more than 15 minutes is considered. Based on the API data of Amap, the traffic accessibility calculation software is used to calculate the traffic accessibility. The statistics are shown below (**Table 2** and **Figure 6**).

Table 2. Old city district accessibility analysis table

Resident travel mode	Walk	Transit	Drive	Cycling
Number of endpoints reached within 15 minutes	43	-	45	45
Number of endpoints reached within 30 minutes	45	21	45	45
The number of endpoints in residential areas that can reach maximum within 15 minutes	10	-	48	36
The number of endpoints in residential areas that can reach maximum within 30 minutes	16	14	6	75

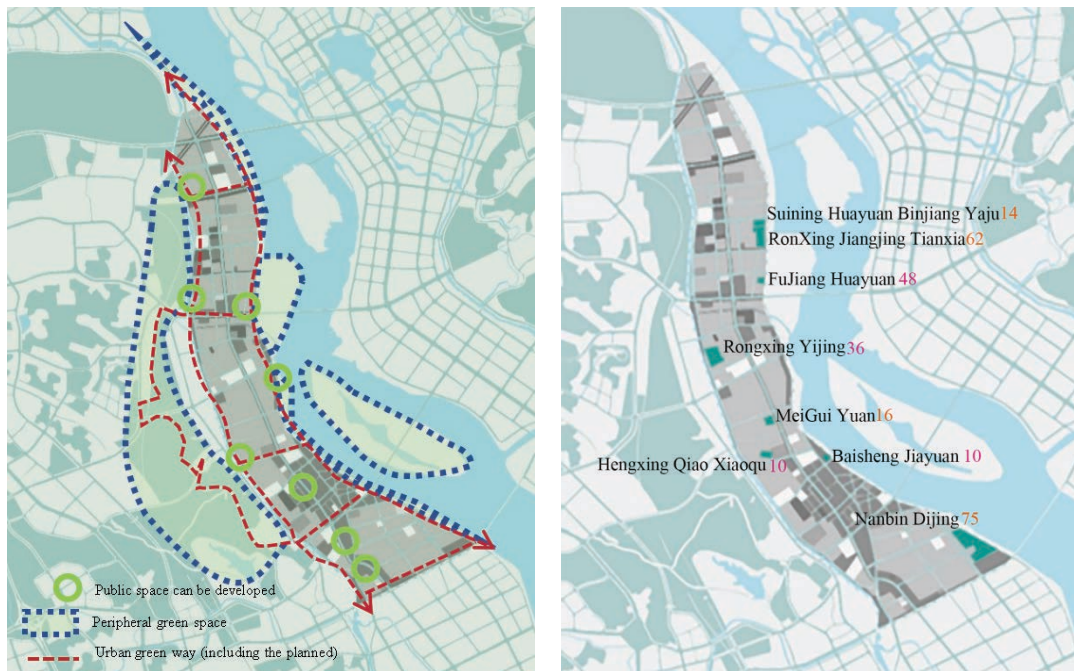


Figure 6. Green space planning of the old city of Suining City—left; The residential areas mentioned in **Table 2** and the corresponding number of accessible endpoints (source: self-drawn)

3.3. Exploring the Suining paradigm way of planning and management with advanced concepts

Suining always adheres to the advanced concept for urban planning and construction management, and explores the formation of a planning and management mode in line with the local environment of Suining. The planning and management of Suining city has been integrated with a pragmatic and innovative spirit from beginning to end, which is reflected in the whole process of urban management.

First, actively implementing the advanced city concept, trying to pilot exploration and learn. In order to improve the control of urban landscape and greening, the Urban Landscape Planning and Management Center was established in 2013 to coordinate the management of urban green space and style. In 2017, a position called Overall-City-Style-Planner was set up to conduct urban style problems, which was the first time in China. As early as 2014, China began to actively explore the reform of the “multiple plan” and promoted the reform of the urban and rural planning system, forming a three-in-one special plan. In the urban renewal, the sponge city pilot, urban design pilot, “Ecological Restoration”, through the on-the-spot investigation, go out learning, learning urban construction, green space ecological restoration means, and advanced urban and rural management technology enrich the knowledge reserves and help a lot in urban construction. Suining pays attention to cultivating local planning technical personnel, through the implementation of the community planner system, ensuring planning into the community, to the details. In the past 10 years, Suining has organized more than 20 visits and studies and arranged more than 300 trainee studies.

Second, according to the local environment of Suining city, Suining promotes the localization of advanced ideas. In the process of organic renewal of the old city, the mode of unit management and control is promoted, classification of “district level, street level, and micro-renewal” is promoted, and different urban renewal areas adopt different development logics, different stages, and path modes. Both in urban planning and construction, Suining City adheres to taking measures according to local conditions, innovating practice, scientifically integrating “sponge city” and

“urban repair, ecological reconstruction” in the renewal, and promotes the completion of the sponge construction, such as the transformation of more than 10 main roads in old roads, such as Jiefu Road.

Third, strengthening intelligent innovation and promoting the organic renewal under intelligent control. There are many problems that the organic renewal of the old city needs to be considered, so, in order to put the renewal into practice, it is necessary to consider the realization way and mode of urban renewal. The government will promote a new platform for public services and create a 15-minute convenient life circle. In the context of smart city development, the government will promote the provision of one-stop public services and improve administrative efficiency based on the needs of residents. At present, the smart bus system and some smart community guidance have been completed, and smart payment and mobile phone navigation can be used smoothly. At the same time, the combination of government services and big data can complete the preliminary vision of “running one trip less, doing one thing more, not missing one minute”, and the administrative efficiency of the old city has been greatly improved. At the same time, with the opportunity of building a provincial innovative city, the government will promote the construction of innovation carriers to digital parks, feed the construction of the old city with the transformation of industrial functions, and promote the intelligent construction of parking, entertainment, and leisure facilities.

3.4. With multi-party cooperation and win-win cooperation, the research, planning, and construction of the Suining model

The implementation of the planning and construction of the old city renewal involves many factors, which need to consider the interests of various parties and the coordination and coordination. At the same time, the implementation of the old city renewal also needs the comprehensive coordination of multiple think tanks. In the renewal of the old city, Suining city has been exploring the core idea of people-oriented, taking optimizing the regional public service facilities and improving the living environment as the fundamental task, and is committed to the construction of a high-quality urban environment and living space. Through the exploration of the renewal of the old city, Suining city has put forward the development concept of “green, smart, and livable”, and strengthened the protection and improvement of the urban ecological environment, cultural features, urban planning, and other aspects (Figure 7).

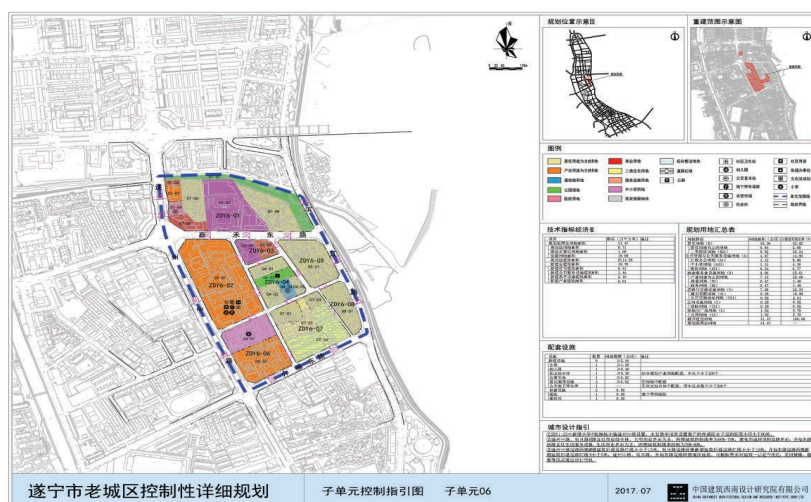


Figure 7. Schematic diagram of the unit control diagram of the old town of Suining City (source: *The detailed planning of Suining City's old district*)

First, giving priority to the public and promoting public participation in the national planning. Suining city adheres to the people-oriented principle, fully listens to the opinions and suggestions of the general public, and constantly optimizes the urban planning and functional layout to meet the growing living needs of the citizens. In order to promote the smooth implementation of the old city renewal, Suining City has fully mobilized resources from all aspects of life, established a multi-department, multi-field, and multi-level collaborative working mechanism, and realized the seamless connection of planning, design, construction, management, and other links. When conducting the controlled *the detailed planning of Suining City' Old District*, the citizens were organized to participate in the questionnaire through the coordination of the departments to understand the reconstruction intention of the citizens and integrate them into the planning scheme. At the same time, the planning committee sent community representatives to participate in directly expressing the demands of planning and construction and the aspirations of the citizens, so as to promote the implementation of the old city reconstruction. Relying on the “Sunlight Plan”, while publicizing the project, public opinions are widely absorbed to optimize the scheme and complete the adjustment of the planning scheme. When carrying out the special planning of road traffic in Suining City, it also promoted the participation of the old city citizens.

Second, to promote multi-cooperation to coordinate solutions and the implementation of all parties. While solving the problems of special planning of road traffic in the old city, the government promoted the linkage of colleges and universities shown in **Figure 8**. With the assistance of students from Suining Vocational and Technical School, the government realized the measurement of traffic volume in the whole city, and students of related majors also learned relevant knowledge. After solving the problem of special road traffic planning in the old city, the mode of multi-party cooperation has not ended. Instead, it further promotes concerted efforts to solve more problems to achieve a comprehensive renewal of the old city. In the old factory, Jinhua factory, organic update in the process of the planning, developers docking coordinate control planning party, collaborative planning administration, to control regulation guidance put forward key direction, to update planning guide, finally the ground construction form update scheme, built with the green ecological environment of factory logo park and commercial area, become the pilot construction of the pilot important area.

In general, the multi-cooperation solution mode is an important force to promote social progress. In the future, this model will continue to play an important role in helping all parties to solve more problems in a coordinated way and achieve comprehensive social progress.



Figure 8. Guide the students to map and use the data in the road traffic planning(left); Student survey of the Green Point Rural Planning Competition (right) (source: left: self-taken; right: internet)

4. Findings

In general, Suining fully promotes the construction of the old city and solves many problems. Through the restoration and building of the ecological system with ecology as the core, the distinctive old city of Suining is formed. In terms of urban function, the central business district is the most famous public space for food, procurement, leisure, and entertainment. At the same time, its service life infrastructure, such as primary school, shopping, food, entertainment, and market, is relatively complete, and the people's livelihood infrastructure, water, electricity, gas, and communication, is relatively smooth. However, there is the problem of pipelines not landing in some areas, and the traffic problem of Suizhou Middle Road in the Central Business District is still not solved. In terms of style and culture, important signs such as Guanyin culture have been highlighted, and the construction of urban walking paths and park systems has become the part of characteristic city sign. But the urban architectural style can be slightly unified, and the area has not been optimized. In terms of the coordination mechanism, Suining has a relatively mature coordination mechanism, which only needs further optimization. In the long run, how to implement the old city renewal, promoting the formation of urban characteristics, and the in-depth intelligent development of the city remains to be studied.

Therefore, it can be said that the development and construction of Suining has developed a certain Suining paradigm, which solves some of the problems in the development of the old city. But some of the contents need to be optimized in detail. Some of the problems are difficult to solve after many years of discussion, and they need effective implementation plans. In order to further optimize the development of the old city, put forward some suggestions, sort out the key points to continue to improve, and consider how to do so.

First, the land renewal problem of the central business district. As the most important functional area of the old city, it has a commercial pedestrian street with the characteristics of the old city of Suining. The prosperity of the central business district is the bearing point of the characteristics and historical memory of the old city of Suining, and the main historical buildings of the city gather here. However, because it blocks the vertical traffic flow of the old city, causing traffic congestion, the transformation mode has always been one of the difficult problems in the renewal and construction of the old city. The central business district itself has a part of the building quality that is not high, and the characteristics are not prominent enough to address problems. According to statistics, the CBD business scale below 100 m² accounts for 92.7% of the total number of stores, 65% of the business is shopping business, high homogenization degree; culture, leisure, entertainment business is less than 10%, and mainly in the middle and low end, which is lack of strong interactive experience of new consumption scene and attract people. There are many disadvantages in the transportation mode, viaduct, migration, underpass, and microcirculation, and these schemes have huge obstacles.

The second is the shaping of the urban characteristic style space. From the perspective of the number of cultural and tourism buildings, there is 1 industrial site, 4 historical landscapes, 1 core area of cultural tourism, and 7 historical buildings in the old city, which is characterized by a relatively large number but a relatively concentrated number. All of them do not have obvious characteristics, and do not them have sufficient protection or sufficient utilization either. Besides, it should be the concentrated area of cultural display in Suining City. From the perspective of the overall style of the old city, the style zoning is not very obvious. There are slope roofs and flat roofs of urban buildings, there are pieces of blue and red sloping roofs, modern flat roofs, which are relatively concentrated, but it has not become a relatively verified style area, and the facade is also disorderly (**Figure 9**).



Figure 9. Aerial view of the old city of Suining (source: *The Detailed Planning of Suining City' Old District*)

Third, infrastructure construction issues. The internal and external traffic connection of the old city is not smooth. From the perspective of the spatial pattern of the central city, in addition to the traffic problems on the road, the south extension of Xishan Road and the east-west Fujiang Six Bridge and Jiefu Road West extension line cannot be connected in a short time, and there is the phenomenon of north-south obstruction and east-west obstruction. In terms of street space, the right-of-way conflict among motor vehicles, non-motor vehicles, and pedestrians is obvious. In terms of parking facilities, parking construction in old residential areas is insufficient, commercial hotels and offices have few shared parking spaces, roadside parking demand is large, and parking in the old city is difficult. In terms of public service providers, the spatial distribution of public service facilities in the old city is reasonable, but due to the excessive population density, the per capita capacity of public services is generally low. For example, the average land of primary schools in the old city is about 3.4 m².

Fourth, the organic renewal of the construction and implementation approach, the government needs to think about the specific implementation mechanism. Urban renewal and construction cannot be separated from the support of a good urban and rural promotion mechanism, which not only guarantees the interests of various parties but also ensures the work of the urban renewal system. The renewal of the old city requires relatively mature theory, financial support, as well as the specific interests of citizens, developers, and other stakeholders. The renewal of the old city cannot be separated from the support of think tanks and funds, and to ensure the comprehensive promotion of urban renewal, the government, enterprises, citizens, and other parties should play a role. The dominant position of the government in the organic renewal cannot be ignored. Planning should be scientific and reasonable to ensure the implementation and supervision of policies, and violations should be strictly dealt with. Enterprises should assume certain social responsibilities in the organic renewal, considering the use of funds and the benefits of society, and participate in the urban renewal. In the process of implementation, the needs of citizens should be fully considered, and citizens should also become active participants in urban renewal.

Other stakeholders, such as community organizations and enterprises in related industries, should also actively participate in the urban renewal work, make their own suggestions. The implementation of urban renewal requires the joint efforts of all parties to form an effective cooperation mechanism to ensure the smooth progress of the organic renewal work and create a better living environment for the citizens.

5. Future development strategy

5.1. Combining the direction of thinking, clear specific work content

First of all, the thinking and direction of the old renewal of the city should be clearly defined, and the construction of clear working ideas as a guide, so that what has been done in the past work and the future work can be improved. Urban characteristics should be the part that must be strengthened in the renewal of the old city and even the overall urban construction, and the government should spare no effort to stick to it.

First, “guard the ecology.” The government should adhere to the urban characteristics of ecological protection and green space construction, and fully build Suining Park city.” “Ecological Park Famous City” not only conforms to the summary of Suining’s urban characteristics, but also meets its vision. “Ecology” is easy to build, but “a famous city” is rare. The government should spare no effort to develop the ecological core, at the same time, the culture, the foundation of ecological construction, and the concept of ecological civilization through the whole process of urban development, and the government should strive to achieve the sustainable development of the city.

The second is to “build the system.” To the learning and construction experience of the past advanced cities, urban renewal requires systematic control methods and implementation rules. Suining has explored and researched *Administrative Measures for Urban Renewal of Suining Old City*, though it was not implemented, but made an effort in urban renewal. In March 2022, *Suining City Urban Organic Renewal Project Fund Management Measures* were promulgated, which gave systematic regulations for the fund control of the old city renewal project. In the future, the government should continue to form systematic management documents and policies, covering management, capital, operation, supervision, and other aspects, and promote the municipal departments to study and formulate a management method system, as well as a planning system working together with the district (county).

Third, the “shape style.” The government should take the style renovation as a countermeasure, pay attention to shaping the urban form, and improve the quality and image of the city. To repair the roof style of the old city, build qualified public buildings; for the problems of flat roof and slope top, the government should delimit the area and coordinate the style, and remove and standardize the city image, advertisements and signboards, establish a clean and orderly urban public interface; micro-update the blocks outside the demonstration area, strengthen the shortcomings of service, and improve the quality of public space.

Fourth, “expand the scope.” The old city of Suining is closely connected with the surrounding areas and has more communication. Not only because of the working traffic commuting in Hedong and Hexi, but also because the old city is close to the development zone and high-tech zone, and the urban service function is not carried out alone. A city is a huge and complex system, which should deeply consider its connection with the surrounding areas, fully consider the uncertainty of its development and construction, and consider the overall scope to provide guidance for the improvement of the overall urban capacity.

Fifth, the “show heritage.” The government should pay attention to excavating and displaying the cultural

heritage of the city and enhancing the soft power of the city. This includes the protection of historical and cultural heritage, the development of cultural activities, and the cultivation of cultural industries. With the culture of nourishing cultivation as the core element, it is necessary to display the historical and cultural deposits of Suining through various forms, enhance the attraction of the city, and promote the development of the city. At the same time, the wisdom of the cultural activities planning, advanced urban culture promotion.

Sixth, “building a demonstration.” Take government leading + enterprise operation, + residents (merchants) participation. Around Yucai Road, City Lane, Park Road, and Kaixuan Road, other cultural elements are implanted according to local conditions.

Seventh, the “optimize industry.” After accurately identifying and updating the characteristics of the region, various plots of “retaining and dismantling” should be accurately determined, and classified measures should be adopted. Starting from the old urban environment, the government should pay attention to optimizing the industrial structure and promoting the economic development of the city. This includes the upgrading of traditional industries, the cultivation of emerging industries, and the improvement of innovation ability. The government should increase support for emerging industries, promote the upgrading of traditional industries, improve the innovation ability of cities, and promote the economic development of cities.

The government should think about the renewal of the old city from the perspective of the whole city, not only from the perspective of the old city. The construction of the new district should be linked with the renewal of the old city, especially the transportation around the old city and the supply of public supporting facilities, so as to facilitate the relocation of the population and functions of the old city to the new district. It is necessary to shift from the past development mode of short-term sales collection for commercial and residential construction to the urban renewal mode of multi-party participation, medium and long-term operation and operation, and plan the old city renewal in the way of systematic engineering way. Therefore, in order to consider these complex elements and problems, it is necessary to coordinate the multi-party relationship, which must carry out special research.

5.2. Multi-party coordination and communication mechanism, industry, university, and research institutes, to help solve the renewal problems

The renewal mechanism of the old city of Suining is not complete, and there is no policy of organic renewal of the old city. At the present stage, the people mainly rely on the government’s input to transform the old residential area, which cannot support the current organic renewal work of the old city, so a complete renewal mechanism and system need to be established. First, the policy mechanism needs special management methods and a management system to form a management mechanism and means. Second, it must have a multi-party coordination and communication mechanism, aiming to realize the efficient transmission of information and promote the rational allocation of resources through the scientific process and a completely new organizational structure, so as to effectively solve the possible problems in the renewal process. In the process of building a communication mechanism, it is recommended that the industry, university, and research institutes should participate in cooperation and collaborative innovation. This can not only reduce the cost of research and development, but also help scientific research, and cultivate scientific talents who can solve the problem of localization. To share the innovation results, it is more necessary to give full play to their respective advantages in the integration and transformation process of knowledge and technology, so as to realize the smooth implementation of the renewal of new industries in the old city.

5.3. Smart development focuses on future cities and open platforms to build emerging cities

At present, the wisdom of the construction of the old city is not enough. Although the basic model of intelligent management and control has been built, the construction of the urban information model and the CIM platform has not been completed yet. At the same time, in the aspect of internal administration, although a lot of network communication and intelligent management platforms have been formed, the constraints in the practical application have not been removed, and the operation of traditional ideas and the traditional working methods are deeply rooted. Of course, in the era of information management, the confidentiality of information, security, and other related issues have not been completely solved. Therefore, it is suggested to implement the following planning and construction means.

First, the government needs to strengthen the integration with new technologies such as big data and artificial intelligence to improve the management level of smart cities. At the same time, the establishment of a more stringent information security protection system, as well as an administrative management integration construction system, breaks through the electronic management barriers between all administrative levels, to ensure the normal operation of urban construction. In view of the information confidentiality, security, and other problems, the government can strengthen the construction of technical means and management systems, as well as the publicity and education of management personnel, to improve the understanding of information security.

Second, the government needs to expand the scope of intelligent administrative work, learning, and education. A scientific and reasonable management system and norms should be established to ensure the orderly promotion and long-term development of intelligent administrative work. At the same time, by strengthening the training and education of management personnel, the government can improve their technical and management ability, and provide a solid talent foundation for the sustainable development of intelligent administrative work. The government should strengthen the talent support and management mechanism to help form a local talent tank in Suining City.

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Fourth, it is necessary to process, strengthen information communication and coordination among various departments, establish an information management system covering the whole form a unified and efficient working mechanism, and make administrative work more smooth. In addition, the government should pay attention to the popularization of smart city construction, so that more citizens can participate in the construction of a smart city. The aforementioned form of industry-university-research cooperation is also one of the ways that can cover management. The government can explore the form of an open CIM platform and local scientific research, promote the CIM work, and carry out the learning skills of advanced open platforms, such as In-SAR, to improve the urban information model.

5.4. To maintain ecological health care, adhere to the core of urban characteristics

Ecological characteristics have become an important label of Suining city, and also an important core of urban and rural planning and construction. Health care is another representation of the radiation status of mental care culture

under the ecology. “Heart culture brigade city” construction is not easy. As a node of the Chengdu-Chongqing region, Suining city has created an ecological label, park city scene. The next step should adhere to the core urban characteristics, the ecological built important urban characteristics. Specifically speaking, the following measures should be improved.

First, form a water system space with the concept of “heart culture” as the theme of different “Great health” to connect the urban landscape. Suining city has a continuous, rich, and beautiful water system space, with different levels and dimensions, and its own uniqueness, which can form different health education and health preservation themes based on “great health” and heart-nourishing culture. The city prospers because of the water, and the water is the soul of the city. Suining city can build to “park city” concept as the core of the water ecological environment protection system. Through the integration of water space resources and optimizing the water space structure, to promote a water ecological environment management system and management ability of modern construction optimization of urban space and economic geography, Suining can improve the construction of a high-quality quality harmonious, and livable city.

Second, the government will promote the construction of green and emerging future cities on the basis of the “smart city” plan, and radiate the whole urban space. Taking the construction of the whole region’s intelligent space as an opportunity, the government will establish the safety detection of the water space environment, form a perfect intelligent display space of water, which can widely display and convey the unique water ecological culture of rhythm, and establish intelligent sketch facilities rich in Guanyin culture. Suining should build interesting, intelligent, interactive entertainment facilities, considering intelligent activity interactive facilities, develop personalized lines, driving rental, intelligent tour, and other systems.

Third, based on the theme of “health care” as the core, plan health theme characteristic activities, and develop the whole health activities. From the characteristics of “eating”, around the Suizhou Middle Road Business District area, the whole area along the north and south of Binjiang Road, Qujiang Road, Jinhua area, and other areas, to create a modern level of the old city catering service chain, promote the holding of various forms of food festivals, cultural festivals, and other activities. The formation of a “health” intelligent health system, deep integration and innovation in “medical, health, food, travel” and other aspects, around the riverside along the road, along the canal river, the urban area green health activities planning, into the Guanyin culture to create an intelligent health care sketch, but also improve the urban pension business. For young people, sports and sports development activities and guidance spaces should be increased to promote the construction of smart sports. Finally, with the new district health Valley, Linquan Guangde Shengjing, and Shenglian Lotus Expo Park, to build and improve the health service system.

6. Conclusion

The old city renewal is a complex system project, and the work of Suining has made a good demonstration for the renewal and construction of the old city. Some shortcomings are analyzed, such as Suining, and the urban renewal work has a long way to go. The government must unswervingly adapt measures to local conditions, and at the same time, excavate enough urban characteristics, dare to explore, combine with various forces, and the authors believe that the government will be able to explore a local road of old city renewal.

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Analysis of the Effectiveness of Traffic Restriction Policies and Public Management

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Abstract: With rapid urbanization and motorization, the number of motor vehicles in China has exceeded 430 million as of 2023, leading to severe urban smog and traffic congestion. Many cities have implemented traffic restriction policies to mitigate these issues. This study evaluates the effectiveness of these policies from a public administration perspective, employing literature analysis, case studies, and policy evaluation methods. The findings indicate that such policies significantly improve air quality and reduce traffic congestion in the short term. However, challenges remain in policy design, enforcement, equity, and public acceptance. The study proposes innovative measures such as dynamic restriction mechanisms, enhanced public participation, and integrated governance strategies to improve policy sustainability and scientific rigor.

Keywords: Traffic restriction; Public management; Policy evaluation; Urban governance

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1. Introduction

Rapid urbanization and motorization in China have resulted in a surge of motor vehicles, exacerbating air pollution and traffic congestion. By 2023, China's vehicle population surpassed 430 million, with vehicle emissions contributing significantly to urban smog—exceeding 40% of total pollutants in cities like Beijing and Tianjin. Concurrently, traffic congestion during peak hours has worsened, with a commuter delay index exceeding 2.0 in major cities. In response, traffic restriction policies have been widely adopted as critical public management tools. This study examines the effectiveness, implementation challenges, and social implications of these policies, drawing on cases from Beijing, Shanghai, and other metropolitan areas. By integrating theoretical analysis and empirical evidence, this research aims to propose actionable recommendations for policy improvement.

2. Literature review

2.1. International Research

Globally, motor vehicle restriction policies have been widely implemented as regulatory tools to address air

pollution and traffic congestion. International examples such as Mexico City's Hoy No Circula program and similar policies in Bogotá have demonstrated effectiveness in reducing short-term air pollutant levels and traffic accident rates^[1]. Empirical research indicates that Mexico City's restriction policy contributed to an approximately 11% reduction in airborne pollutants^[2]. In Europe, some cities have enhanced policy outcomes through integrated approaches that combine traffic restrictions with improvements in public transportation systems^[1]. Studies commonly employ quantitative analyses of air quality and traffic data to evaluate policy efficacy. However, international literature also points to limitations such as diminishing long-term effects and the emergence of avoidance behaviors, including the purchase of secondary vehicles^[2]. These findings underscore the importance of supplementing restrictive measures with investments in alternative transport infrastructure and systemic urban mobility solutions to achieve sustainable results.

2.2. Domestic research

In China, research on vehicle restriction policies has evolved from initial effectiveness verification to deeper critical analysis. Domestic studies confirm that policies in cities like Beijing and Shanghai have achieved notable short-term improvements in air quality and traffic conditions. For example, Beijing's odd-even plate policy, implemented since 2008, has contributed to a measurable reduction in PM2.5 levels and peak-hour congestion indices^[3]. However, researchers have increasingly highlighted structural and equity issues, such as the disproportionate travel burden on low-income residents and the spillover pressure on public transportation systems^[3-4]. Scholars, including Gong Zhiwen (2016), have further questioned the legitimacy and long-term sustainability of such policies from a public interest perspective^[3]. Recent academic consensus emphasizes the necessity of integrating traffic restrictions with broader transportation policy packages—including the expansion of metro systems, optimization of bus networks, and promotion of green mobility options—to achieve holistic and sustainable urban governance.

3. Theoretical basis

3.1. Policy tool theory

The motor vehicle restriction policy is a regulatory measure used by governments to alleviate traffic congestion and reduce air pollution through methods such as tail-number restrictions, peak-hour bans, and odd-even schemes. For instance, Beijing's tail-number policy has significantly reduced PM2.5 levels^[4]. While effective short term, studies show diminished long-term efficacy and adaptive citizen behaviors^[6]. International research confirms temporary air quality benefits but limited sustained impact. In China, scholars also examine equity, legitimacy, and governance challenges, proposing improved policy design and integrated transport solutions^[3].

3.2. Public policy evaluation theory

Public administration refers to the activities through which governments and public organizations provide public services and manage public affairs by means of policies, laws, and governance measures. Motor vehicle restriction policies reflect the government's regulatory capacity in resource allocation and social governance^[4]. Effective public administration requires that policies balance efficiency, equity, and sustainability in both design and implementation to meet the needs of diverse groups and enhance the level of urban governance^[5].

4. Current implementation of traffic restriction policies

Major Chinese cities such as Beijing, Shanghai, Guangzhou, and Shenzhen have introduced a variety of traffic restriction policies to combat urban congestion and pollution. For example, Beijing implemented a tail-number restriction policy in 2008, which prohibits 20% of vehicles from driving each day based on their license plate digits. Shanghai, on the other hand, has adopted a combined approach incorporating license plate auctions with geographically specific restrictions, aiming to control both vehicle numbers and their spatial distribution.

A range of methods supports these policies, including rotational tail-number prohibitions, peak-hour bans targeting non-local vehicles, and electronic enforcement mechanisms. Advanced surveillance technologies, such as cameras and big data analytics, are widely used to monitor compliance and improve implementation accuracy. These measures work collectively to reduce traffic volume and vehicular emissions during critical periods.

5. Identifying key challenges in policy implementation

5.1. Challenges: Combating evasion tactics and overcoming inconsistent enforcement

During the design phase of vehicle restriction policies, many cities conducted insufficient research, leading to poorly targeted measures. When defining restricted areas and periods, some failed to adequately consider road capacity and traffic flow distribution, inadvertently worsening congestion within these zones. Such data-deficient policy design reduces the practical effectiveness of traffic restrictions.

5.2. Equity issues: Disparate impact on low-income groups and privileged exemptions for official and high-income vehicles

Low-income households, often reliant on aging vehicles in areas with inadequate public transit, face disproportionate financial and time burdens due to travel restrictions—whether from costly alternative commutes or lost income^[7]. In contrast, affluent residents can often circumvent these policies by acquiring additional or new-energy vehicles. Furthermore, exemptions granted to government and certain corporate fleets reinforce perceptions of inequity, undermining both the fairness and public trust in such measures.

5.3. Public transport overload

The implementation of traffic restriction policies has significantly increased public reliance on mass transit; however, many urban public transportation systems lack the capacity to handle this surge in demand. For instance, following the restrictions, Beijing's subway system experienced a noticeable rise in peak-hour passenger flow, leading to extreme crowding on certain lines. Similarly, bus load rates also climbed substantially, resulting in diminished commuter comfort and efficiency^[9]. This strain on public transport highlights a critical infrastructural shortfall during restriction periods. At the same time, the growing use of unregulated electric mobility devices—such as low-speed electric vehicles for the elderly—has introduced new safety and management challenges. Often operating outside formal traffic management systems, these vehicles frequently travel in motorized lanes or against traffic flow, increasing the risk of accidents and further complicating urban traffic governance.

6. Causes of problems

6.1. Policy design deficiencies: Inadequate research and structural rigidity in urban traffic management

During the design phase of vehicle restriction policies, many cities fail to conduct comprehensive and scientific

research, resulting in measures that lack precision and relevance ^[8]. A notable example is the Tianjin license plate restriction mix-up, where inadequate assessment prior to implementation led to public discontent due to erroneous measures. Furthermore, when establishing restricted zones and time windows, urban road capacity and the distribution of traffic flows are often overlooked, sometimes exacerbating congestion within these areas. Such policy design, lacking empirical support, significantly undermines the intended effectiveness of traffic restrictions. Moreover, existing policies frequently adopt a rigid “one-size-fits-all” approach without mechanisms for adaptive adjustment based on actual conditions. Beijing’s tail-number restriction policy, for instance, has remained largely unchanged since its introduction in 2008, despite significant shifts in urban mobility patterns and commuter behavior. This inflexibility hinders the policy’s ability to accommodate emerging travel modes and diverse public needs. Additionally, inadequate consideration for vulnerable groups—such as low-income families and individuals with disabilities—further highlights the design shortcomings. To enhance equity and efficacy, future policy formulation must incorporate more sophisticated data analysis, account for varied social impacts, and ensure better integration with public transportation systems to promote sustainable urban governance.

6.2. Insufficient supporting environmental protection

Although many cities have adopted electronic surveillance to enforce traffic restriction policies, significant loopholes remain in practice. In some areas, insufficient density of monitoring equipment fails to cover all roads, allowing non-compliant vehicles to avoid penalties ^[10]. Furthermore, the use of fake or cloned license plates in certain cities further weakens the restriction’s enforceability. These regulatory gaps greatly diminish the intended impact of the policy, reducing both its effectiveness and deterrence, while also encouraging further violations through imitation. In addition, inconsistent enforcement—particularly toward privileged vehicles—undermines public perception of fairness and diminishes the policy’s legitimacy and overall efficacy.

6.3. Low public participation: Insufficient government communication and low public awareness of policy rationale

The successful implementation of traffic restriction policies relies heavily on effective public communication and outreach. However, in many cities, governments have failed to adequately interpret and publicize policy details prior to rollout. As a result, a significant portion of the public remains poorly informed about the objectives, specific rules, and penalty standards of the policy, leading to misunderstandings and resistance during enforcement. Moreover, there is a noticeable lack of public awareness regarding the long-term environmental benefits of such measures, with many residents focusing instead on short-term personal inconveniences. Some even perceive the policy as a temporary fix rather than a substantive solution to pollution and congestion. This superficial public understanding undermines both social support and the overall effectiveness and sustainability of the policy.

7. Recommendations

7.1. Improve policy design: Dynamic and response mechanisms informed by data and air quality metrics

To boost scientific rigor, restrictions should be dynamically tuned to real-time traffic and air-quality data, exempting essential trips and incorporating global best practices that blend market incentives with regulation.

7.2. Promote public engagement: Digital communication and feedback integration

Governments should transparently communicate the rationales behind traffic restrictions through diverse channels such as social media and public forums, while actively soliciting ongoing public feedback. It is also essential to implement supportive measures—including improved transit options, compensatory mechanisms, and phased implementation schedules—to mitigate impacts on vulnerable communities. Such practices not only enhance policy credibility but also foster long-term public acceptance and compliance.

7.3. Integrated governance: A holistic strategy with global insights

Vehicle restriction policies should be implemented alongside eco-compensation measures for affected communities, urban greening initiatives, and industrial emission reductions. Drawing on models such as Singapore's congestion pricing system, such integration combines economic incentives with administrative regulation, fostering more systematic and sustainable pollution control.

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Historical Memory in the Foreign Policy of Spanish-speaking Countries

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Abstract: This paper focuses on the construction logic of historical memory in the foreign policies of Spanish-speaking countries, such as Spain and Latin American countries, against the backdrop of globalization. With the help of historical memory theory and the construction model of international identity, this paper studies how the colonial heritage and Cold War experience affect the formation of identity narrative in contemporary diplomatic decision-making. The memory of plundering resources in the colonial era prompts Mexico and other countries to further strengthen their resource sovereignty policies. The legacy left by the independence movement continues the process of regional integration by virtue of Bolivarianism. The memory of the intervention of the United States and the Soviet Union during the Cold War prompts Cuba and other countries to develop ideological medical diplomacy. At the level of international identity building, Spanish promotes the convergence of the Ibero-American community in the form of cultural ties. Similarly, in view of the differences in the recognition of the “former colonist colonized” identity between Spain and Latin American countries, it has triggered regional cooperation conflicts. Taking the case studies of Spain, Mexico, and Argentina as the approach, this paper points out that there is a “double-edged sword” effect in the historical memory of foreign policy: it can enhance the cohesion between the internal, and it may also weaken the foundation of identity due to political polarization and the impact of the digital economy. Spanish-speaking countries may rely on the instrumental strategy of historical memory to reconstruct the identity of the “Global South” in the emerging issues, such as artificial intelligence ethics and deep-sea mining.

Keywords: Historical memory; Foreign policy; Colonial heritage; Cold War memory; International identity

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1. Introduction

1.1. Research background

Today, with the close integration of globalization, the foreign policies of Spanish-speaking countries (Spain and 33 Latin American countries) show a special path dependence. As a region once colonized by Spain, Latin American countries have long been influenced by the geopolitics of the United States. However, as a member of

the European Union, Spain has been unable to give up its cultural ties with the Latin American “Ibero American community”^[1]. In view of this historical complexity, the positions of Spanish-speaking countries on issues such as climate negotiations and resource sovereignty disputes often have the dual characteristics of “post-colonial trauma” and “regional autonomy.” The lithium nationalization policy introduced by Mexico in 2022 is not only a response to the history of resource plundering during the colonial period, but also a practical choice for Mexico to compete for strategic initiative in the global new energy transformation. In addition, the apparent contradiction of Spain’s 2023 EU sanctions against Cuba and its promotion of the “Ibero-American community” highlights a more serious problem: Unresolved historical wounds haunt the foreign affairs of Spanish-speaking countries. A contradiction that reflects the difficulties Latin America faces in balancing economic dependence with anti-colonial rhetoric.

1.2. Research questions

How does historical memory use identity narration to influence the diplomatic decisions of Spanish-speaking countries? How can these countries’ identities in contemporary international affairs be shaped by the memory of resource plundering and cultural repression formed by colonial heritage, and the memory of the US Soviet intervention during the Cold War? Is the “anti-colonial discourse” that Argentina has been using in the sovereignty contradiction of the Falklands intrinsically related to the historical memory of its independence movement in the 19th century? Is the continuation of the ideology embodied in Cuba’s medical diplomacy historical feedback on Soviet aid during the Cold War?

1.3. Research significance

This study provides a new perspective for grasping the instrumental application of Spanish-speaking countries’ identity of the “Global South” in climate negotiations and the upsurge of nationalization in resource sovereignty disputes. During the nationalization of lithium mines in Chile, Mexico, and other countries, by emphasizing the “colonial heritage” to shape the international public opinion situation, the domestic policy and global justice narrative are tied together. Spain’s strategy of balancing Latin American traditional ties and European identity within the framework of the European Union highlights the complex role of historical memory in cross-regional diplomacy.

2. Theoretical basis

2.1. Key concepts

2.1.1. Theories involved in collective historical memory

Aleida Assmann’s historical memory theory defines collective historical memory as “collective identity constructed with the help of cultural symbols and rituals.” The core of this theory is that groups are not passively accepting historical facts, but actively using a series of cultural practices to transform past traumatic experiences or glorious moments into the spiritual core of shaping the current group identity^[2]. Its core role is to provide legal evidence from history for current actions, so that realistic choices can obtain deep meaning protection beyond immediate interests. On the stage of international affairs, Latin American countries have repeatedly emphasized the narrative of “ecological vulnerability caused by resource plundering during the colonial period” on multilateral occasions such as climate negotiations. This is just a typical practical example of this theory. By recalling the collective memory of resource plundering in colonial history, the historical injustice is connected with the distribution of ecological responsibility at present, so as to strive for a more favorable standard for the division of responsibility in matters related to Climate Governance, so that the appeal for realistic interests can be verified

from the perspective of historical justice.

2.1.2. International identity building model

Alexander Wendt's model of international identity, based on the perspective of social constructivism, firmly believes that national identity is not an a priori entity, but a "product of ideas." It is gradually formed in the process of continuous interaction with other actors in the international community. In this process of interaction, the state defines its position and identity in the international system by defining the boundary between "self" and "other"^[3]. In the practice of foreign affairs, identity labels such as "non-Western" and "Global South" are often used strategically. The main idea is to build a differentiated identity with Western developed countries and strengthen the sense of belonging and solidarity of internal groups. During the operation of the community of Latin American and Caribbean States (celac) mechanism, relying on the concept of regional autonomy contained in the Bolivarianism, and with continuous discourse construction and practice cooperation, it continuously enhances the regional identity among Member States, making the mechanism unique from other international organizations, highlighting the core significance of identity in shaping the mode of international cooperation.

2.2. Analysis dimension

2.2.1. Language and culture ties

On the occasion of the Ibero-American summit, Spanish has the dual characteristics of colonial heritage and modern cooperation ties. As a product of colonial history, it retains the memory of cultural infiltration; Its commonality breaks through the differences of political and economic existence among countries, forms the implicit identity based on cultural homology, and creates the communication cornerstone and dialogue space for regional cooperation.

2.2.2. Reconstruction of post-colonial identity

With the protection of the rights and interests of indigenous peoples and the nationalization of resources, Latin American countries have driven the pace of reshaping post-colonial identity. The former has achieved the revival of local culture and got rid of the subordinate shackles of colonial culture; The latter takes charge of strategic resources, removes external economic constraints, gets rid of the label of "colonized" together, and re-establishes an independent and equal national identity.

2.2.3. Regional integration conflict

Due to the differences in the recognition of the identity of "former colonist colonized" between Spain and Latin American countries, the Ibero-American community presents a situation of co-existence of cooperation and competition. Spain regards itself as a cultural source to seek leadership. Latin American countries are wary of the reappearance of power in history and strive to talk equally. The tension generated by this opposition promotes the development of regional integration in dealing with contradictions.

3. The influence of historical memory on foreign policy

3.1. Colonial trauma

During the colonial period, Spain's organized plundering of gold and silver veins in Latin America not only built up the historical memory of resource plundering, but also precipitated into a deep awareness of the intervention

of external forces in local resources in the collective consciousness of resource rich countries such as Mexico and Chile, which gave birth to and continued the policy tradition of “resource nationalism.” This tradition is not just a simple xenophobia, but a structural response to the damage to the right to development caused by the plundering of resources in history ^[4-5]. In 2022, the Mexican government came up with a state-owned lithium company and clearly issued a policy of prohibiting foreign investment from participating in lithium mining. This is just the direct projection of historical traumatic memory in the contemporary resource governance area. Relying on the state’s mastery of strategic resources, it reconstructs the self-narrative of resource sovereignty and prevents the recurrence of the plundering mode of external resources. The arbitration demands of Chinese-funded enterprises, such as Ganfeng Lithium, due to policy adjustment, actually show the collision between the concept of resource sovereignty formed in history and the logic of contemporary international capital flows. The essence of this collision is the contradiction between the security cognition and the rules of real economic cooperation shaped by historical memory.

The practice of cultural assimilation promoted by Spain in the colonial period strengthened the legitimacy of colonial rule by suppressing indigenous languages, religions, and customs. The collective memory left by this cultural imprisonment prompted Latin American countries to upgrade the protection of indigenous rights and interests to the core position of national identity establishment and the Diplomatic Discourse System in modern times. In the negotiation of the United Nations Framework Convention on Climate Change (UNFCCC), the “pachamama” in indigenous culture was the introduction of the concept into the discussion of global ecological ethics is not only the display of cultural symbols, but also the reconstruction of the value reference system of ecological governance with the help of the concept of indigenous cosmology. This strategy of using indigenous culture as a weapon to resist the discourse of Western environmental hegemony not only responds to the trauma of cultural repression in history but also strives for a differentiated speaking space for developing countries in the global climate governance activities, creating a dual consistency between cultural identity and practical demands.

3.2. The legacy of the independence movement

The idea of “American Integration” advocated by Simon Bolivar, as a highly influential political idea during the Latin American independence movement, has not faded with the evolution of the times, but has been continued in the contemporary era with the help of regional mechanisms such as the Community of Latin American and Caribbean States (CELAC). The key to this idea is to get rid of the control of external forces over American affairs and build a cooperation framework based on regional autonomy. The Kingston declaration, adopted at the eighth summit of CELAC held in 2024, emphasizes the common position of Latin American countries on issues such as food security and climate change. Its deep logical essence is the contemporary practice of Bolivarianism, relying on the cohesion of regional consensus, and gradually jumping out of the scope of influence of the Organization of American States (OAS) framework dominated by the United States for a long time. This effort is not only an echo of the ideal of “the Americans themselves governing American affairs” during the independence movement, but also a redefinition of the regional independent development space in the context of globalization, trying to balance the geopolitical impact of external forces by relying on collective forces.

3.3. Cold War experience

During the Cold War, the two camps of the United States and the Soviet Union frequently intervened in Latin American affairs, especially the history of external forces’ influence on regional regime change through ideological manipulation, which left a strong ideological vigilance in Latin American countries’ diplomatic decision-making.

This vigilance turned into a diplomatic practice with a strong anti-hegemonic color. The historical situation that Cuba was supported by the Soviet Union during the Cold War made it always integrate the anti-hegemonic narrative into humanitarian action in the stage of establishing a medical diplomacy system, creating a unique style of Ideological Diplomacy. In 2025, Cuba's dispatch of medical personnel to more than 60 countries in the world is not only the cross-border delivery of medical resources, but also the implementation of its own diplomatic philosophy. It should respond to the ideological defamation of external forces by actual humanitarian contributions. Chinese Foreign Ministry spokesman Mao Ning highlighted the humanitarian value of "saving a large number of lives", which is basically a verbal counterattack against the United States' accusation of "forced labor." This counterattack relies on highlighting the consistency between the anti-hegemonic position developed from history and the actual humanitarian action, and then constructs a historical narrative of Cuba's diplomatic practice, resisting the discourse offensive in terms of ideological confrontation.

4. Construction path of international identity

4.1. Language and culture community

Spanish, as the output of the integration of the Iberian Peninsula and the American continent for hundreds of years, has long exceeded the attribute significance of simply being a communication tool in the mechanism framework formed by the contemporary Ibero American summit, and has become a cultural totem to maintain regional emotional interaction. This cultural community formed around language has built a dialogue platform for all participants to cross political system differences and geographical interests contradictions. With the help of its position as the cultural source of the Spanish-speaking world and the multilateral cooperation mechanism such as the "Spain China Forum", Spain has flexibly turned its linguistic advantages into diplomatic potential. In the process of promoting trilateral cooperation with Latin American countries, Spain has systematically strengthened its role as a "transatlantic bridge" connecting Europe and the Americas. With the help of the cultural identity hidden behind the language, Spain has calmed the opposition in the political game and created a favorable soft foundation for cooperation in a broader field. This diplomatic strategy based on culture has made Spanish an implicit way to resolve political differences and created a deeper emotional resonance outside the official discourse system.

4.2. Identity conflict in regional cooperation

The "former colonist colonized" identity gap formed in the historical narrative between Spain and Latin American countries has always been the cause of structural tension that is difficult to bridge in the process of regional cooperation. This difference caused by identity cognition is obviously different in the priority setting and value orientation of cooperation issues. In multilateral cooperation occasions such as the EU-CELAC summit, Spain, as a core member of the EU, has repeatedly put "values diplomacy" in a prominent position, trying to control the cooperation agenda by relying on the democratic standards and human rights concepts in the western discourse system; However, Latin American countries are more willing to take economic sovereignty and the right to development as the core focus of cooperation based on their historical memory of getting rid of colonial rule and the practical requirements of ensuring national independent development. At the summit between the EU and CELAC in 2023, the differences between the two sides on specific issues, such as the design of trade rules and the threshold of investment access, in essence, are the concentrated emergence of such differences in identity recognition. The EU side, represented by Spain, focuses on the universality of rules, and Latin American countries

guard the independent nature of the development route. This conflict of value orientation makes the further deepening of regional cooperation face insurmountable conceptual obstacles.

4.3. Participation in global governance

Latin American countries, which exist in the global governance system, adopt strategies to use the identity of “Global South” to create a discourse system that closely combines historical narrative and realistic demands. In global issues such as climate governance, Latin American countries wisely link the history of the plundering of resources during the colonial period with the current allocation of climate responsibility and shape a morally persuasive argument logic ^[6]. Argentina’s “anti-colonial” position on the dispute over the Malvinas Islands and its proposal to require developed countries to assume more emission reduction obligations during the negotiation of the United Nations Framework Convention on Climate Change (UNFCCC) have built a self-consistent discourse loop of “historical justice and practical benefits.” By linking the resource deprivation brought by colonial history to developing countries with the current differences in their ability to cope with climate change, Latin American countries have seized the commanding heights of discourse in terms of morality and have also transformed the historical narrative into a diplomatic means to seek practical benefits, forming a unique negotiating means in the global governance game.

5. Case study

5.1. Spain: Identity balance under the EU Framework

Spain will not accept the EU’s “rearming Europe” plan in 2025 and requires obtaining funds in the form of donations rather than loans, which not only maintains the status of EU Member States but also prevents the accumulation of debt from damaging the results of economic cooperation with Latin American countries. This strategy reflects the historical continuity of its “Europe-Latin America” dual identity.

5.2. Mexico: Dual recognition of NAFTA and Latin American regionalism

Mexico insisted on including the “labor and environment clause” in the USMCA negotiations. It not only responded to the pressure caused by the United States but also relied on the CELAC mechanism to promote regional standards in Latin America, striving to find a balance between North American Integration and Latin American autonomy.

6. Challenges and responses

6.1. Internal political polarization weakens identity cohesion

Colombia’s left and right wings are in opposition, resulting in repeated swings in foreign policy. In 2022, after the left-wing president Pedro came to power, he made adjustments to Venezuela’s policy, and the right-wing policy of closing the border was abolished. However, the domestic right-wing forces still use the judicial system to hinder regional cooperation.

6.2. Risk of weakening language and culture ties in the era of the digital economy

Even though Spain has promoted the “digital 2025” plan and used AI technology to improve the use of Spanish in e-commerce and tourism, the trend of Anglicization on TikTok and other platforms still poses a threat to the status

of Spanish. Mexican companies' use of AI to produce multilingual product videos has promoted the trade process, but may dilute the local cultural characteristics.

7. Conclusion

Historical memory plays a “double-edged sword” role in the foreign policies of Spanish-speaking countries: colonial heritage and Cold War experience have given legitimacy to resource sovereignty and regional integration, and may also cause internal cracks due to identity narrative conflicts. When dealing with emerging practical challenges, the Spanish-speaking countries have demonstrated their adept diplomatic strategy of weaving historical narratives, current interest demands, and identity politics together. In emerging issues such as artificial intelligence ethics and deep-sea mining, Spanish-speaking countries will probably continue to use the narrative strategy of “historical justice-realistic interests” to reconstruct the identity of the “Global South” through instrumental historical memory. At a time of deep-sea mining rights disputes, Latin American countries will probably invoke the principle of “maritime freedom” during the colonial period to claim sovereignty over deep-sea resources and then seek a more favorable situation in the negotiations of the International Seabed Authority (ISA). Consequently, in today's world, where multipolar development is taking place and international situations are increasingly complex, Spanish-speaking countries use historical memories as a tool to secure their own interests when dealing with new challenges. This strategy of tying historical memory with emerging issues will become a key feature of the diplomacy of Spanish-speaking countries.

Disclosure statement

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Exploration of the Impact and Mechanisms of Socioeconomic Status on Adolescent Health Behaviors

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Abstract: Adolescence is a crucial stage for the development of values and health behaviors, during which individuals are susceptible to external environmental influences that can significantly impact their physical and mental well-being, with far-reaching implications for their future development. Socioeconomic status (SES) serves as a macro-level factor influencing adolescent health behaviors, directly linked to habits such as healthy eating, physical exercise, and risky behaviors like alcohol consumption and smoking. Consequently, socioeconomic status has increasingly become one of the primary indicators for assessing adolescent health behaviors. This article delves into the impact and mechanisms of socioeconomic status on adolescent health behaviors, summarizing the corresponding mechanisms of action based on an understanding of specific impact manifestations, with the aim of providing a basis for formulating intervention policies targeting adolescent health behaviors.

Keywords: Impact; Mechanisms; Adolescents; Health behaviors; Socioeconomic status

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1. Introduction

During adolescence, individuals experience accelerated physiological development and gradual transformation in their psychosocial roles. The cultivation of healthy behaviors is directly related to the future physical and mental health growth of adolescents. Health behaviors are primarily manifested as active choices made by individuals to ensure physical and mental well-being, including regular exercise, a balanced diet, and avoidance of risky behaviors. Significant disparities in health behaviors exist among adolescents across different regions, with clear polarization observed not only between regions with varying levels of economic development but also among adolescents from families with different income levels. A decline in family socioeconomic status often correlates with an increased likelihood of adolescents engaging in health-risk behaviors, such as reduced physical exercise, purchasing unhealthy foods, or adopting even more detrimental habits like alcohol consumption and smoking.

It is precisely this disparity in socioeconomic status that leads to corresponding changes in the health behaviors of adolescents. How to thoroughly analyze the underlying mechanisms between the two and seek reasonable intervention measures has become a hot topic in today's society.

2. Overview of socioeconomic status and adolescent health behaviors

2.1. Definition of socioeconomic status

Socioeconomic status refers to the position of an individual or family within the social structure, objectively reflecting their ability to possess social material and cultural resources. Differences in resource possession among individuals or families can influence an individual's future quality of life and growth trajectory. Socioeconomic status is a macroscopic and comprehensive concept. Although different disciplines may define it differently, the essence revolves around resource possession and social stratification ^[1].

2.2. Classification of adolescent health behaviors

Adolescent health behaviors refer to behavioral patterns observed in real life that impact an individual's physical and mental well-being, as well as their ability to develop socially. The essential characteristics of these behaviors are their continuity and susceptibility to intervention. Under scientific and systematic guidance, adolescents can dynamically adjust their inappropriate behavioral patterns, positively influencing their individual health in the future. Typically, adolescent health behaviors can be categorized into two types: health-promoting behaviors and health-risk behaviors. Adolescent health-promoting behaviors encompass healthy dietary habits, regular and reasonable physical exercise, and healthy lifestyle routines. These behaviors are proactive measures taken by adolescents to maintain their physical and mental well-being. Health-risk behaviors include poor dietary habits, limited physical activity, substance abuse, and psychological issues. These behaviors often arise from the physical and mental development of adolescents or external environmental influences. Improper intervention may lead to short-term or long-term health risks ^[2].

3. Manifestations of the impact of socioeconomic status on adolescent health behaviors

Socioeconomic status (SES) is a comprehensive concept, and differences in SES among individuals or families are directly reflected in the choices of healthy behavioral habits in the daily lives of adolescents. Typically, as SES levels decline, the likelihood of adolescents engaging in unhealthy behaviors inversely increases. This impact is directly evident in daily material consumption, physical activity, and psychological behaviors, among other aspects.

3.1. Material health behaviors

Health behaviors are most directly influenced by SES. On the one hand, in terms of daily dietary choices, SES differences lead to distinct nutritional patterns among adolescents. For families with low SES, constrained by daily living expenses, they often prioritize inexpensive, filling foods, with little attention given to the green health and nutritional balance of the food. Consequently, the dietary structure in such families tends to favor high-fat, high-sugar, and low-cost processed foods, posing numerous adverse effects on the physical health and development of adolescents. In contrast, families with high SES typically have more generous budgets, allowing for a wider

range of food choices, with a focus on purchasing healthy options such as high-quality proteins, fresh fruits, and vegetables. Moreover, members of such families often possess higher levels of health literacy, paying greater attention to the nutritional balance and green health of their food. As a result of these differences, adolescents from low SES backgrounds face a higher risk of obesity, overweight, and chronic diseases. On the other hand, regarding the development of unhealthy habits such as alcohol consumption and smoking, SES also exhibits a negative correlation ^[3]. Numerous studies have demonstrated that adolescents from low SES backgrounds tend to start smoking at an earlier age and, due to greater daily life stress, smoke more frequently. The underlying factors for this phenomenon include the role model effect of family and social members, as well as the adolescents' own need to cope with psychological stress and negative emotions through smoking. In terms of alcohol consumption, it is more prevalent among low SES adolescents. Even though high SES adolescents may also encounter alcohol in their daily lives, their drinking behavior is mostly confined to specific social gatherings or major holidays, with a lower level of alcohol dependency.

3.2. Health behaviors related to physical activity

In terms of the connection between socioeconomic status (SES) and health behaviors related to physical activity, the main manifestations are at the level of resources and opportunities. Adolescents from high-SES families often have more opportunities to participate in high-quality, paid sports activities such as tennis, swimming, and dancing. Additionally, their families have sufficient financial means to support the purchase of various sports equipment, cover competition expenses, and provide daily transportation. Moreover, the schools these adolescents attend are usually equipped with highly qualified teachers and comprehensive sports facilities. In contrast, adolescents from low-SES families face multiple layers of restrictions in participating in physical exercise. Their families often cannot afford the costs of daily learning and training, and the communities they live in lack free and safe sports venues. The sports resources provided by their schools are also relatively scarce. Under such circumstances, low-SES adolescents tend to have reduced physical activity levels, spending more time watching TV and playing with mobile phones, which exacerbates the health risks associated with a sedentary lifestyle. Regarding sleep, the impact of SES is often overlooked. Low-SES adolescents are prone to being affected by various factors, leading to insufficient sleep duration and poor sleep quality. This is attributed to the lack of independent and quiet resting spaces, as well as noisy and crowded living environments ^[4]. In some families facing significant economic pressure, adolescents often need to share household chores or take on part-time jobs, inevitably increasing physical fatigue and squeezing their time for studying and sleeping. An unstable living environment can also lead to various psychological problems in adolescents, negatively affecting their future learning and development.

3.3. Mental health behaviors

Health behaviors are not only manifested at the physiological level but also at the behavioral level of maintaining mental health and seeking help. When some adolescents experience negative psychological issues such as depression and anxiety, high-SES adolescents and their family members often have a more comprehensive and scientific understanding of mental health problems and possess sufficient financial resources to seek professional psychological counseling services. Conversely, adolescents from low-SES backgrounds and their accompanying family members often lack knowledge about mental health, habitually attributing psychological problems to individual factors. Moreover, due to the high costs associated with psychological counseling and treatment, even when serious psychological issues are identified, they rarely seek professional help proactively. Instead, they tend

to cope through avoidance or aggression. Over time, these psychological problems gradually worsen, negatively impacting the physical and mental health development of adolescents ^[5].

4. The mechanism of socioeconomic status on adolescent health behaviors

4.1. Family mechanism

The family environment is the most direct microenvironment influencing the growth of adolescents, and the distribution of various types of capital within the family system directly relates to adolescents' choices and development in terms of healthy behaviors.

Firstly, the mechanism of economic capital. Economic capital, as a core dimension of SES, directly determines whether adolescents can receive sufficient economic support from their families to afford a higher standard of living. In reality, regular exercise requires the support of sports equipment such as swimming goggles, basketball shoes, and dance attire. The cost of swimming lessons often hovers around 200 yuan, not to mention the transportation expenses incurred for commuting. A balanced diet necessitates a steady supply of fresh fruits and vegetables as well as high-quality protein. Families with low SES face significant financial pressures, and their limited incomes are typically prioritized for meeting basic survival needs, leading to a natural reduction in health-related expenditures. Economic pressures also indirectly affect adolescents' healthy behaviors. Members of low-SES families often work in strenuous, low-paying jobs, leaving them with little time to engage in outdoor activities with their children. In contrast, parents from high-SES families often plan to exercise with their children or provide sufficient financial support for their children to participate in sports training ^[6].

The educational level of parents also influences, to a certain extent, adolescents' cognitive abilities and choices regarding healthy behaviors. Many highly educated and high-income parents possess a wealth of scientific nutritional knowledge and consciously impart healthy concepts to their children in daily life, such as the benefits of exercise for improving memory and the importance of a balanced diet rich in vegetables. Parents with low socioeconomic status (SES) are influenced by traditional beliefs. Due to their own unhealthy behavioral habits, they directly contribute to the emergence of unhealthy behaviors in their children. Additionally, life stressors can easily trigger conflicts, leading to psychological issues such as anxiety, depression, and autism in adolescents, thereby exacerbating the divergence in healthy behaviors among them.

4.2. School and community environmental mechanisms

Adolescent activities often take place in school and community settings, where the school and community environmental mechanisms serve as the macro-context for adolescent behavioral choices. School quality is closely related to the SES of the community in which it is located. Schools in high-SES communities typically have sufficient funding, well-equipped sports facilities, and can offer a variety of physical education courses in their daily teaching, along with providing healthy and nutritionally balanced meals for students ^[7]. In contrast, schools in low-SES communities face financial constraints and resource scarcity, particularly with outdated and severely damaged sports facilities, making it difficult to offer diverse physical education courses and healthy meal options. These schools are often surrounded by convenience stores and fast-food restaurants, further increasing the opportunities for adolescents to engage in unhealthy behaviors. The SES level of a community is also reflected in whether it has sufficient green spaces, parks, and free public sports facilities. In some low-SES communities, due to insufficient public space, poor community environment, and high crime rates, adolescents lack safe and

convenient sports venues, severely limiting their outdoor activities. As a result, they spend more time indoors, increasing their static screen time from playing online games ^[8].

4.3. Individual psychological mechanisms

Low SES often brings about issues such as financial strain, family conflicts, and low social status, which become common sources of stress for adolescents. Over time, this stress can lead to severe psychological problems. To alleviate negative emotions, adolescents may resort to drinking, smoking, or overeating for temporary relief. Although these methods may be effective in the short term, they compromise the long-term health of adolescents ^[9]. Adolescents from low socioeconomic status (SES) backgrounds experience numerous social constraints during their upbringing, leading to negative emotions toward the current social state. Their expectations that personal effort can change their fate gradually decline, and they may even experience a sense of confusion ^[10]. This pessimistic outlook subtly weakens adolescents' self-control, further exacerbating unhealthy behaviors such as substance attraction, drinking, and improper diet.

5. Conclusion

In summary, socioeconomic status exerts a profound influence on adolescents' health behaviors, permeating various micro-habits in their development. To effectively address inequalities in adolescents' health behaviors, it is essential to focus on the social ecosystem, emphasizing long-term tracking studies and causal judgments regarding socioeconomic status. Protective measures such as positive mentorship, enhancing psychological resilience, and providing family support should be implemented to mitigate the negative impacts of socioeconomic status, thereby safeguarding the development of healthy behaviors among adolescents.

Disclosure statement

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From Local Knowledge to Global Wisdom: The Ecological Dimension of Nomadic Ethics and Its Value in Civilizational Dialogue

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Abstract: In the context of the Anthropocene, where the global ecological crisis is intensifying, the pursuit of a civilizational paradigm shift beyond technological governance has become an imperative of our time. The ethical system of nomadic civilizations, centered on “reverence for life and respect for nature”, has often been regarded as a form of “local knowledge.” This paper argues that its inherent worldview of “animism”, the practical rationality of “taking only in season and respecting protected lands”, and the belief system of “Father Heaven, Mother Earth” collectively constitute a profound ecological philosophy. This philosophy is capable of transcending its local origins to become a “global wisdom” that contributes to the worldwide dialogue on ecological ethics. A philosophical interpretation of the ecological dimension of nomadic ethics not only reveals its timeless significance for ecological civilization but also provides vital Eastern wisdom and a reflective mirror for addressing the predicaments of modernity and fostering a shared future for humans and nature.

Keywords: Nomadic ethics; Ecological dimension; Local knowledge; Global wisdom; Civilizational dialogue

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1. Introduction

The symbiotic relationship between humans and nature forms the foundation of civilizational sustainability. As a distinctive component within the pluralistic yet integrated framework of Chinese civilization, nomadic civilization is not a historical relic. Through millennia of dynamic adaptation to the grassland ecosystem, it has developed a body of sustainable wisdom that is both scientific and practical. The ecological dimension embedded in its ethical and moral traditions is not merely “local knowledge” adapted to a specific environment, but also a philosophical resource endowed with universal value. In an era of global ecological crisis, rediscovering and interpreting this wisdom—enabling it to move from the grasslands to the global stage and participate in the constructive dialogue on ecological civilization—is of unprecedented urgency and importance.

2. The ethics of “reverence for life”: Ecological philosophy in institutions and customs

The nomadic ethic of “reverence for life” is not a simplistic perceptual concept, but a form of philosophical consciousness embodied in institutional norms and daily customs. This concept was institutionalized early in the formation of the Mongol Empire through legal codes such as the Great Yassa. Decrees issued by Genghis Khan—for example, “defiling springs is forbidden”, “drawing water with bare hands is forbidden”, “urinating on ashes is forbidden”, as well as provisions protecting flora and fauna, such as “prohibiting the hunting of young animals in specific seasons”—established the earliest ecological legal framework in nomadic society. The essence of these laws lies not merely in resource management based on economic calculation, but in a respect for the intrinsic value of natural life, elevating ecological protection from individual morality to a collective responsibility and laying the institutional foundation for nomadic ecological ethics.

At the level of custom, nomadic peoples practiced unique burial traditions that embodied the philosophy of “returning life to nature.” Whether the deep burial of emperors with “no mound above the tomb”, or the “sky burial” practiced by commoners, the core principle was to minimize disturbance to the grassland ecosystem. As recorded in *Caomu Zi*, “They were sent to the northern burial grounds, buried deep, then trampled flat by ten thousand horses. They waited until the grass turned green before withdrawing the guard, by which time the land had become level with the plains, leaving no trace behind”^[1]. This concept of “from nature, back to nature” vividly illustrates the deep ecological idea that “humans and nature form a community of shared destiny.” The practice of sky burial carried this concept to its extreme: no coffins or trees were used as barriers, and no earth was disturbed or polluted by cremation; instead, the body was ultimately returned to heaven and earth, completing the final cycle of life matter. This was not merely custom, but a profound form of cosmological education.

Moreover, totem worship and behavioral taboos permeated daily life, forming a “capillary” network of nomadic ecological ethics. Taboos such as prohibiting harm to insects and birds, forbidding ground-breaking during the grassland’s growth period, and avoiding uprooting medicinal plants when gathering—interwoven with linguistic taboos such as “if one handles bird eggs with bare hands, the bird will not incubate them”—created an invisible web of ecological protection. This system was not mere “superstition”, but a cultural code refined through long-term trial and error, used to restrain short-term interests and maintain the long-term stability of the ecosystem. It represents the living expression of nomadic ecological philosophy in the micro-contexts of daily life.

3. The hunting ethic of “taking in season, respecting protected lands”: Practical rationality based on ecological thresholds

Hunting, as an important supplement to the nomadic economy, was strictly confined within an ethical framework of “moderation” and “sustainability”, forming a highly rationalized practical wisdom of “taking only in season and respecting protected lands.” This ethical norm shares common roots with the traditional Chinese governance wisdom of “prohibiting and permitting according to the season”, but its unique value lies in its understanding of the modern concept of “natural carrying capacity” within the fragile grassland ecosystem.

Its core lies in a profound insight into “temporality” and “population dynamics.” The *Hei Da Shi Lue* records: “The hunting season lasts from the ninth month to the second month. When they regularly eat what they hunt, they kill fewer sheep”^[2]. By strictly limiting hunting to the winter months and actively avoiding

the spring and summer breeding and growth seasons of animals, this practice demonstrated absolute respect for the natural rhythms of life—a form of rigid self-discipline from the temporal dimension to ensure species continuity.

Even more refined was the “release ethic.” Originating from the ancient taboo of “avoiding the destruction of entire herds”, it crystallized into three principles: releasing paired males and females to ensure the genetic basis for reproduction; releasing the weak, young, or injured, reflecting ecological ethical concern for vulnerable life; and strictly prohibiting the hunting of pregnant females, considered the greatest disgrace for a hunter. As recorded in d’Ohsson’s *History of the Mongols*, elders would plead with the Khan for the remaining prey, “who then released them, so that they might multiply and serve for future hunts” ^[3]. This act was not simple compassion, but a far-sighted form of “ecological investment.” By actively maintaining the balance of species numbers and structure, it enabled the sustainable use of natural resources, demonstrating a dialectical unity of “benefit” (immediate needs) and “righteousness” (ecological balance).

Viewed through the lens of consumption philosophy, nomadic hunting practices were strictly bound by “genuine needs”, thoroughly rejecting accumulation and exchange driven by greed. Their consumption ethos rested on two pillars: first, using the ecosystem’s carrying capacity as the absolute upper limit, never overdrawing nature’s regenerative ability; second, using the community’s healthy survival as the measure, rejecting excessive material demands. This practical rationality of “take only what is needed” was a survival wisdom honed by nomadic peoples in a fragile ecology. It resonates with the warning in *Lüshi Chunqiu*: “If you drain the pond to catch fish, you will certainly catch fish, but next year there will be no fish”—together offering an answer to the eternal question of how to coexist harmoniously with nature.

4. The belief system of “Father Heaven, Mother Earth, animism”: Internalization and sublimation of ecological constraints

The deepest and most stable foundation of nomadic ecological ethics lies in the belief system of “Father Heaven, Mother Earth” and “animism.” This system internalized ecological protection from external norms into spiritual belief and elevated it from rational calculation to emotional identification, thereby endowing it with cultural vitality that transcends time and space.

4.1. “Father Heaven, Mother Earth”: Ecological responsibility in cosmic kinship

Nomadic peoples regarded Heaven and Earth as the supreme parents, believing that “Heaven, Earth, and Humanity are the most fundamental elements of nature. Therefore, humans revere Heaven and Earth just as they respect their own parents, and Heaven and Earth also nurture and benefit humans as if protecting their own children” ^[4]. This “cosmic kinship theory” shaped a unique human-nature relationship: humans are not conquerors of nature, but children deeply favored by Heaven and Earth. Consequently, gratitude and reciprocation became a natural ethical obligation.

This belief was directly embodied in daily ecological practices: the offering of the first bowl of freshly brewed milk tea to Heaven and Earth, or the ritual of flicking liquor three times as libation before drinking—these ceremonies constituted integral components of a “gratitude economy.” Meanwhile, practices such as using dried dung as fuel, burying ashes, and protecting grass roots represented acts of devout stewardship towards the “body of the Parental Cosmos.” This kinship-based ethic of responsibility proves more enduring and profound

than contract-based relationships, transforming ecological conservation into an instinctive cultural practice deeply embedded within the collective consciousness, rather than merely an external imposition.

4.2. “Animism”: Ecological awe in Shamanic belief

The “animism” of Shamanism endowed the grassland ecosystem with sacredness. It held that mountains, rivers, forests, springs, and even birds and beasts were inhabited by “spirits” possessing will and power. This “re-enchantment of nature” turned the entire environment into a “sacred space” filled with meaning and taboos. Polluting springs, trampling seedlings, or hunting spiritual animals (e.g., eagles, wolves) were considered sacrilegious acts that would incur divine punishment.

Take Oboo worship as an example: it was not only a religious ritual but also an exquisite ecological protection mechanism. The area surrounding the Oboo became a de facto “community nature reserve”, where grazing and logging were strictly prohibited. Through the power of faith, core ecological protection zones were established and maintained. This “inside-out” model of constraint—shaping inner awe to regulate external behavior—offers a key insight for modern ecological governance: the most effective constraint is self-constraint deeply embedded within culture.

5. Conclusion: Ecological insights from grassland wisdom to global civilization

The ecological ethics of nomadic civilization is a highly mature system of wisdom integrating institutions, practices, and beliefs. It is by no means an “Other” opposed to modern civilization, but an indispensable civilizational resource for addressing the global ecological crisis.

Philosophically, with its cosmology of “animism” and “Father Heaven, Mother Earth”, it provides a potent response to modernity’s “disenchantment of nature”, offering ancient wisdom for “re-enchanting” the natural world and restoring the sanctity and interconnectedness of life. On the practical level, its hunting ethic of “taking in due season and respecting protected lands” vividly demonstrates the essence of “sustainable development”—a form of prosperous moderation grounded in awareness of ecological thresholds. In terms of governance, it reveals that sound ecological governance must “integrate strength with softness”: requiring not only rigid laws like the Yassa legal code, but more importantly, the soft power embodied in Oboo worship traditions, which can be internalized as civic virtue and cultural practice.

Therefore, the purpose of rediscovering the ecological dimension of nomadic ethics is not nostalgia, but a forward-looking endeavor. It represents a concrete path for the creative transformation and innovative development of China’s excellent traditional culture, aiming to elevate this ancient “local knowledge” beyond temporal and spatial boundaries into a “global wisdom” that can participate in the global dialogue on ecological ethics and contribute unique solutions for building a “community of life for humans and nature.” This is both the contribution of nomadic civilization to Chinese civilization and the contribution of Chinese civilization to world civilization.

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Challenges and Pathways for Deepening China's Cultural System Reform in the New Era

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Abstract: Over the past century, the Communist Party of China has deepened its cultural system reform through four periods: the New Democratic period, the socialist revolution and construction period, the reform, opening up, and socialist modernization period, and the period from the 18th National Congress of the Party to the present. Entering a new era, while significant achievements have been made in cultural system reform, it still faces challenges such as ideological work being impacted by globalization, insufficient optimization of cultural service and product supply mechanisms, comprehensive network governance facing information technology challenges, and the cultural international dissemination system and effectiveness needing improvement. Therefore, efforts should be made to deepen the exploration of cultural system reform paths from aspects such as continuously improving the responsibility system for ideological work, optimizing cultural service and cultural product supply mechanisms, perfecting the comprehensive network governance mechanism, and building a diverse and coexisting cultural international exchange system.

Keywords: New era; Deepening culture system reform; Challenges; Exploration of the path

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1. Introduction

In the *Decision of the Central Committee of the Communist Party of China on Further Deepening Reforms and Promoting Chinese-style Modernization*, passed at the Third Plenary Session of the 20th CPC Central Committee, it elaborately expounds on the major tasks of deepening the cultural system and mechanism reform, as well as the paths and specific measures to be followed to achieve these tasks. In this article, the difficulties and challenges are expounded on, which the Communist Party of China was facing in deepening cultural system reform over the past century, and innovative strategies for deepening cultural system reform are explored^[1].

2. Challenges in deepening cultural system reform in the new era

The deepening of the cultural and institutional reforms of the Communist Party of China over the past century

has gone through four periods: the New Democratic Era (1921–1949), the Socialist Revolution and Construction Period (1949–1978), the Reform and Socialist Modernization Construction Period (1978–2012), and the period since the 18th National Congress of the Party (2012–present). Entering the new era, although the deepening of the cultural system and mechanism reforms has achieved remarkable results, it still faces multiple challenges and obstacles.

2.1. The impact of globalization on ideological work

The President of the CCP pointed out: “Ideological work is an extremely important task for the Party.” Therefore, people “must firmly hold the leadership, management, and decision-making power of ideological work in our own hands. At no time can it be handed over to others; otherwise, we will make irreparable historical mistakes.” At the political level, ideology determines the direction of a country’s development and its rise and fall; at the social level, ideology affects the harmony and stability of society, thereby influencing the long-term stability of the country; at the individual level, ideology influences an individual’s world view, life view, and value system, thereby affecting the political direction of the country ^[2]. Under the tide of globalization, the global political and economic landscape is complex and volatile. The infiltration of hostile forces into the country’s ideological and cultural fields is becoming increasingly rampant. Various forms of “Westernization and division”, “peaceful evolution”, and “color revolution” are emerging one after another. “Black swan” and “grey rhino” events may occur at any time, and ideological work is facing multiple challenges. Firstly, Western developed countries have infiltrated capitalist values through economic cooperation and cultural dissemination, attempting to weaken the influence of socialist ideology. Secondly, the Internet technology has accelerated the dissemination of diverse ideas, leading to the fragmentation of social values and the erosion of the cohesion function of the mainstream ideology. Moreover, the market monopoly of multinational enterprises may be accompanied by the implicit implantation of consumer culture and lifestyle concepts, indirectly undermining the identification with local culture. Therefore, in the context of globalization, ideological struggles have evolved into a deep-level contest of comprehensive national strength. This requires people to safeguard cultural security through institutional improvement and international dialogue, thereby providing a solid guarantee for the political security and regime security of the country ^[3].

2.2. Inadequate mechanism for optimizing cultural service and product supply

Currently, although the total supply of cultural services and products in the country has achieved significant optimization and growth, there are still structural contradictions. First, the structure of supply entities is unbalanced, with insufficient effective supply. Currently, the supply of cultural services in the country shows a significant feature of “state advancement and private retreat.” This is mainly due to the fact that state-owned institutions are constrained by the system, resulting in insufficient innovation motivation for their products, while private cultural enterprises face the “glass door” phenomenon, and there are deficiencies in the proximity of cultural products to the people ^[4]. Second, there is an imbalance in the matching of supply and demand, and the distribution of public cultural services is unbalanced. A large number of consumers believe that the existing cultural products lack individual tags. Among young people, most express a willingness to pay a premium for customized cultural services. There is an oversupply of traditional culture supply, while there is a large gap in the supply of emerging business models, such as immersive experiences and national trend IPs. The per capita area of cultural facilities in first-tier cities is more than that in county areas. Third, the digital conversion rate is low. Under the background of the Digital China strategy, the process of digitalization of cultural resources is significantly

lagging behind. The construction of smart service platforms places a heavy emphasis on hardware investment, while neglecting content operation; it places a heavy emphasis on platform establishment, while neglecting data interconnection; it places a heavy emphasis on technology display, while neglecting user experience ^[5]. Fourth, the supply system faces financing difficulties and insufficient capital support, which hinders the expansion of cultural enterprises and limits the potential release of the cultural industry in terms of technological innovation and market expansion, further exacerbating the challenges faced by the cultural industry in resource allocation, project advancement, and market competitiveness improvement. Therefore, effectively solving financing problems and enhancing the cultural industry's capital attraction are important issues that need to be urgently addressed at present ^[6].

2.3. Comprehensive network governance faces challenges from information technology

With the rapid development of information technology, comprehensive network governance is facing unprecedented technical challenges, which have increased the difficulty of network culture governance ^[7]. Firstly, the widespread application of artificial intelligence technology has led to an exponential growth in network content production and dissemination, making it more difficult to identify false information. Secondly, the anonymous nature of blockchain technology provides a concealed space for network culture crimes, and the usage rate of cryptocurrencies on the dark web has reached 78%, increasing the difficulty of tracking network culture financial crimes. Thirdly, the popularization of 5G and the Internet of Things has led to a sharp increase in the number of connected devices, and device security vulnerabilities may be exploited on a large scale, forming distributed network attacks. Fourthly, algorithm recommendation technology's personalized push has exacerbated the "information cocoon" effect, with the cognitive disconnection between different groups increasing by 35 percentage points compared to 2020, affecting network public opinion and the balance of ideological ecology. Fifthly, the development of cutting-edge technologies such as quantum computing has made existing encryption systems vulnerable to being cracked, threatening the security of key information infrastructure ^[8]. These technological advancements not only promote the development of network culture space but also pose higher requirements for comprehensive network culture governance, and it is urgent to establish an innovative response mechanism that integrates technical governance and legal regulation.

2.4. The need for an improved cultural international communication system and its effectiveness

At present, there are still significant shortcomings in the current system and the efficiency of China's cultural international dissemination. These shortcomings mainly manifest in three aspects: First, the structure of the dissemination entities is unbalanced. Official institutions account for a large proportion, while the participation of private organizations, enterprises, and other market entities is insufficient, resulting in serious homogeneity in the dissemination of content. Second, the integration of dissemination channels is insufficient, lagging behind the average level of countries like the United States, Japan, and South Korea, and the multi-platform linkage effect is weak. Third, there is a "cultural discount" phenomenon in content innovation. Overseas audiences believe that the understanding threshold of traditional Chinese culture is too high, while modern cultural products lack distinctive identification. In terms of effectiveness assessment, currently, no scientific dissemination effect monitoring system has been established, and few external cultural projects have set quantitative evaluation indicators. Fourth, the issue of regional dissemination imbalance is particularly prominent ^[9]. The cultural penetration index

towards countries along the “Belt and Road” is much lower than that of European and American countries. These structural deficiencies have led to a low input-output ratio of cultural international dissemination in China. It is urgent to adopt measures such as establishing a collaborative mechanism of multiple entities, innovating cross-cultural narrative methods, and improving the effectiveness assessment system to comprehensively enhance the systematicness and effectiveness of cultural international dissemination.

3. Exploration of the path for deepening cultural system reform in the new era

The implementation strategies for deepening the cultural system reform in the new era are of vital importance. In the face of the difficulties and challenges during the reform process, people need to actively innovate and respond. Only in this way can people establish a complete modern Chinese cultural market, meet the increasingly growing spiritual and cultural needs of the people, enhance the country’s cultural soft power, promote Chinese culture to go global, and provide solid cultural support for the comprehensive construction of a modern China.

3.1. Strengthening the party’s leadership over culture and continuously improving the responsibility system for ideological work

Firmly grasping cultural leadership and continuously improving the responsibility system for ideological work are the fundamental tasks of the Party’s propaganda and ideological work in the new era of China ^[10]. The current international situation is complex and volatile, and the domestic tasks of reform, development, and stability are arduous and heavy. People must adhere to the guidance of the Thought of Socialism with Chinese Characteristics in the New Era, deepen the research on the Sinicization of Marxism, build a Chinese academic discourse system with distinct characteristics, fully implement the responsibility system for ideological work, and effectively safeguard the national ideological security. First, strengthen the primary responsibility of the Party committee (Party group), establish a responsibility list for ideological work, clearly define the “dual responsibilities” of all levels of leading cadres, establish a mechanism for the coordinated development of economy and ideology, and prevent “black swan” events. Second, improve the analysis and assessment mechanism, conduct regular risk screenings in the ideological field, implement a dynamic monitoring and early warning system for ideological security, and establish a contingency plan for major public opinion warnings and responses. Thirdly, innovate working methods and approaches, utilize new media technologies to enhance the ability of public opinion guidance, and innovate the theoretical dissemination model of “two microblogs and one terminal.” Fourthly, improve the assessment and accountability mechanism, and incorporate ideological work into the contents of inspections, patrols, and cadre evaluations. Fifthly, strengthen team building, cultivate and bring up an ideological work team with a strong political stance and high professional skills. Through the systematic implementation of these measures, a responsibility system covering all aspects horizontally and throughout the entire hierarchy will be established. This will not only consolidate the guiding position of Marxism but also adapt to the changes in the communication landscape, ensuring that the responsibility system for ideological work is implemented effectively and providing a strong ideological guarantee and powerful spiritual strength for the comprehensive construction of a socialist modernized country ^[11].

3.2. Adhering to the people-centered philosophy and optimizing the mechanism for providing cultural services and cultural products

At present, there are structural contradictions in the supply mechanism of cultural services and cultural products

in the country. It is urgent to carry out structural reforms and establish an intelligent supply-demand matching system, and adopt innovative measures to address these current contradictions ^[12]. First, a cultural consumption big data platform should be established. By integrating data sources such as ticketing systems and e-commerce platforms, real-time monitoring of regional cultural consumption hotspots can be achieved, and content production demand predictions based on AI algorithms can be made. Second, an “order-based” supply reform should be implemented. The “you-order, I-perform” model should be adopted in museums, theaters, and other venues, enabling online voting for performance programs and VR preview for cultural exhibitions. Third, to meet the high-quality demands of the people for spiritual and cultural life, diverse and high-quality cultural products and services should be provided, in addition to traditional books, newspapers, etc. More products and services with high-tech elements and cultural value-added should be provided. Through these measures, a fundamental transformation from “the government providing dishes” to “the people ordering dishes” in cultural services can be truly realized. Fourth, resource allocation should be optimized, and the construction of the public cultural service system should be promoted. Key emphasis should be placed on strengthening the construction of grassroots cultural facilities, promoting the standardization and equalization development of public cultural services, ensuring that county-level cultural centers, libraries, etc., reach the maximum standards, and expanding the coverage rate of village-level comprehensive cultural service centers. Fifth, the application of digital technology should be strengthened. Through digital technology, a cultural digital resource library should be constructed, cultural resources should be integrated for utilization, and digital platforms such as smart museums, libraries, and service stations should be created, enabling the public to obtain diversified cultural services more conveniently. Secondly, a digital heritage project should be constructed, strengthening digital protection of cultural relics, using technologies such as laser scanning and multi-spectral imaging, establishing a traceable digital collection blockchain system, IP transformation bases, etc. ^[13].

3.3. Establishing a systemic thinking approach and improving the comprehensive governance mechanism for the network

In the face of the complex international and domestic situations, the cultural industry, cultural services, and cultural consumption patterns are undergoing profound changes. The application and promotion of technologies such as artificial intelligence, blockchain, 5G, the Internet of Things, and algorithm recommendation not only promote the deep integration and innovation within the cultural industry, but also accelerate the optimization and upgrading of the cultural industry structure ^[14]. However, with the rapid development of science and technology, network comprehensive governance is facing unprecedented challenges. It is necessary to establish systematic thinking and improve the mechanism of network comprehensive governance. First, people need to deepen the reform of the network management system. Strengthen the core position of the Party’s leadership, implement the responsibility system for network ideology, establish a multi-party co-governance pattern of “Party committee leadership, government management, enterprises fulfilling responsibilities, social supervision, and netizens’ self-discipline”, highlight the coordinating function of the cyber information department, and form a cross-departmental governance synergy. Second, people need to promote the integrated management of news publicity and online public opinion. People should integrate the functions of online content construction and management, establish a unified command system, improve the mechanism for guiding online public opinion, strengthen the dissemination of mainstream values, build a risk prevention and control system, establish a rapid refutation mechanism for erroneous ideas, enhance the ability to clear harmful information, and improve the level of cross-

border public opinion struggles. Thirdly, efforts should be made to strengthen the legal construction in the online space. The legal framework for the internet domain should be continuously improved in a dynamic manner. Special regulations, such as the “Regulations on the Governance of Internet Information Content”, should be fully implemented. A complete enforcement mechanism covering “monitoring — early warning — handling” should be established. Fourth, people need to establish a long-term mechanism for governing the network ecosystem through innovation. By leveraging big data and AI technologies, people will build an intelligent supervision platform. People will also strengthen the main responsibilities of internet platforms, enhance the research and development of content review technologies, establish a hierarchical and categorized management system, and improve the reward system for reporting illegal online activities. Fifth, people need to establish a sound protection system for minors’ online activities. Develop specific protection regulations, clearly define the responsibilities of all parties, build a three-in-one protection network involving “family, school and society”, strengthen online literacy education, optimize content filtering mechanisms, improve anti-addiction systems, establish channels for resolving minors’ online rights and interests, implement safeguard measures, strengthen the construction of internet talent teams, establish an evaluation mechanism for governance effectiveness, and promote international cooperation in internet governance ^[15].

3.4. Implementing the global civilization initiative and building a diversified and symbiotic international cultural exchange system

The current practice of the global civilization initiative requires the establishment of a more efficient international cultural exchange system. In terms of the reconfiguration of the international communication landscape, efforts should focus on national strategic goals, optimize the media resource matrix, promote the transformation of mainstream media into global new media, and create comprehensive media brand projects with international influence. Through the establishment of a multi-dimensional evaluation system, a discourse system in line with China’s national conditions should be developed, an international communication narrative system based on universal values of humanity should be constructed, and precise communication strategies should be adopted to eliminate cultural barriers. In the construction of the Chinese discourse system, it is necessary to deeply explore the essence of China’s excellent traditional culture and extract the characteristic cultural symbols of China. At the same time, one should actively participate in global issue discussions and adopt innovative expression methods, such as data and case studies, to form a Chinese expression that combines profound ideological depth with warm emotional temperature. The construction of the implementation mechanism for the global civilization initiative requires the establishment of a multi-dimensional social recognition system. Through cultural activities and academic discussions, it promotes mutual learning among civilizations and utilizes digital technology to expand communication channels. At the same time, the immigration and exit management policies should be optimized, visa facilitation promoted, international cooperation in the education field strengthened, and a two-way interactive pattern of “going out” and “bringing in” formed. This systematic project is advanced through the coordinated promotion of three dimensions: the reconfiguration of the communication pattern, the innovation of the discourse system, and the improvement of the implementation mechanism. The aim is to enhance China’s cultural soft power and international discourse power, and contribute Chinese wisdom to promoting the exchange and mutual learning of human civilizations.

Disclosure statement

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Research on the Construction of Smart Manufacturing Systems under the Lean Production Model

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Abstract: Against the backdrop of the manufacturing industry's shift towards intelligence, the deep integration of the lean production model's principle of "eliminating waste and continuous improvement" with Smart Manufacturing technologies has become a key path to enhancing production efficiency and core competitiveness. Based on the core ideas of lean production, this paper constructs a Smart Manufacturing system encompassing labor optimization, Smart Manufacturing, AI-based inspection, unmanned delivery, virtual factories, and big data decision-making. It clarifies the overall framework of "5 subsystems and 88 tools", with a focus on two main dimensions: the design logic of the Smart Manufacturing system and the implementation path of core intelligent technologies. By integrating key technologies such as equipment IoT, photographic inspection, and unmanned delivery, it achieves rule coverage and intelligent decision-making throughout the entire production process, providing theoretical support and practical reference for building an efficient, flexible, and low-cost Smart Manufacturing system for manufacturing enterprises.

Keywords: Lean production; Smart Manufacturing system; Subsystem construction; AI intelligent inspection; Unmanned delivery; Virtual factory; Big data decision-making

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1. Introduction

With the widespread adoption of Industry 4.0 technologies, traditional manufacturing models face issues such as low efficiency, high costs, and slow responsiveness. The lean production model, centered on "value stream optimization", provides a conceptual guide for Smart Manufacturing systems. Building a Smart Manufacturing system requires a foundation in lean thinking and the integration of AI, IoT, big data, and other technologies to achieve intelligent coordination of all production elements. Currently, manufacturing enterprises often encounter challenges such as "subsystem fragmentation" and "disconnect between technology and production rules" during system construction. The "5 Subsystems — 88 Tools" framework proposed in this article incorporates elements

such as labor, intelligent production, inspection, distribution, virtual simulation, and data-driven decision-making into a unified system. It focuses on addressing the two critical issues of “system design logic” and “implementation of core technologies”, promoting the deep integration of lean production and Smart Manufacturing, and achieving a full-process lean and intelligent production system.

2. Design logic of the Smart Manufacturing system under the lean production model

2.1. Core principles of system design

The design of a Smart Manufacturing system under the lean production model must be fundamentally guided by “value creation”, deeply implementing the four core principles of “waste elimination, process optimization, data-driven decision-making, and flexible response.” This aims to achieve the mutual empowerment of lean concepts and intelligent technologies, ensuring that every technological application precisely serves lean objectives and that every lean improvement is clearly supported by technology, forming a closed loop of “technology-lean” symbiosis and mutual promotion ^[1].

2.1.1. Eliminate waste

In response to the “seven wastes” of lean production, a three-dimensional matching system of “technology tool—waste type—quantitative target” is constructed, allowing intelligent technology to become a “precision scalpel” for eliminating waste: Eliminating waiting waste: Deploy an equipment IoT platform (supporting OPC UA/MQTT protocols, with a data collection frequency of once per second) to monitor equipment idle states in real time (such as CNC machine standby or AGV no-load). When an equipment idle time exceeds 5 minutes (customizable threshold), the system automatically triggers a “task matching algorithm” to assign suitable tasks from the pending task pool (for example, assigning urgent component processing tasks to idle machines), while simultaneously sending scheduling instructions to the operator terminal. This reduces the average equipment idle rate by 30%, and single-shift production time utilization exceeds 90%.

2.1.2. Elimination of inventory waste

Introduce AI demand forecasting tools (based on LSTM neural networks, trained on datasets including nearly 12 months of order data, seasonal fluctuations, and market demand data) to predict production demand for the next 1–4 weeks, with an error rate controlled within $\pm 3\%$ ^[2]. Combined with the intelligent production subsystem’s “pull-based scheduling”, this achieves “production on demand” — for example, if the forecast predicts a demand of 500 units for a certain component next week, only 510 units (including 10 units of safety stock) are scheduled for production, avoiding inventory accumulation caused by “overproduction.” The turnover days of raw material inventory are reduced from 30 days to 15 days, and finished goods inventory costs decrease by 45%.

2.1.3. Eliminating handling waste

The unmanned delivery subsystem is equipped with a “dynamic route optimization algorithm” (an improved ant colony algorithm, with a computation efficiency of ≤ 1 second per calculation) to analyze material handling demands in the workshop in real time (such as material delivery from the raw material warehouse to Machine 1), automatically planning the optimal path (avoiding congested routes and prioritizing empty AGVs). This reduces the average handling distance within the workshop from 200 meters to 120 meters, shortens handling time from 30 minutes to 19 minutes, lowers handling energy consumption by 25%, and completely eliminates inefficiencies

such as “detour handling” and “repeated handling.”

2.2. The system framework of “5 major subsystems and 88 tools”

Based on the requirement to cover the entire production process with rules, construct the “5 major subsystems” as the core carriers of the Smart Manufacturing system, and integrate 88 lean and intelligent tools to achieve collaborative interaction between the subsystems.

2.2.1. Human resource optimization subsystem

Integrating 18 tools, focusing on “optimal workforce efficiency”, and building a full-process human resource management system covering “capability assessment—task allocation—performance optimization—skill improvement—cost control.” Among them, the intelligent skill assessment tool quantifies employee skill levels (5-level grading) through “online theoretical tests (50 professional questions covering areas such as equipment operation and quality inspection) and offline practical video analysis (AI behavior recognition algorithm scoring on operational standardization and efficiency).” This generates a skill database^[3]. The big data scheduling system automatically matches personnel to positions and generates visual scheduling tables based on production task requirements (e.g., needing 10 machine operators for a certain period), employee skill levels, and attendance data, supporting exception adjustments (e.g., automatically matching substitute personnel when an employee takes leave). As a result, the workforce idle rate decreased from 12% to 5%. The real-time performance analysis module collects data such as production quantity and pass rate through IoT devices, calculating KPIs like human efficiency, OEE, and pass rate, and identifying performance bottlenecks (e.g., low efficiency due to lack of skill proficiency). The personalized training tool pushes targeted content based on performance analysis results (e.g., online 3D animation courses, offline mentor-guided practical training), shortening the skill improvement cycle by 50%. Additionally, 14 other tools, including labor cost accounting, job demand forecasting, and cross-position allocation, work together, leading to an average workforce efficiency increase of 15% and a 12% reduction in labor cost per unit product.

2.2.2. Intelligent production subsystem

As the core of the system, it integrates 22 tools and builds a “Connected Equipment—Process Optimization—Production Scheduling—Built-in Quality” system around “lean production single-piece flow and pull production.” The equipment IoT platform supports OPC UA/MQTT protocols, collecting machine tool speed (± 1 rpm), temperature (± 0.5 °C), and other data once per second, enabling real-time equipment status monitoring^[4]. The flexible production scheduling system generates pull-based schedules based on order priority and equipment load; when orders change, adjustments are completed within 10 minutes, preventing in-process inventory accumulation. The process parameter optimization tool combines lean DOE with AI algorithms to analyze historical parameters and quality data, automatically outputting a parameter combination that achieves “lowest energy consumption and highest efficiency”, while also supporting manual fine-tuning. The in-process traceability module records the full production process information via RFID tags (workstation, time, operator), allowing root cause identification of quality issues within 5 minutes. Additionally, there are 18 other tools, including equipment preventive maintenance (predicting failures based on vibration data) and production anomaly alerts. Equipment OEE is increased to 90%, and in-process inventory is reduced by 40%.

2.2.3. AI intelligent inspection subsystem

Integrating 15 tools with the goal of “zero-defect quality”, a system of “visual acquisition—intelligent recognition—defect analysis—process feedback” is established. The visual acquisition system deploys 20-megapixel industrial cameras (inspection resolution 0.001mm) and customized lighting (ring lights for metal parts, strip lights for plastic parts) at key quality inspection points, with edge computing modules completing image preprocessing within 50 ms. The AI visual recognition model is trained based on a lean quality standards library (e.g., scratches ≤ 0.5 mm are considered acceptable), supporting the identification of 20 defect types with an accuracy of $\geq 99.8\%$ and a recognition speed of 10 items per minute, far exceeding manual inspection. The defect classification module categorizes defects by severity (critical/major/minor) and by workstation, generating real-time quality reports. Quality tracing tools link production process parameters to pinpoint root causes (e.g., dimensional deviation due to low temperature). Additionally, there are 11 other tools, including inspection data storage and quality early warning systems, eliminating human inspection errors and reducing quality waste by 35%.

2.2.4. Unmanned delivery subsystem

Integrating 13 tools, we have built a “demand-aware—path planning—automated delivery—inventory linkage” system around “Lean JIT.” The AGV dispatch management system supports the coordination of 50 AGVs, collecting real-time location and battery data, and assigning tasks according to production material requirements. The dynamic path optimization algorithm (improved ant colony algorithm) plans the optimal route within 1 second, avoiding congestion, reducing average handling distance by 40% and time by 37%. The material demand forecasting tool predicts 1–4 week demand using an LSTM neural network, with an error margin of $\pm 3\%$, and generates delivery plans in advance. Automated loading and unloading tools (robot arms, conveyors) enable the AGVs to automatically dock with smart shelves and equipment, eliminating manual handling waste. Additionally, there are 9 other tools, including AGV power management and logistics data statistics, achieving a delivery punctuality rate of 99.5% and reducing inventory turnover days by 50%.

2.2.5. Virtual simulation and big data decision-making subsystem

As the “brain” of the system, it integrates 20 tools to drive lean improvement through data-driven methods. The virtual factory platform, built on Unity 3D, constructs a 1:1 digital twin model to simulate production process optimization (such as changes in capacity after adding equipment), with 100 iterative simulations predicting improvement effects. The all-dimensional data integration tool aggregates structured data (equipment parameters, workforce performance) and unstructured data (inspection images) using ETL technology, storing them in a 50 TB Hadoop cluster and a 100 TB MinIO data lake, supporting real-time updates and millisecond-level retrieval. Big data analysis models include OEE analysis (identifying equipment efficiency losses) and value stream analysis (quantifying non-value-added time proportion), outputting a prioritized optimization list. The self-decision algorithm (NSGA-II multi-objective optimization), combined with lean goals (such as a 5% improvement in OEE and 3% cost reduction), automatically generates plans, with decision plan simulation tools testing the effects in the virtual factory. Additionally, there are 16 other tools for evaluating improvement effects, forming a closed loop of “virtual simulation—physical implementation—review and optimization”, improving lean improvement efficiency by 60%.

2.3. Subsystem coordination logic

The five major subsystems do not operate independently but achieve full-process collaboration through data interfaces, forming a complete production rule loop covering “human resources—production—inspection—delivery—decision-making.” For example: the human resources optimization subsystem allocates staff according to production task requirements; the intelligent production subsystem executes production instructions through equipment IoT; the AI intelligent inspection subsystem monitors product quality in real-time and feeds back to the production subsystem for parameter adjustments; the unmanned delivery subsystem ensures timely material delivery based on production progress and inventory data; and the virtual simulation and big data decision-making subsystem integrates data from all subsystems to carry out global optimization and decision-making, ensuring that the entire system is always oriented towards lean production goals and achieves “zero waste, high efficiency, and high quality” in production operations.

3. Implementation path of core technologies for smart manufacturing under the lean production model

3.1. AI intelligent inspection technology

AI intelligent inspection technology centers on “photo inspection” and uses visual recognition technology to achieve fast and precise testing of product quality, serving as a key support for lean production in “eliminating quality waste.” The implementation of the technology needs to be carried out in three steps:

3.1.1. Visual acquisition system setup

Based on lean “quality control points” analysis, data collection devices are deployed at key nodes such as raw material warehousing, after component processing, and before finished products leave the factory. Dimensional inspections use 20-megapixel industrial cameras (resolution 0.001 mm), while surface defect inspections use 5-megapixel HDR cameras, paired with customized lighting (ring lights for metal parts and strip lights for plastic parts) to ensure clear imaging. Edge computing modules are deployed on the camera side to complete image denoising, enhancement, and distortion correction preprocessing within 50 ms, avoiding congestion in raw data transmission. Images are then pushed in real-time to the AI recognition module via API interfaces, ensuring seamless inspection processes. At the same time, data collection points are planned according to the principles of “no missed critical defects and no repeated inspections” to eliminate redundant inspection waste.

3.1.2. AI model training and optimization

A dataset was constructed based on the Lean Quality Standard Library, containing 10,000 qualified samples and 8,000 defective samples (covering 20 types of defects such as dimensional deviation and scratches, including edge cases like scratches of 0.49mm). Each sample is annotated with the defect type, location, and severity. A training framework was built using the YOLOv8 algorithm, and the dataset was split into training, validation, and test sets in a 7:2:1 ratio. The model was iteratively optimized using gradient descent, and after each training epoch, accuracy was tested on the validation set. Training stopped when the main defects reached an identification accuracy of $\geq 99.8\%$ and a recall rate of $\geq 99.5\%$. Subsequently, the model is updated monthly with new defect samples (such as new types of surface imperfections), using transfer learning to shorten the training cycle (from 72 hours to 12 hours) to ensure the model adapts to new defect types appearing in production, preventing inspection omissions due to model lag.

3.1.3. Closed-loop application of quality data

AI inspects the generated quality data (defect types, occurrence stations, related process parameters) and transmits it in real-time to the big data decision-making subsystem. Using association rule algorithms, it analyzes the root causes (e.g., dimensional deviation due to the machine tool temperature being 5 °C below the set value, surface scratches due to tool wear exceeding 0.1 mm) and generates a “defect–root cause” association report (e.g., “When machine tool 1 temperature < 180 °C, dimensional deviation rate reaches 8%”). At the same time, the decision-making subsystem automatically pushes the root cause analysis results to the corresponding subsystems: if the root cause is a process parameter deviation, it is sent to the intelligent production subsystem, triggering the “automatic process parameter adjustment” workflow (e.g., increasing the set temperature of machine tool 1 from 180 °C to 185 °C); if the root cause is equipment wear, it is sent to the equipment management module, triggering the “preventive maintenance” command (e.g., prompting replacement of machine tool 1’s cutting tool). After adjustments, the AI intelligent inspection subsystem increases the sampling frequency for products at that station (from 10 items per hour to 20) to verify the improvement effect in real-time—if the dimensional deviation rate drops from 8% to 1.2%, the adjustment parameters are solidified. If the improvement effect is not as expected (e.g., deviation rate still above 3%), the root cause analysis process is restarted, forming a “inspection–analysis–adjustment–verification” quality data closed loop, thoroughly eliminating quality waste caused by parameter deviation and equipment wear, and stabilizing the product pass rate above 99.5%.

3.2. Unmanned delivery technology

Unmanned delivery technology, centered on AGV unmanned handling robots and combined with path optimization algorithms, achieves “just-in-time, zero-waste” production logistics and is the core technology for lean production to “eliminate handling waste.”

3.2.1. Coordination between AGV scheduling system and production rhythm

The unmanned delivery subsystem interfaces in real-time with the smart production subsystem via API to obtain information such as the material demand timing, quantity, and location at production stations. By combining this with real-time AGV location data and using path optimization algorithms (such as Dijkstra’s algorithm or Ant Colony Optimization), the optimal delivery routes are planned to ensure that materials are delivered “just in time when needed”, avoiding inventory buildup caused by early deliveries or production delays due to late arrivals.

3.2.2. Multi-scenario adaptation and flexible adjustment

For complex workshop environments (such as dynamic obstacles and multi-AGV coordination), AGVs are equipped with integrated LiDAR and visual navigation technologies to enhance their environmental adaptability. At the same time, in line with the lean production requirement of “flexible manufacturing”, the AGV scheduling system can adjust delivery plans in real time according to changes in production tasks (such as order adjustments or workstation reorganization) without manual intervention, achieving flexible and lean logistics distribution.

3.2.3. Real-time linkage of inventory data

The unmanned delivery subsystem synchronizes data with the inventory management module in real time. After completing delivery tasks, AGVs automatically update inventory quantities (raw material outflow, semi-finished goods inflow), ensuring the accuracy and timeliness of inventory data. This provides precise inventory data support for the big data decision-making subsystem, avoiding the core waste of “excess inventory” in lean production.

3.3. Equipment IoT and virtual factory

Equipment IoT and virtual factory technology are key to achieving full-process transparency and proactive optimization in production, providing technical support for lean production's "eliminating bottlenecks and continuous improvement."

3.3.1. Data collection and analysis for IoT-enabled equipment

By deploying IoT modules on production equipment (such as machine tools, robots, and sensors), operational data of the equipment (speed, temperature, vibration, machining accuracy, etc.) can be collected in real time and transmitted to the IoT platform for real-time monitoring and anomaly alerts, preventing production interruptions caused by equipment failures (the "waiting waste" in lean manufacturing). At the same time, big data analysis of equipment efficiency (OEE) can identify reasons for low equipment utilization (such as long changeover times or frequent minor stoppages) and propose optimization measures (such as applying quick-change tools and preventive maintenance plans).

3.3.2. Simulation and optimization of virtual factories

Based on real production data collected through IoT-enabled equipment, a digital twin model of the physical workshop is built on the virtual factory platform at a 1:1 scale. The production process (such as production line layout, process routes, and material flow) is simulated. Virtual simulation allows for the early identification of production bottlenecks (such as insufficient capacity at certain workstations or congestion in logistics paths) and testing of optimization solutions in a virtual environment (such as adjusting production line layout or optimizing process sequences), thereby avoiding costs and production interruptions associated with physical workshop adjustments, achieving lean production through "preemptive improvement" rather than "after-the-fact remedies."

3.4. Big data self-decision making

Big data self-decision technology is the "brain" of the Smart Manufacturing system. By integrating data from various subsystems, it enables "lean and automated" production decision-making, driving the transformation of lean production from "human-driven improvement" to "data-driven improvement."

3.4.1. Comprehensive data integration

The big data decision-making subsystem aggregates data from all dimensions, including human resources, production, inspection, distribution, and equipment, to build a unified data warehouse. Through data cleaning and standardization, it ensures the accuracy and consistency of the data, providing a reliable data foundation for decision-making.

3.4.2. Construction of the self-decision algorithm model

Based on the core objectives of lean production (such as OEE improvement, cost reduction, and quality enhancement), a multi-objective optimization algorithm model is constructed. For example: automatically adjusting equipment processing parameters according to equipment operation data and production task requirements to improve efficiency; automatically optimizing raw material ratios based on quality data and raw material data to reduce defect rates; and automatically adjusting scheduling plans based on labor efficiency data and production plans to achieve optimal labor productivity.

3.4.3. Decision execution and feedback

The optimization plans generated by the self-decision algorithm are automatically distributed to various subsystems via API interfaces (e.g., adjusting equipment parameters in the intelligent production subsystem, modifying schedules in the workforce optimization subsystem). At the same time, the execution effects of the decisions (such as efficiency improvement and cost reduction ratios) are monitored in real-time, and the algorithm model is continuously optimized through a closed-loop feedback mechanism to ensure that decisions always align with the lean production goal of “continuous improvement.”

4. Conclusion

The construction of a Smart Manufacturing system under the lean production model should take “lean thinking as the soul and intelligent technology as the instrument.” Through the framework design of “5 subsystems and 88 tools”, it aims to achieve rule coverage and collaborative operation across the entire production process. At the same time, by focusing on the implementation of core technologies such as AI intelligent inspection, unmanned delivery, equipment IoT, virtual factories, and big data decision-making, it promotes the transformation of Smart Manufacturing from “system construction” to “value creation.” Future research can further enhance the collaborative precision between subsystems and explore the integration of Smart Manufacturing systems with upstream and downstream supply chains, extending lean production from “within the factory” to “the entire supply chain”, thereby building a broader Smart Manufacturing ecosystem.

Disclosure statement

The author declares no conflict of interest.

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The Current Challenges and Strengthening Strategies of Ideological and Political Leadership Capacity of College Counselors

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Abstract: Ideological and political leadership is the primary content and inherent requirement of building an educational power. College counselors are the backbone force for the construction of an educational power, and it is necessary to effectively strengthen the forging and improvement of their ideological and political leadership. Ideological and political leadership essentially represents an influence and shaping power, including political leadership that can unite students' emotional identification, influence their political and ideological identification, ideological guidance that can respond to students' theoretical confusion and enhance their theoretical confidence, value shaping that can stimulate students' thoughts and emotions and evoke their higher-level motivations, and action incentive that can lead students to unite and strive and guide them to serve the country and build the nation. Currently, there are practical difficulties in college counselors' ideological and political leadership, such as traditional content and methods of leadership, loose ways and methods of leadership, weak leadership ability and level, and inefficient exploration and utilization of leadership resources. It is necessary to comprehensively enhance the ideological and political leadership of college counselors in terms of doing things, borrowing wisdom, leveraging resources, and taking advantage of opportunities.

Keywords: College counselors; Ideological and political leadership power; Current predicaments; Strengthening approaches

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1. Introduction

In the speech at the National Education Conference in September 2024, it was emphasized that "The education power we aim to build should be a socialist education power with Chinese characteristics. It should possess strong ideological and political leadership capabilities, talent competitiveness, technological support capabilities, social security capabilities, social collaboration capabilities, and international influence, providing strong support for comprehensively advancing the construction of a strong country and the great cause of national rejuvenation

through Chinese-style modernization.” It was first proposed that the concept of “ideological and political leadership capabilities.” This article explores the current predicaments of the ideological and political leadership capabilities of university counselors and the corresponding strengthening strategies.

2. The current challenges of ideological and political leadership capacity of college counselors

2.1. Incompatibility between the content enhancement and the development of new media

At present, the content and methods of ideological and political guidance by college counselors are rather conventional, with limited innovation and insufficient highlights. On the one hand, the way some university counselors provide ideological and political guidance still focuses on the one-way transmission of knowledge, while neglecting the individual characteristics of students. The guiding approach is relatively rigid, there is insufficient interaction between teachers and students, and the ability to explain, refine, and lead theories needs to be improved. When dealing with current affairs and difficult issues, they are unable to provide clear and understandable answers. There are sometimes problems of empty preaching and rote learning. There are also issues of presenting content that is too simple and catering to others. There is a lack of systematic analysis from the perspective of students as the main body ^[1]. The explanatory power for real-world issues is insufficient at times. On the other hand, the worldviews, life views, and value systems of college students are still not fully formed, and they are highly susceptible to external influences, often wavering. As the network informatization has entered the era where “everyone is a self-media”, and with the rapid development of algorithms and other technologies, various social trends, after disguising themselves, enter students’ daily lives through modern and diversified information dissemination methods, impacting the formation of students’ correct values. The ideological and political guidance work is facing an unprecedentedly complex situation, and the educational quality and effectiveness are showing a downward trend. This puts forward higher standards and requirements for the content and methods of ideological and political guidance by college counselors ^[2].

2.2. Mismatch between method improvement and technology update

Due to the strong characteristics of the network, such as elasticity, virtuality, and absence of presence, college counselors often have difficulty precisely aligning with the spiritual needs of college students. On one hand, in reality, front-line college counselors have been working under great pressure for a long time, often working in a “frantic” manner and getting lost in numerous assessment standards. They often lack sufficient time and energy to comprehensively grasp the ideological dynamics and emotional needs of students and cannot precisely solve students’ problems. On the other hand, constrained or dominated by the values deeply rooted in the minds of college students, leading to the fragmented, independent, and centrifugal phenomenon of the discourse system between college counselors as educators and college students as the educated. They are not on the same discourse channel, unable to enter each other’s information circle, unable to touch the hearts, gain recognition, form resonance, and achieve the best effect ^[3].

2.3. The mismatch between the improvement of educational resources and the actual needs of work

The process of conducting ideological and political work involves a situation where educational resources are interconnected and supported, blending together, complementing each other, and achieving mutual enhancement.

If each educational resource operates independently, fails to cooperate with one another, and becomes fragmented, only functioning within their respective domains and aspects, then these educational resources will ultimately be unable to form a combined force. The purpose of ideological and political work will not be truly accomplished or realized. Therefore, the mutual collaboration, compatibility, and empowerment among educational resources are of great significance ^[4]. However, nowadays, most college counselors act alone and perform “one-man shows”, mostly in a one-to-one unidirectional output manner, lacking multi-point “joint diagnosis.” There is a lack of full mobilization of the enthusiasm and initiative of multiple time and space educational resources and forces to participate in the educational work, and no educational synergy has been formed. Relying solely on the efforts of individual college counselors, it is difficult to “accurately diagnose the problem” or “prescribe the right medicine.” Even if the “prescription” is correct, choosing the wrong time and space will result in minimal or even no effect. The inefficient utilization of leading resources is also closely related to the fragmented nature of the university’s ideological and political work mechanism. From an internal mechanism perspective, university ideological and political work is situated in a hierarchical system environment of “departmental separation” and “function division”, with the problem of educational resources being scattered and fragmented among various departments and systems, unable to achieve sharing. It faces fragmented, superficial dilemmas such as each department acting independently, weak connectivity, low integration, and a lack of communication, resulting in a significant reduction in the effectiveness of ideological and political leadership ^[5].

3. Strengthening strategies for enhancing the ideological and political leadership capacity of college counselors

3.1. Enhancing the ideological and political leadership capabilities of university counselors through practical work

The ideological and political guidance work is a cause that concerns the development of the country and the future of the nation. It requires college counselors to continuously improve and perfect their abilities and skills in the process of loving, being loyal, pursuing, and doing well in this work. They should also enhance the internal driving force for doing a good job in ideological and political guidance, and thereby actively enhance their ideological and political guiding power. First, it is achieved through deep love for the cause. Genuine and heartfelt love is an inexhaustible source for the development of the cause. Marx pointed out: “Passion and enthusiasm are the essential driving forces that enable humans to pursue their objects with great intensity.” If college counselors are passionate, enthusiastic, and full of vigor in their work of ideological and political guidance, then they will maximize their creativity and vitality to do this job well, and will regard ideological and political guidance work as a cause, dedicating themselves to it with an energetic and confident attitude. The love for this cause of ideological and political guidance will prompt college counselors to find every possible way to do this job well, to firmly adhere to the goals of the cause without wavering, and to strive and work hard with determination. With a proactive professional attitude and a noble and full professional sentiment, they will carefully handle this work, and in the process of loving the cause, consciously enhance their ability of ideological and political guidance ^[6]. The second point is to enhance through the pursuit of a career. Persistent pursuit is the driving force for achieving success in one’s career. Firm Marxist beliefs and firm socialist ideals and beliefs are the spiritual motivation for college counselors to enhance their ideological and political leadership capabilities. If college counselors do not have firm beliefs and convictions, they will not be able to consciously strengthen their study of the Party’s innovative theories and enhance their ideological and political leadership capabilities, nor will they be able to do a good job

in ideological and political education. Only if college counselors regard the education of socialist modernization and the building of a strong country as the goal of their career pursuit, constantly stimulating their strong desire to do a good job in ideological and political work, enhancing their sense of mission and responsibility for doing ideological and political work, can they maintain an enterprising and never-tiring spirit, actively promote the great cause, and consciously enhance their ability in ideological and political work in the process of their persistent pursuit of the great cause. Third, enhance through achieving success in one's career. Striving to do a good job is the fundamental guarantee for the success of a career. To successfully complete a career, merely having good ideas and enthusiasm is clearly insufficient. College counselors must use their practical actions to promote the vigorous practice of building a powerful and strong educational country. If college counselors do not get down to work earnestly, strive for practical results, and strive to do their job well, there will be no improvement in the guiding power of ideological and political work ^[7].

3.2. Enhancing the ideological and political leadership capacity of university counselors through knowledge borrowing

The enhancement of ideological and political leadership ability cannot be achieved without the cultivation and development of comprehensive professional qualities. First, it should be improved through learning. Universities should clarify the content and boundaries of the work of university counselors, and make full use of new technological means, such as the Internet and big data platforms, to liberate them from complex, fragmented, and mechanical routine tasks and the roles of "safety officers" and "firefighters." Attention should be paid to evaluating the educational ability and effectiveness of university counselors. At the same time, it is necessary to ensure that university counselors receive education first, providing them with more learning opportunities and communication platforms to broaden their horizons and deepen their understanding. This will enable them to possess excellent political qualities and profound theoretical knowledge, so that this team is qualified and capable of truly fulfilling their due responsibilities in the process of guiding the ideological values of young students. Second, enhance through research. Mastering research methods and being good at conducting research are inevitable requirements for the professionalization and vocationalization of the university counselors' team, and it is also an objective requirement for enhancing the ability and level of university counselors in equipping young students with scientific theories, guiding them with correct ideas, and cultivating them with core values ^[8]. To enhance the ideological and political leadership, university counselors should adopt effective measures and methods, and conduct research not only on educational laws, the laws of ideological and political work, and the laws of students' growth and development, but also on new developments in students' physical and mental development, the phased characteristics of the times, new trends in online public opinion and Western diverse social ideologies, and new situations in the dissemination of social ideologies. They should also strengthen research based on the actual work of university counselors, summarize practical experience, further deepen understanding of the laws, and find effective solutions and methods to better enhance the ideological and political leadership of university counselors. Third, enhance through humble learning. The ideological and political guidance work covers a wide range, involves multiple fields, and has a long educational cycle. Therefore, college counselors should become expert-type guides and leaders in implementing the fundamental task of fostering virtue. College counselors should be adept at actively learning from experts with rich educational wisdom, senior colleagues, and colleagues, to obtain the continuous driving force for progress ^[9].

3.3. Enhancing the ideological and political leadership capabilities of university counselors through leveraging external resources

Empowering education refers to a series of educational methods and behaviors adopted by university counselors to cultivate students under the fundamental task of fostering virtue and promoting all-around development. They leverage external abundant educational resources and forces to assist students in their growth and development. University counselors should be adept at “leveraging resources”, use them skillfully, focus on the targeted nature of empowering education, strictly safeguard the dominant position of empowering education, and promote ideological and political guidance from “mass irrigation” to “precise irrigation”, thereby effectively enhancing the effectiveness of education and doing a good job in ideological and political guidance. Firstly, educators need to leverage the power of the Internet, artificial intelligence, big data, etc., to enhance precise ideological and political education, and improve the scientificity, targeting, and effectiveness of ideological and political leadership work. Ideological and political leadership, in essence, is a human-oriented task ^[10]. How to precisely focus on, care for, and pay attention to every real person and specific individual requires distinguishing levels and targets, strengthening categorized guidance, and achieving precise profiling of young people and precise supply of value content. With the core of intelligent algorithms, computing power, and big data, big data provides technical support for college counselors to accurately depict and outline students’ academic, psychological development, and changes in thoughts and behaviors, offering technical support for the foresight and forward-looking nature of ideological and political leadership work ^[11]. Thus, it can scientifically provide educational content and achieve precise leadership. Secondly, it is necessary to gather the educational efforts of the entire school and implement the “all-round education” concept. On the one hand, efforts should be made to tap into the internal talent resources of the school. Through effective mobilization and integration of various educational resources including school leaders, ideological and political theory teachers, teachers from related disciplines in the field of philosophy and social sciences, and the university’s counselor team, a “concentric circle” of education should be formed with a unified direction and goal, addressing the issue of a large number of educational personnel but weak educational strength. On the other hand, the exemplary role of outstanding party members, student cadres, and advanced role models should be utilized to play a leading and exemplary role, with particular attention paid to identifying and widely publicizing typical figures and advanced deeds among college students, in order to educate and guide the student body. Thirdly, there should be a purposeful, planned, step-by-step approach to leveraging outstanding alumni, renowned experts, and advanced figures from various sectors of society to “match” and “connect” with the growth needs of students. These forces and resources should be transformed and integrated into the “infiltration power” that enables students to observe society, reflect on life, and achieve growth and success. This should result in a subtle and imperceptible educational effect ^[12].

3.4. Enhancing the ideological and political leadership capacity of university counselors through leveraging opportunities

The concept of “taking advantage of the trend” means to follow the development trend of things, grasp the themes of the times, reflect the requirements of the times, seize the opportunities of the times, and be good at leveraging various internal and external forces to quickly achieve the goal. To do a good job in ideological and political guidance, college counselors need to be good at taking advantage of the trend, formulating the trend, and creating the trend, ultimately achieving “adaptation to the trend and innovation”, keeping pace with the times, and innovating. First, one must assess the situation and base oneself on the “two major situations.” By focusing on

the current trends and hotspots of concern both domestically and internationally, and from multiple perspectives, including China and the world, history and the future, right and wrong, advanced and backward, conduct student ideological and political guidance work. Educate and guide students to establish correct worldviews, outlooks on life, and values. One should grasp the research and development trends of ideological and political work, keep pace with the general trend of the times, change the working approach, study the growth patterns of students and the laws of ideological and political work, and implement ideological and political work at a smaller scale, in detail, and with practicality ^[13]. Second, educators should place greater emphasis on optimization and innovation. In the process of ideological and political guidance work, we should adapt to circumstances, keep pace with the times, and innovate according to the changing circumstances. College counselors must accurately grasp the “pulse” of students, remove the “barriers” in their hearts, open up their “hearts”, and promptly and positively respond to and resolve practical problems closely related to students’ vital interests, guiding students to grow and achieve success ^[14]. Thirdly, one should consciously adapt to the changes in the situation and deeply understand that the Internet has become the “new normal” for college students’ study and life. One should actively occupy this ideological and political “new battlefield” on the internet. Regarding this, college counselors should actively pay attention to the active media platforms of students, such as “Bilibili”, “Kuaishou”, “Douyin”, “Xiaohongshu”, etc., popular applications. They should actively learn and understand the functions of these media platforms, create personal WeChat public accounts, Weibo accounts, etc., expand the space and domain of daily ideological and political education, and regularly push carefully produced ideological and political education text and image messages, including case analysis, short plays, story sharing, current affairs comments, etc., to disseminate ideological and political knowledge in a popular and down-to-earth way. On new media platforms, college counselors should actively understand the expression techniques of online discourse in the new media era, the art of guiding online public opinion, and the methods of online publicity and mobilization. They should transform complex and profound ideological and political theories into “internet language” and “micro-language” that students are willing to accept. They should use technical means to summarize and analyze students’ interests, to touch them emotionally and convince them with reason, and enhance the attractiveness, affinity, and infectivity of ideological and political leadership work.

Disclosure statement

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Research on Legal Issues of Adolescent Data Security from the Perspective of Global Data Security Law

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Abstract: Adolescents, as active participants in the digital era, face increasing risks to data security, including online education breaches, social media misuse, and unlawful data collection. This paper defines adolescent data (ages 12–18) and underscores its importance for individual growth and social stability. Through literature review, case analysis, and comparative study of the EU’s GDPR, the U.S. COPPA, and laws in Japan and South Korea, it finds shared principles of necessity, security, and consent, yet divergent approaches in regulation, penalties, and scope. While China’s Law on the Protection of Minors and related statutes provide a foundation, problems remain: vague definitions, weak regulatory mechanisms, and limited industry self-regulation. To address these, the paper proposes clarifying definitions and rights, strengthening sanctions, improving regulatory coordination with advanced technologies, and enhancing self-discipline and public awareness. These measures aim to refine China’s legal framework and better protect adolescent data security in line with global best practices.

Keywords: Youth data security; Global data security law; Data breaches and misuse

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1. Introduction

Adolescents are key participants in the digital era but face serious data security threats, including breaches, misuse, and unlawful collection. Protecting their data is essential to close legal gaps and safeguard rights during a critical stage of development. Internationally, the U.S. *Children’s Online Privacy Protection Act* (COPPA) and the EU’s *General Data Protection Regulation* (GDPR) provide important safeguards, though challenges in cross-border governance and emerging technologies remain ^[1]. In China, the *Law on the Protection of Minors* and the *Data Security Law* have laid foundations, yet problems of vague definitions, weak enforcement, and limited localization persist. This study adopts literature review, case analysis, and comparative research, integrating legal, sociological, and psychological perspectives to propose more comprehensive and practical improvements for China’s adolescent

data protection framework.

2. Theoretical analysis of adolescent data security

2.1. Definition and scope of adolescent data

Definitions of adolescence vary: the UN and China's Law on the Protection of Minors set 18 as the upper limit; the WHO defines 10–19; and Erikson's theory identifies 12–18 as the stage of identity formation. For this study, adolescence is defined as ages 12–18, a period of high digital engagement and limited risk resilience, thus requiring focused legal protection ^[2].

Adolescent data includes personal identity data (e.g., names, ID numbers) vulnerable to theft and fraud; health data (medical and psychological) at risk of privacy breaches and discrimination; educational data (grades, learning habits) affecting fairness in evaluation and admissions; and social data (friend lists, messages) prone to bullying, privacy violations, and psychological harm ^[3–4].

2.2. The critical value of adolescent data security

Adolescent data security is essential for individual well-being and social stability. Leaks can cause anxiety, harm privacy, and expose youth to consumerist manipulation. At the societal level, secure data reduces fraud and bullying, supports educational fairness by ensuring proper use of student information, and helps maintain a safe online environment, thereby fostering healthy adolescent development.

3. Analysis of the current status of global data security laws

3.1. Overview of data security laws in major countries and regions

The analysis in **Table 1** shows both convergence and divergence in adolescent data protection. All jurisdictions stress consent, minimization, and limits on secondary use, reflecting recognition of adolescents as a vulnerable group ^[5]. Differences remain: the EU adopts strict, comprehensive regulation; the U.S. applies a fragmented federal–state model; and Japan and South Korea combine statutory rules with varying self-regulation. These divergences complicate cross-border data flows and pose challenges for adapting foreign models to China's context.

3.2. Comparison and lessons from international data security laws

Across jurisdictions, adolescent data protection converges on key principles: necessity and minimization in collection, secure storage, rights of access and deletion, and consent-based sharing. Differences remain in governance models, enforcement, and scope. The U.S. FTC is efficient but resource-limited ^[6]; the EU enforces strictly but at high coordination costs; Japan's system is fragmented; and South Korea's body needs stronger collaboration. Penalties are heavier in the U.S. and EU, lighter in Asia; coverage is broad in the EU, narrower elsewhere ^[7]. For China, lessons include creating a unified regulator, raising sanctions, and balancing domestic needs with cross-border governance. The age definition of adolescents in different countries' laws is presented in **Figure 1**.

Table 1. Comparative analysis of adolescent data security laws in major jurisdictions (EU, U.S., Japan, and South Korea)

Comparative dimension	European Union (Centered on GDPR)	United States (Centered on COPPA and State Laws)	Asian countries (Japan, South Korea)
Core Legal Basis	<i>General Data Protection Regulation (GDPR)</i> , effective 2018	1. <i>Children's Online Privacy Protection Act (COPPA)</i> , enacted in 1998 2. State-level laws (e.g., Student Online Personal Information Protection Act in California)	1. Japan: <i>Act on the Protection of Personal Information</i> 2. South Korea: <i>Personal Information Protection Act</i>
Applicable Age Range	No unified lower limit; for minors under 16, parental/guardian consent required	1. COPPA: under 13 2. State laws: often cover K–12 students (approx. ages 5–18)	1. Japan: under 15 as minors; parental consent required; varies depending on context (14 years in some cases) 2. South Korea: under 14 defined as minors; parental consent required
Data Collection Rules	Emphasis on “data minimization”; prohibit excessive collection; mandatory clear informed consent	1. COPPA: prohibits collecting personal info (e.g., photos, messages) without parental consent 2. State laws: prohibit unnecessary student data collection	1. Japan: under 15, collection requires parental consent; explicit prohibition on collecting unnecessary adolescent data 2. South Korea: requires prior consent; limits data to “minimum necessary for purpose”
Data Storage Requirements	Strict: enhanced protection, mandatory deletion after achieving purpose; storage period must be “no longer than necessary”	No unified storage period; requires reasonable safeguards. State laws demand protection of student data security and prohibit unauthorized disclosure	1. Japan: requires clear technical standards; industries must comply 2. South Korea: requires clear storage periods and prohibits “excessive long-term retention”
Data Usage Restrictions	EU principle of “purpose limitation”; explicit right to access, correct, erase; prohibition of secondary use beyond original purpose	1. COPPA: use only for specified purposes 2. State laws: prohibit use of student data for non-educational purposes (e.g., targeted advertising)	1. Japan: no restriction on use scope, but prohibits transfer for commercial purposes 2. South Korea: prohibits unauthorized commercial use of adolescent data
Supervisory Authorities	EU level: European Data Protection Board (EDPB); national level: supervisory authorities (e.g., German Federal Data Protection Authority)	1. Federal: Federal Trade Commission (FTC), e.g., 2019 fined YouTube \$170M 2. State: state-level Attorney General offices	1. Japan: Personal Information Protection Commission; supplemented by industry self-regulatory bodies 2. South Korea: Personal Information Protection Commission (specialized supervisory body)
Key Challenges	High compliance costs; cross-border conflicts; burdens for SMEs	Federal and state law fragmentation; weak mobile app/data broker regulation; enforcement challenges	1. Japan: weak industry self-discipline; insufficient enforcement capacity 2. South Korea: fragmented supervisory authorities; enforcement mechanisms incomplete

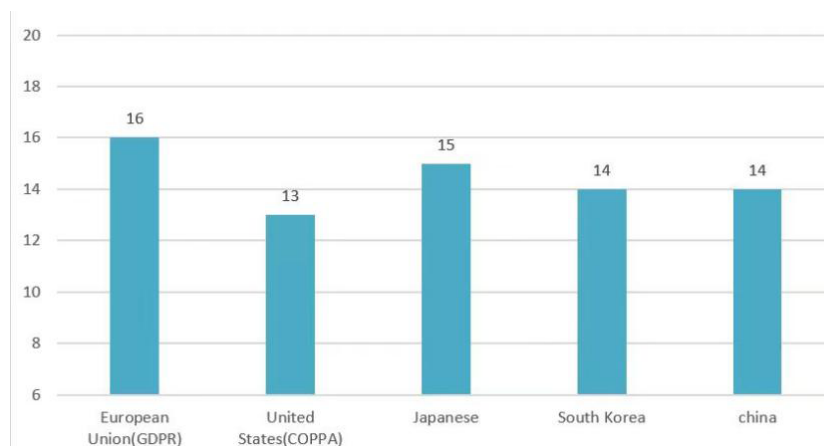


Figure 1. Age definition of adolescents in different countries' laws

4. Challenges and threats to adolescent data security

4.1. Risks of data breaches in the online environment

Adolescents face increasing risks from large-scale data breaches. In 2024, U.S. ed-tech company PowerSchool suffered a cyberattack in which hackers exploited employee credentials to steal tens of millions of minors' Social Security numbers and medical records, causing identity theft risks and reputational damage. Beyond individual cases, many platforms still lack adequate safeguards: authentication often relies on weak passwords without multi-factor verification, encryption is poorly implemented, and access controls allow unauthorized internal or third-party data use, all contributing to persistent vulnerabilities.

4.2. Data misuse and improper use

Commercial misuse is widespread. Institutions collect browsing and purchase histories to push targeted ads, reinforcing consumerist values, while illicit markets trade adolescent data, as shown in a 2023 case involving over 50,000 stolen records ^[8]. Government agencies also face compliance issues: over-collection of student data, irregular sharing without clear accountability, and weak storage protections all increase exposure to misuse and cyberattacks, undermining minors' rights.

4.3. Risks of cross-border data flows

Globalization of education and social platforms has expanded cross-border transmission of adolescent data, raising compliance risks due to legal divergences. The U.S. emphasizes self-regulation, while the EU enforces strict GDPR standards, complicating corporate compliance ^[9]. Multi-jurisdictional flows often create overlapping or absent regulatory authority, making coordinated responses to breaches difficult and exacerbating systemic security risks.

5. The current status and problems of legal protection for adolescent data security in China

5.1. Protection of adolescent data security in China's existing legal system

China has built a multi-layered framework for adolescent data security. The Law on the Protection of Minors requires lawful, necessary processing and guardian consent for those under 14, with rights of correction and deletion. The Personal Information Protection Law reinforces these requirements with specific rules and safeguards, while the Cybersecurity Law mandates lawful collection, clear purpose, and user consent. Together with recent regulations, these laws form the backbone of China's adolescent data protection system.

5.2. Problems and deficiencies

China's adolescent data protection still faces three main challenges: ambiguous provisions, weak regulation, and poor self-regulation. Current laws lack a unified definition of "adolescent data" responsibility among platforms, processors, and third parties remains unclear, and sanction standards are vague. Regulatory mechanisms suffer from overlapping duties, insufficient inter-agency coordination, and outdated technical capacity, limiting effective enforcement ^[10]. At the same time, enterprises often neglect disclosure and safeguards, industry associations lack binding authority, and cooperation across firms is minimal, leaving systemic risks inadequately addressed.

6. Pathways to improve China's legal protection system for adolescent data security

To strengthen adolescent data security, China should refine legislation, optimize regulation, and promote industry–society co-governance. Legislation must explicitly define adolescent data (ages 12–18), include sensitive categories such as biometric and health information, and grant minors and guardians stronger rights of consent, information, correction, and deletion. Sanctions should be stricter, and criminal liability applied to serious violations. On regulation, a national authority should coordinate adolescent data protection, supported by specialized roles for cyberspace, public security, and education departments, with inter-agency mechanisms ensuring coherence. Advanced technologies such as big data, AI, and blockchain should be integrated into monitoring and enforcement. At the societal level, industry associations should develop binding codes and oversee compliance, while enterprises strengthen transparency, internal management, and third-party controls. Public awareness must also be enhanced through school education, guardian training, and media outreach. Together, these measures would establish a more coherent, technology-enabled, and participatory framework for safeguarding adolescent data in China.

7. Conclusion and prospects

This study reviewed global adolescent data security laws, noting that while the EU's GDPR, the U.S. COPPA, and Japan–South Korea frameworks share a protective orientation, they differ in supervision, penalties, and scope. China's legal system provides a foundation but still faces vague definitions, weak regulation, and limited industry self-discipline. To address these issues, this paper proposes refining legislation, clarifying responsibilities, enhancing regulatory tools, and fostering industry and social co-governance. Future research should examine the dual risks and potential of emerging technologies, explore unified cross-border governance mechanisms, and strengthen long-term public awareness, all of which are crucial for building a more comprehensive and future-oriented framework for adolescent data security.

Disclosure statement

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Analysis of the Reasons for Employee Turnover in Liaoning Province

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Abstract: First, a large-scale interview was conducted on the phenomenon and causes of employee turnover in Liaoning. The analysis concluded that low employee salaries are the main reason for job changes. As the length of service increases, employees may change jobs due to various factors such as family needs, the improvement of their own demand levels, and dissatisfaction with the work environment. Regions with higher GDP development levels have greater demand for talent, which is a major factor leading to talent mobility. Based on the interview results, the authors focused on studying Liaoning's salary level, economic development level, and organizational environment. Through the research on the relationship between population, economy, and employment, the results show that: Liaoning's total population ranks in the middle of the country, with negative incremental growth; its population structure features a high proportion of educated people and a tendency toward aging; Liaoning's economic development level is not high nationwide, lacking driving forces for economic growth; Liaoning's average salary level is at the lower end of the national ranking, which is not conducive to retaining talents; in terms of contribution to the economy, the primary industry has an excessive labor force, while the secondary and tertiary industries have low attractiveness to high-end talents. Finally, countermeasures for talent return are proposed: strengthening the construction of the soft environment of organizational culture; improving the scientific nature of the recruitment process to achieve the matching of employees and positions; implementing material and non-material incentives; and enhancing the level of industrial innovation.

Keywords: Employees; Turnover; Talent retention

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1. Introduction

As an ancient saying goes, "Extraordinary times call for extraordinary people." Population migration is an inevitable outcome of economic and social development. A region cannot increase labor supply, expand demand, enhance agglomeration effects, or improve urban competitiveness without a large inflow of population. Regions with a higher inflow of population possess greater potential for economic and social development.

2. Investigation and analysis of the causes of employee turnover

It is generally believed that the more stable the job, the more likely it is to produce innovative achievements. The authors conducted a sampling survey of employees in Liaoning Province, with a total of 357 survey samples. Among the sampled respondents, 53% were male and 47% were female; 38% had majored in liberal arts, and 38% in science and engineering; 74% held a bachelor's degree, 15% a master's degree, and 10% a junior college degree; 42% had graduated for less than 1 year, 38% had graduated for more than 1 year but less than 5 years, and 16% had graduated for 6 to 10 years. The work locations of the respondents were concentrated in Shenyang, Dalian, Beijing, and Shanghai. In terms of income, 48% of the samples had a monthly income of 3,001–5,000 yuan, 27% had a monthly income of less than 3,000 yuan, and 19% had a monthly income of 5,001–10,000 yuan.

Regarding the number of job changes, 42% of the samples stated that they had never changed jobs, 16% had changed jobs once, 23% had changed jobs twice, 14% had changed jobs three times, and 3%–1% had changed jobs more than four times.

In terms of the reasons for job changes, the word frequency analysis of the reasons for job changes shows that the main reasons for employees to change jobs include low salary, personal reasons, work environment, and the pursuit of career development.

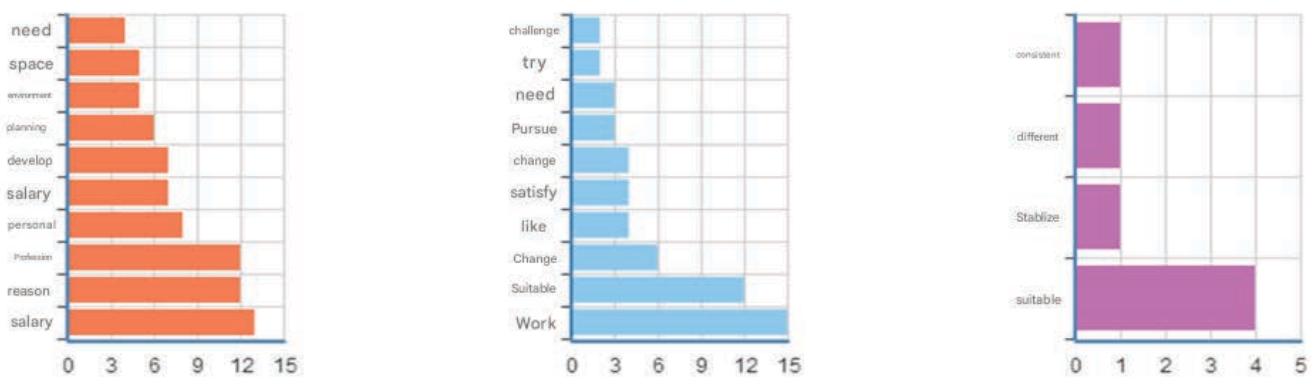


Figure 1. Word frequency analysis of the reasons for job changes of college graduates

Based on the word frequency analysis, an attempt was made to analyze the correlation between the number of job changes, gender, graduation time, and income. The results show that there is a high positive correlation between the number of job changes, income status, and graduation time. Specifically, the longer the graduation time, the more the number of job changes; the higher the income level, the more the number of job changes.

Combining the correlation analysis and the word frequency analysis of job change reasons, it can be concluded that regions with higher GDP development levels have greater demand for talent, which is a major factor contributing to talent mobility. Low salary is the main reason for job changes. As the length of service increases, employees may change jobs due to various reasons such as family factors, the improvement of their demand levels, and dissatisfaction with the work environment.

3. Research on the relationship between population, economy, and employment in Liaoning Province

3.1. Liaoning population

Liaoning's total population ranks in the middle of the country, with negative incremental growth, a high proportion of highly educated people in the population structure, and an aging population trend ^[1].

According to the 2022 data, Liaoning has a total population of 41.97 million, ranking 15th among 31 provincial-level administrative regions in China, with its total population in the middle of the country. In terms of age structure, the population aged 35–59 is the largest in Liaoning, followed by the population aged over 60, 18–34, and 0–17, showing an aging population trend. In terms of educational attainment, the number of people with a senior high school education in Liaoning ranks 13th in the country.

By observing the changes in Liaoning's population over the past 43 years, it is found that Liaoning's population birth rate has been on a downward trend, while the death rate has been rising slowly, and the overall trend of the natural growth rate has been declining. Since 2010, the death rate has been higher than the birth rate, and the natural growth rate has shown negative growth.

The analysis of the correlation between land area, population, regional GDP, fiscal revenue, and expenditure in 39 counties in Liaoning shows that the land area of counties has a significant positive correlation with the population size and local fiscal expenditure.

There is a significant positive correlation between the number of university enrollments and the local population size. A decrease in the local population size will lead to a reduction in the source of university students and a decrease in the supply of labor.

3.2. Expectation of talent employment situation

3.2.1. Liaoning's average salary level ranks at the lower end of the country

In terms of the average salary level of employees, Liaoning ranks 27th among 31 provincial-level administrative regions in China. This reduces the cost for talents to flow to regions with higher salaries, which is not conducive to retaining talents in Liaoning.

3.2.2. Industrial structure and demand for graduates

Current situation of Liaoning's three-industry structure: In terms of contribution to the economy, the primary industry (agriculture) has an excessive labor force; the number of employees in the secondary industry (industry) is decreasing, while the number of employees in the tertiary industry (service industry) is increasing.

3.2.3. Gap between industrial level and talent demand

Taking big data talents as an example, 4 first-tier cities (Beijing, Shanghai, Guangzhou, Shenzhen) and 5 cities in Liaoning (Dalian, Shenyang, Anshan, Yingkou, Panjin) were selected, and the number of big data talent demands was collected through the 51job website.

Excel was used for variance analysis to compare the proportion of demand for various types of big data talents between the 4 first-tier cities and the 5 cities in Liaoning. The result shows that $P=1$, indicating that there is no significant difference between the two groups. The line chart comparison shows that the demand for big data development engineers in first-tier cities is slightly higher than that in Liaoning, while the demand for data specialists and data statisticians is slightly lower than that in Liaoning. In general, regions with higher economic development levels have a greater demand for high-end big data talents.

4. Analysis of organizational environment

In order to better solve the problem of what kind of organizational cultural environment should be created for employees, combined with some representative research on organizational culture and organizational identification, this survey puts forward the following questions and uses empirical research methods to explore them: Under the influence of collectivist culture, is it easier for individuals to form identification with the organization, and use collective standards instead of individual standards when making decisions, so as to improve organizational efficiency and organizational performance? Is a harmonious relationship in the organization more conducive to employees' identification with the organization? Does the paternalistic authority of leaders have an impact on the obedience of subordinates? These questions are worthy of consideration and exploration in order to provide suggestions for enterprise managers in Liaoning Province to build a corporate culture.

Through literature review and actual interviews with employees of enterprises in Liaoning Province, this paper divides organizational culture into five dimensions: collectivism, high power distance, femininity, long-term orientation, and weak risk avoidance. The impact of these five dimensions as independent variables on organizational identification was studied ^[2]. The survey was conducted in February 2020, and questionnaires were distributed to employees of enterprises and public institutions in Liaoning Province, with 226 valid questionnaires recovered. Among the samples, 42% were male and 58% were female, with an average age of 38.06 years (sd=12.49 years). Ordinary employees, middle-level employees, and senior-level employees accounted for 70%, 23%, and 3% respectively.

SPSS 22.0 was used to conduct regression analysis on the high-score groups (top 27% of scores) and low-score groups (bottom 27% of scores) of each dimension. The impact of the high-score group of high power distance (emphasizing hierarchy, leadership authority, and subordinates' obedience) on organizational identification was negative but not significant, while the impact of the low-score group on organizational identification was significant at the 0.05 level. In terms of specific coefficients, power distance in the high-score group of power distance did not show a significant impact on organizational identification; on the contrary, power distance in the low-score group of power distance showed a significant negative impact on organizational identification. This indicates that for people who pursue equal values, their identification with the organization will be very low in an organization with high power distance; while for people who are accustomed to leadership authority, hierarchy, and subordinates' obedience to superiors, power distance has no impact on their organizational identification. Therefore, if the power distance in the organizational culture cannot be changed and the entire organization attaches great importance to authority and hierarchy, it is better to recruit personnel who recognize the values of leadership authority, hierarchy, and obedience to work in the organization.

The impact of the high-score group of collectivism (individuals obey the collective, and collective interests are higher than individual interests) on organizational identification was significant, indicating that people with a stronger collectivist spirit are more likely to form identification with the organization; while when the collectivism score is very low, that is, when individuals lack the spirit of obeying the collective, the impact on organizational identification is not significant. Therefore, collectivism can be regarded as a factor to improve organizational identification, and the higher it is, to a certain extent, the more positive the impact will be. In the collectivism dimension, the high-score group of the family concept (working hard for the better life of the family) had a significant positive impact on organizational identification; that is, people with a stronger family concept are more likely to form identification with the organization. In specific human resource practices, the family concept dimension can be used to predict a person's future identification with the organization.

The impact of both the high-score group and the low-score group of feminine traits (emphasizing harmonious relationships) on organizational identification was not significant, indicating that emphasizing relationships and harmony in the organization has little impact on employees' organizational identification.

The low-score group of material incentives had a significant negative impact on organizational identification, indicating that if the material incentives in the organization are lower than a certain level, it will be detrimental to organizational identification; while the high level of material incentives had no significant impact on organizational identification. Therefore, material incentives can be regarded as a basic factor, which means that organizations must ensure the satisfaction of employees' material needs.

If the returns (salary, bonus, etc.) are lower than the industry's minimum level, it will reduce employees' identification with the organization. However, a very high level of material incentives does not necessarily lead to a high level of organizational identification.

Among the non-material incentive factors, the high-score group had a significant positive impact on organizational identification, while the low-score group had no significant impact on organizational identification. This indicates that the more non-material incentives there are, the more employees will identify with the organization. Therefore, non-material incentives are factors to improve organizational identification. Among the non-material incentive dimensions, the factors that have the greatest impact on organizational identification are job authorization (0.614**), meeting development needs (0.607**), liking the work done (0.429**), and work recognition (0.403**). This suggests that in the daily management and cultural construction of the organization, it is necessary to make good use of job authorization, plan employees' career development, give full play to the talents of employees to achieve the best matching of employees and positions, and provide timely and appropriate recognition for employees' work achievements.

5. Research conclusions

Liaoning's GDP development level is a major factor contributing to the mobility of local talents.

Low salary is the main reason for job changes. As the length of service increases, employees may change jobs due to various reasons such as family factors, the improvement of their demand levels, and dissatisfaction with the work environment.

In terms of the average salary level of employees, Liaoning ranks 27th among 31 provincial-level administrative regions in China. This reduces the cost for talents to flow to regions with higher salaries, which is not conducive to retaining talents.

In terms of expenditure-based gross national product, Liaoning ranks 14th among 31 provincial-level administrative regions in China, which is relatively high. However, in terms of gross capital formation, Liaoning ranks 20th; in terms of fixed asset investment, it ranks 25th; and in terms of capital formation rate, it ranks 30th among 31 provincial-level administrative regions in China, showing insufficient driving force for development.

Prediction of industrial employment in Liaoning Province in the next three years: Vocational education is particularly important in the context of a large number of people leaving the agricultural sector, the overall employment pressure, the demand for skill upgrading, and the growing demand for research-oriented labor in agriculture. The number of employees in the secondary industry will decrease. In the future, the technological progress in the development of the industrial sector will lead to an increase in the organic composition of capital, which will curb the demand for labor. With the improvement of the economy, the share of labor in the industrial