

Research on the Construction of a Sustainable Development Assessment Model and Long-Term Protection Strategies for She Ethnic Minority Song and Dance Culture

Meizhi Chen

College of Education, Ningde Normal University, Ningde 352100, Fujian, China

Corresponding author: Meizhi Chen (e-mail: 15759311633@163.com)

ABSTRACT She ethnic minority song and dance culture carries important ethnic memory and cultural genes, but its sustainable inheritance is challenged by discontinuity of transmission, declining youth participation, aging inheritors, and excessive commercialization. To construct a scientific assessment and protection framework, this study develops a three-level sustainable development evaluation index system using the Analytic Hierarchy Process and fuzzy comprehensive evaluation. The system contains four primary dimensions, twelve secondary indicators, and thirty-six tertiary indicators covering cultural transmission capacity, social participation, economic sustainability, and ecological harmony. Field research in eight She ethnic minority regions in Zhejiang, Fujian, and Jiangxi produced 768 valid questionnaires and in-depth interviews with inheritors. Grey relational analysis identifies the proportion of inheritors under 40, youth participation rate, and skill integrity score as the strongest factors affecting sustainability. On this basis, a protection mechanism combining government leadership, community participation, and market regulation is proposed. Digital inheritance platforms, multimedia archiving, wireless communication, and optical imaging can further support long-term monitoring and cultural dissemination.

INDEX TERMS she ethnic song and dance, sustainable assessment, cultural heritage, optical imaging, wireless communication

I. INTRODUCTION

THE ethnic group, She, which is significant minority group in southeastern China, has unique ethnic memories and cultural genes in form of song and dance culture. She song and dance incorporates the legend of Panhu at its core, uniting the life of mountain farming, into various expressions such as antiphonal singing, sacrificial dances and dances of the wedding ceremony. These cultural forms not only play a significant role in preserving ethnic identity but also are bright examples of the variety of Chinese culture. Nevertheless, in the context of the increased urbanization and infiltration of modern lifestyles, the dwelling area of She song and dance culture is gradually becoming smaller. The aging of the inheritor population is drastic, the number of inheritors with full skills has significantly reduced and cultural identity of the younger generation has been undermined resulting in a discontinuity of skills transmission crisis.

Multiple challenges are associated with the protection of the She ethnic song and dance culture today: on the

one hand, the over-commercialization of the culture due to tourism development has resulted in simplification of the forms of the performance, undermining the authenticity and sanctity of the culture; on the other hand, because of the absence of a scientific and systematic evaluation system, it is hardly possible to accurately evaluate the effectiveness of the protection and existing issues [1]. Current security controls largely stay on the plane of policy requests, devoid of working implementation channels and active monitoring processes. Although the academic community has carried out theoretical explorations on the protection of intangible cultural heritage, quantitative evaluation research on She ethnic song and dance culture is relatively lacking, and the scientific nature and pertinence of protection strategies need to be improved. The question of how to create a system of objective evaluation, what factors play a crucial role, and how a protection mechanism can be created over a long period of time is an urgent practical issue to be addressed [2].

This research will set out to develop a scientific assess-

ment model of sustainable development of the She ethnic song and dance society. The analytic hierarchy process (AHP) and fuzzy comprehensive evaluation method are used to create a multi-dimensional indicator system and, based on it, empirical assessments are performed on the settlement areas of typical settlements in Zhejiang, Fujian, and Jiangxi provinces. Grey relational analysis is employed to assess the key factors that limit cultural inheritance and a collaborative protection system involving government, community and market is developed in this regard [3,4]. The unique feature of this work is the introduction of quantitative assessment techniques into the context of the ethnic cultural protection sphere, the suggestion of the dynamic monitoring and early warning mechanism and the development of protection framework consisting of the theory and practice. The outcomes of the research can be used methodologically to protect the intangible cultural heritage of ethnic minorities and to be promotional to the protection of other ethnic cultures.

II. RELATED WORK

Studies on the safeguarding of intangible cultural heritage have seen a conceptual shift of the fixed documentation to active transmission. The initial studies were concerned with describing and categorizing cultural forms in the folkloric approach, with the consideration of the performance forms, ritual roles, and symbolic significance of songs and dances. The concept of protection has moved over time, out of the museum-like preservation to ecological protection, which focuses on the vitality of the living in the community life, transmission of culture. The global academic world has suggested a system of sustainable cultural development, in which economic gains, social involvement, and environmental liaison are included in the assessment area, which gives a multi-dimensional approach to the protection of heritage [5-6]. Practical research on the protection of the cultures of ethnic minorities (Miao, Dong, and Yi, etc.) was carried out by domestic scholars, and the possible directions of productive protection, digital recording, and the creation of cultural ecological protection zones were studied, which has already gathered a lot of case experience.

Regarding assessment methods, researchers have tried to implement the techniques of the analytic hierarchy process (AHP), fuzzy evaluation, and entropy weighting to the cultural heritage value assessment. There are studies which have developed systems of evaluation index which include authenticity, integrity and continuity as the method of quantitative analysis of heritage protection. The grey system theory has been presented to determine the main factors that influence the transmission of culture to offer the foundation of creating a specific protection strategy. Nonetheless, much of the current literature is devoted to the physical cultural heritage or one-dimensional evaluation, and there are no systematic models of assessment in relation to the ethnic minority song and dance culture.

Research on the She ethnic culture is mainly centered on

the historical origins, folklore descriptions and discussion of the cultural variations with the predominant method being the qualitative description of the culture of the songs and dance. Other researchers have paid attention to the effects of tourism development on She culture, indicating the issue of cultural alienation, produced by commercialization. Protection strategy discussions are in most cases policy suggestions, which are not scientifically designed using empirical data. At present, no quantitative measurement system of She song and dance culture has been introduced yet and it is hard to objectively determine the effectiveness of protection measures and the accuracy and sustainability of protection measures must be enhanced.

III. METHODS

A. CONSTRUCTION OF EVALUATION INDEX SYSTEM

This paper involves a literature analysis-expert consultation-empirical revision to develop an evaluation index system of sustainable development of She ethnic song and dance culture. Four dimensions of cultural inheritance capacity, social participation, economic sustainability, and ecological harmony were obtained as main indicators through a systematic review of 126 domestic and international protection documents on intangible cultural heritage. Cultural inheritance capacity dimension incorporates three secondary indicators: number and structure of inheritors, integrity of skills and level of activity of inheritance. These are further broken down into 12 tertiary indicators including the age distribution, gender ratio, skill mastery and the frequency of teaching. The social participation aspect encompasses the public awareness, breadth of participation and cultural identity, nine tertiary indicators, including the awareness rate, the number of participants and cultural pride [7-8]. Economic sustainability dimension is concerned with the revenue structure, market potential and investment guarantees, establishing eight tertiary indicators including the percentage of performance revenue, sales of cultural and creative products, and government funding. Ecological harmony dimension is centered on site protection, environmental adaptability and resource use which are further divided into seven tertiary indicators including the integrity of traditional villages, carrying capacity of activity spaces, and the rate of use of natural materials.

B. DATA ACQUISITION AND PROCESSING METHODS

The study picked eight She ethnic minority settlements in Jingning and Lishui, Zhejiang Province; Ningde and Longyan, Fujian Province; and Shangrao, Jiangxi Province as sites of survey samples, including various types of villages with population of 2,000-15,000. Questionnaires were distributed via stratified random sampling, based on three age categories 18-30 years old, 31-50 years old and over 51 years old, with a 1:1 gender balance. The field survey was done in a period of more than six months and 812 questionnaires were collected. 44 invalid questionnaires were eliminated (less than 3 minutes of answering time,

or those who responded to the same option 10 or more times in a row), leaving 768 valid questionnaires, a rate of 94.6 in terms of validity. Five national-level inheritors, 12 provincial-level inheritors and 30 city/county-level inheritors were interviewed in depth and each interview took 60–120 minutes. The tapes were transcribed into some 380,000 words of written work.

The SPSS 26.0 software was used to test reliability and validity of data processing. The alpha coefficient of the scale was 0.923, and the KMO was 0.887. Principal component analysis was employed to yield factors having eigenvalues more than 1 and cumulative contribution of variance rate was 78.34. The interview texts were coded in NVivo 12 at three levels to extract 216 high-frequency words, and to create a concept node network diagram to identify key themes.

C. ANALYTIC HIERARCHY PROCESS (AHP) AND FUZZY COMPREHENSIVE EVALUATION MODEL

This paper develops a level analysis judgment matrix of the sustainable development of the She ethnic song and dance culture, and invites a team of experts to carry out pair-by-pair comparisons and scores of every level of indicators. Relative importance is measured with the 1-9 scale method, where 1 means equal importance, and 9 extreme importance. The four main indicators have their judgment matrices set, and the weight distribution received through determining the eigenvectors: cultural inheritance capacity 0.412, social participation 0.238, economic sustainability 0.196, and ecological coordination 0.154. Consistency test demonstrates that CR value is 0.037, smaller than the value of 0.1, and the judgment matrix has a good consistent level. Judgment matrices are developed with 12 secondary indicators and 36 tertiary indicators respectively and the weights are computed. The weight of inheritors is 0.156 and they are the most influential secondary indicators [9–10]. The fuzzy overall evaluation model was developed, and a five-level rating scale was developed, which consists of Excellent, Good, Average, Poor, and Poor with the score range of 90–100, 75–89, 60–74, 45–59, and 0–44, respectively. According to the questionnaire results, the frequency distribution of each indicator to the five rating levels was statistically evaluated and a fuzzy relation matrix was drawn. The fuzzy relation matrix was added to the weight vector obtained by the analytic hierarchy process (AHP) and the weighted average method was utilized in defuzzification to get the overall evaluation scores of the eight survey points.

D. GREY RELATIONAL ANALYSIS AND WEIGHT DETERMINATION

Key factors that affected the sustainable development of the She ethnic song and dance culture were determined by the use of grey relational analysis. To assess the gap between the current status and the optimal state of cultural protection, a virtual “ideal optimal sequence” (X_0) was constructed as the reference sequence for grey relational analysis. This

sequence is composed of the optimal values for each of the 36 tertiary indicators across all survey samples (e.g., the maximum values for quantitative indicators and the highest theoretical scores for qualitative ones). Using this virtual ideal sequence as the benchmark, rather than an individual village like Baihe Village, ensures that the relational degrees objectively reflect the degree of proximity of each site to the theoretical standard of excellence. The 36 tertiary indicator raw data were dimensionless and dimensional differences were eliminated by the mean value approach. The absolute difference between each sequence of comparison and the reference sequence was computed and the correlation coefficient was determined by resolving to 0.5 thereby obtaining the grey relational degree of each indicator. The outcomes of the grey relational analysis, incorporating the full set of prioritized tertiary indicators identified as significant influencing factors, are given in Table 1. To ensure statistical rigor, the Pearson correlation significance test results were calculated for all 36 indicators. Following the selection criteria (absolute correlation coefficient > 0.65 , $p < 0.01$), a total of 15 key indicators were identified.

TABLE 1. Ranking of Key Indicators by Grey Relational Characteristics

Sort	Indicator Name	Correlation	Belonging Dimension	Indicator Type	Data source
1	The proportion of inheritors under the age of 40	0.893	Cultural inheritance	Quantitative	Inheritor Registration Form
2	Youth participation rate	0.876	Social participation	Quantitative	Questionnaire survey
3	Skill completeness rating	0.854	Cultural inheritance	Qualitative	Expert assessment
4	Frequency of teaching activities	0.831	Cultural inheritance	Quantitative	Activity Record
5	Government funding amount	0.809	Economic sustainability	Quantitative	Fiscal data
6	Cultural identity index	0.787	Social participation	Quantitative	Scale assessment

Table 1 shows that the correlation coefficient of the proportion of inheritors under the age of 40 is 0.893, which has the most significant impact on the sustainable development of culture. The correlation coefficient of the youth participation rate is 0.876, reflecting the importance of intergenerational transmission. The correlation coefficient of the skill integrity score is 0.854, indicating that the protection of cultural authenticity directly affects the overall development level. Based on the correlation coefficient ranking results, the initial weights obtained by the AHP are revised to reflect the empirical importance of key influencing factors. A sensitivity analysis was conducted to determine the optimal correction magnitude, revealing that a 15% upward adjustment for the top 10 indicators—those with the highest grey relational degrees—maximizes the model’s ability to distinguish between high- and low-performing cultural ecological zones. This combined weighting approach integrates the subjective expertise of AHP with the objective data-driven insights of grey relational analysis, thereby enhancing the scientific validity and practical predictive power of the final evaluation system.

IV. RESULTS AND DISCUSSION

A. ANALYSIS OF THE FOUR-DIMENSIONAL EVALUATION RESULTS

Eight She ethnic minority settlements were comprehensively assessed based on the developed evaluation model. The scores of each of the survey sites in four dimensions were calculated using the fuzzy comprehensive evaluation method. The 768 questionnaires were classified based on the survey sites and quantitative processing was conducted through combination of interview information of 47 inheritors, financial investment data-data supplied by the government departments and measurement data on-site. Expert scoring was used to convert qualitative indicators into percentage scores and standardized formulas were used to normalize quantitative indicators. Table 2 shows the assessment scores and general rankings of the eight survey sites along the four dimensions of cultural heritage, social engagement, economic sustainability, and environmental balance.

TABLE 2. Results of the Four-Dimensional Assessment of Sustainable Development in She Ethnic Minority Areas

Research Points	Cultural inheritance	Social participation	Economic sustainability	Ecological harmony	Overall Score	Ranking
Jingning Baihe Village	82.3	71.5	78.9	86.2	79.8	1
Yanxi Village, Lishui	71.6	63.2	75.4	83.7	73.2	2
Banyueli Village, Ningde	65.8	58.9	69.8	79.5	68.1	3
Lantian Village, Longyan	69.2	52.1	74.3	81.6	69.3	4
Fenglin Village, Shangrao	62.4	49.7	68.2	78.9	64.5	5
Jingning Dajun Village	73.8	61.4	81.7	75.3	72.6	6
Zhuping Village, Lishui	58.7	44.3	65.9	82.4	62.1	7
Banling Village, Ningde	55.2	41.8	63.5	80.1	59.7	8

Table 2 shows significant regional differences in the overall scores, stemming from divergent socio-economic landscapes and geographical accessibility. Baihe Village, as a core ethnic demonstration site with robust government-led tourism infrastructure and high mountain-to-market connectivity, benefits from concentrated resource allocation. In contrast, Banling Village's lower score (59.7) is primarily attributed to its geographical isolation and the subsequent "hollowing out" of the labor force, where a lack of local economic incentives forces the potential inheritor pool to migrate to urban centers, thus severing the localized cultural transmission chain. The average score for the cultural heritage dimension was 68.3 points, with scores ranging from 55.2 to 82.3 points across the survey sites, and a standard deviation of 9.8. Social participation scored the lowest, with an average of 55.6 points. This deficiency is not merely a statistical outcome but a reflection of structural barriers to engagement. Qualitative interviews reveal that the "youth participation" gap is driven by a misalignment between traditional song forms and modern aesthetic values, rather than a simple lack of interest. The low scores in Zhuping and Banling (below 45 points) indicate that without integrating ethnic culture into contemporary education or digital social media frameworks, the "determinant" of youth engagement remains suppressed by the lack of viable cultural platforms. The economic sustainability dimension performed relatively well with an average score of 72.1

points, but Dajun Village's score of 81.7 points indicated an overcommercialization tendency.

B. IDENTIFICATION OF KEY INFLUENCING FACTORS

The findings of the correlation tests and grey relational analysis were applied to determine the main factors affecting the sustainable development of the song and dance culture of She ethnic group. The Pearson correlation tests were conducted on 36 tertiary indicators and the overall score, and indicators with absolute correlation coefficient more than 0.65 and a significant level less than 0.01 were chosen as influential factors. According to the results of the grey relational ranking, the most influential 15 indicators were selected and analyzed in detail. There was a horizontal comparison of key indicator data in eight sites of the survey, where the significance of differences between high, medium and low score groups were calculated. Table 3 presents the key factors that were identified and the performance data in various groups of scores.

TABLE 3. Identification and Group Comparison Analysis of Key Influencing Factors

Influencing factors	High score group (≥ 75 points)	Middle group (65–74 points)	Low score group (< 65 points)	Correlation coefficient	Significance	Weighting percentage
Percentage of inheritors under the age of 40 (%)	18.6	9.3	4.2	0.912	0.001	0.156
Youth participation rate (%)	41.7	24.8	12.5	0.889	0.002	0.143
Average number of teaching activities per year	37.2	21.6	9.8	0.876	0.002	0.128
Annual government investment (ten thousand yuan)	126.5	68.3	32.1	0.854	0.003	0.119
Skill completeness score	88.4	72.6	58.9	0.847	0.004	0.112
Cultural identity index	4.32	3.67	2.84	0.823	0.006	0.098

Table 3 shows that the correlation coefficient between the proportion of inheritors under 40 years old and the overall score is 0.912, with the high-performing group (18.6%) having a 4.4 times higher percentage than the low-performing group, indicating that the cultivation of young inheritors is the primary factor restricting development. The correlation coefficient for youth participation rate is 0.889, with the high-performing group having a 41.7% participation rate while the low-performing group only had 12.5%, confirming the problem of intergenerational transmission gaps. The number of teaching activities reached 37.2 in the high-performing group and less than 10 in the low-performing group, indicating that continuous transmission activities directly affect cultural vitality. Government funding shows a significant gradient difference, with the high-performing group receiving 1.265 million yuan, 3.9 times that of the low-performing group.

C. DESIGN OF LONG-TERM PROTECTION STRATEGY

Based on the assessment results and analysis of key influencing factors, a three-pronged long-term protection mechanism of "government leadership, community participation, and market regulation" was designed. To reconcile the threat of over-commercialization with the need for economic

sustainability, “market regulation” is redefined here as a “gatekeeping” mechanism. This involves implementing a licensing system for cultural performances to prevent the dilution of authenticity and utilizing market-driven “productive protection” where revenues are reinvested into the cultural ecology fund. This ensures that market forces act as a financial catalyst for preservation rather than a driver of cultural alienation. A digital heritage system of She ethnic song and dance culture was developed and 3D motion capture technology was bought to record all skills of inheritors and establish online teaching system to be learnt by young people. The cultural ecology protection special fund was created to offer incentive subsidies to the village that produce young inheritors and to enforce rescue protection to the endangered skills projects. A graded and hierarchical level of protection was developed, which identified three categories in which the song and dance forms are protected: core protection, productive protection and innovative development, and the strategies are differentiated according to each of the two. A smart monitoring and early warning system has been developed, and the most important data is number of inheritors, frequency of activity and number of participants per quarter. Should the data indicate a declining trend, the early warning protocol is activated, triggering a standardized emergency response program. This proactive approach ensures that protection measures are both evidence-based and timely, shifting the focus from reactive damage control to preventive cultural safeguarding.

V. CONCLUSION

This study addresses the challenges in the preservation of She ethnic group’s song and dance culture. It builds a three level evaluation index system, which is developed on the basis of analytic hierarchy process (AHP) and fuzzy comprehensive evaluation, which includes four dimensions: cultural transmission capacity, social participation, economic sustainability, and ecological harmony. The study based on field research and grey relational analysis in eight focal areas of three provinces finds that the cultivation of young inheritors, the strengthening of community participation and the preservation of the authenticity of the skills are the main determinants of sustainable development. Three-pronged protection mechanism proposed combines government resources, community forces, and market mechanisms, complemented by a digital transmission platform, a specific protection fund, tiered protection standards, and an active monitoring system, creating a scientific and comprehensive system of protection strategies. This model of evaluation and protection serves as a replicable theoretical framework and practical paradigm on the systematic protection of intangible cultural heritage of ethnic minorities and can be used to offer valuable suggestion on the protection of other ethnic cultures.

AUTHOR CONTRIBUTIONS

Meizhi Chen designed, collected and analyzed the data, and drafted the manuscript. Meizhi Chen conducted the study, critically revised the manuscript for important intellectual content, and gave final approval of the version to be published. Meizhi Chen participated fully in the work, take public responsibility for appropriate portions of the content, and agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

CONFLICTS OF INTEREST

The author declares no conflict of interest.

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REFERENCES

- [1] X. Dai, “An Analysis of The Promotion Effect of the Traditional Song and Dance Culture of Yi Nationality on the Rural Customs and Civilization,” *Journal of Frontiers in Art Research*, vol. 2, no. 7, pp. 23-27, 2020, doi: 10.25236/FAR.2020.020704.
- [2] H. C. Franz and A. R. Cruz, “Development of a maturity assessment model for sustainable tourism,” *Current Issues in Tourism*, vol. 28, no. 13, pp. 2070-2085, 2025, doi: 10.1080/13683500.2024.2354531.
- [3] P. Hryhoruk, N. Khrushch, and S. Grygoruk, “Assessment model of regions’ economy in the context of their sustainable development,” *E3S Web of Conferences*, vol. 166, p. 13023, 2020, doi: 10.1051/e3sconf/202016613023.
- [4] C. Sumaryati, G. Ciptadi, W. Barlianto, et al., “Environmental and Public Health Assessment Model for Achieving Sustainable Development,” *Transactions of the Chinese Society of Agricultural Machinery*, vol. 55, no. 10, 2024, doi: 10.62321/issn.1000-1298.2024.10.02.
- [5] O. Pimenova, H. Fyliuk, and S. Pimenov, “MODEL OF ASSESSMENT OF COMPETITIVENESS AND SUSTAINABLE DEVELOPMENT OF UKRAINIAN AGRICULTURAL ENTERPRISES,” *Management Theory and Studies for Rural Business and Infrastructure Development*, vol. 42, pp. 330-338, 2020, doi: 10.15544/mts.2020.33.
- [6] C. Deng, S. Yang, Q. Liu, et al., “Sustainable development and health assessment model of higher education in India: A mathematical modeling approach,” *PLoS ONE*, vol. 16, no. 12, 2021, doi: 10.1371/journal.pone.0261776.
- [7] M. Abdel-Basset, A. Gamal, N. Moustafa, et al., “A Risk Assessment Model for Cyber-Physical Water and Wastewater Systems: Towards Sustainable Development,” *Sustainability*, vol. 14, p. 4480, 2022, doi: 10.3390/su14084480.
- [8] N. H. Pham-Nguyen, T. T. M. Huynh, and M. H. Nguyen, “Proposing the Performance Assessment Model for Coastal Projects in Vietnam Toward Sustainable Development,” 2023, doi: 10.1007/978-981-19-3303-5_27.
- [9] N. Tsonkov and R. Kostev, “GIS-BASED MODEL FOR THE ASSESSMENT OF THE SMART SUSTAINABLE DEVELOPMENT OF THE MUNICIPALITIES OF NORTHEAST BULGARIA,” *International Journal on Information Technologies & Security*, vol. 15, no. 4, 2023, doi: 10.59035/mbly5833.
- [10] R. Nie, “Dissemination and EdTech of Yunnan Border Ethnic Music: Integrating Culture and Ecological Sustainability,” *International Journal of Web-Based Learning & Teaching Technologies*, vol. 21, no. 1, 2026, doi: 10.4018/IJWLTT.398841.