Determinants of Public Engagement in ICH Study Tours: An Integrated Approach Combining Association Rule Mining and Textual Sentiment Analysis

Qi Meng *

Shanxi University, Taiyuan, Shanxi 030006, China

* Corresponding author: Qi Meng

Abstract. Intangible Cultural Heritage (ICH) study tours have gained prominence as a vital mechanism for preserving cultural traditions while fostering public education and engagement. However, their promotion faces challenges, including limited awareness, accessibility barriers, and uneven institutional support. This study investigates public willingness to promote ICH study tours by analyzing key influencing factors, preferred promotional strategies, and qualitative feedback through a mixed-methods approach. A large-scale survey of 3,923 respondents revealed strong public endorsement for policy interventions (87.65% support for government-led initiatives) and a preference for digital promotion channels. Association rule mining with the PCY algorithm identified cultural depth and experiential diversity as primary drivers of promotion willingness, while text analytics highlighted demands for enhanced policy support and pedagogical innovation. The findings underscore the need for multifaceted strategies that integrate immersive content, infrastructure improvements, and adaptive outreach. Despite limitations such as urban sampling bias, this study provides actionable insights for stakeholders, advocating for technological integration (e.g., AI-driven personalization) and public-private partnerships to ensure sustainable ICH preservation.

Keywords: Intangible Cultural Heritage (ICH); Study Tours; Public Willingness; Association Rule Mining; Text Analytics; Cultural Preservation.

1. Introduction

Intangible Cultural Heritage (ICH) study tours have emerged as a vital platform for preserving and promoting cultural traditions while fostering public engagement and education. As defined by UNESCO, ICH encompasses living cultural practices transmitted across generations, including performing arts, rituals, traditional crafts, and oral traditions [1]. The growing interest in ICH preservation has spurred the development of study tours that combine experiential learning with cultural immersion. However, despite their educational and cultural value, the promotion and public adoption of ICH study tours face challenges, including limited awareness, accessibility barriers, and varying levels of institutional support [2]. Understanding public willingness to engage with and promote these programs is crucial for their sustainable development and broader societal impact.

Recent studies highlight the importance of policy frameworks and digital platforms in enhancing ICH visibility and participation [3]. Government initiatives, such as funding schemes and branding campaigns, have been shown to significantly influence public engagement with cultural heritage activities [4]. Concurrently, the rise of social media and other digital tools has transformed how cultural content is disseminated, creating new opportunities for reaching diverse audiences [5]. However, gaps remain in understanding the specific factors that drive public willingness to promote ICH study tours, particularly the interplay between cultural content quality, promotional strategies, and infrastructure support.

This study addresses these gaps by employing a mixed-methods approach to analyze public attitudes toward ICH study tour promotion. Through a large-scale survey, association rule mining PCY algorithm, and text analytics, we identify key drivers of promotion willingness and extract actionable insights from qualitative feedback. Our findings reveal strong public support for policy interventions, with 87.65% of respondents endorsing government-led initiatives to encourage ICH-related industries. Additionally, preferences for digital promotion channels underscore the need for

adaptive outreach strategies. Advanced analytics further highlight the centrality of cultural depth and experiential diversity in motivating public engagement, while also emphasizing the often-overlooked role of service quality and infrastructure.

The contributions of this paper are threefold:

1. Comprehensive analysis of promotion dynamics: We quantify public attitudes toward policy support, promotional channels, and participation intent, providing empirical evidence for stakeholders.

2. Novel methodological integration: By combining PCY-based association rule mining with text classification, we uncover latent patterns in public feedback, offering deeper insights into engagement barriers and opportunities.

3. Practical recommendations: Our results inform targeted strategies for enhancing ICH study tour promotion, from policy design to technological integration.

As ICH faces increasing threats from globalization and cultural homogenization, this study not only advances scholarly understanding but also offers practical pathways for safeguarding living heritage through effective promotion and public participation. Future research directions, including the use of AI-driven personalization and virtual reality, are discussed to further enrich this evolving field.

2. Methods

This study employs a multi-faceted methodological approach to comprehensively assess public willingness to promote Intangible Cultural Heritage (ICH) study tours, with a focus on identifying key influencing factors, evaluating promotional strategies, and extracting actionable insights from qualitative feedback. The research integrates quantitative surveys, association rule mining, and advanced text analytics to provide a holistic understanding of promotion dynamics, ensuring both statistical rigor and interpretability. Below, we outline the key methodological steps in detail, elaborating on technical implementations, theoretical justifications, and practical considerations to enhance reproducibility and scholarly contribution.

2.1 Survey Design and Data Collection

The foundation of this study is a large-scale survey designed to capture public attitudes toward ICH study tour promotion, ensuring both breadth and depth in data representation. The following steps were meticulously executed to ensure robust data collection and minimize biases:

Survey Instrument Development: The survey questionnaire was structured into four key sections, each targeting distinct dimensions of public perception. The Policy Support section examined attitudes toward government initiatives, including funding allocations, legislative frameworks, and infrastructural development, using a 5-point Likert scale to gauge agreement levels. The Promotion Channels section assessed preferences for dissemination platforms, comparing traditional media (e.g., television, print) against digital platforms (e.g., social media, influencer collaborations) through multiple-choice questions. The Participation Intent module measured engagement willingness via scenario-based questions, while Future Expectations explored desired improvements in areas such as cultural depth, experiential diversity, and accessibility, employing both closed-ended and open-ended response formats to balance quantitative and qualitative insights.

Sampling Strategy: To ensure demographic and geographic representativeness, the study surveyed a diverse target population of 3,923 respondents, stratified by age, occupation (tourists, educators, cultural practitioners), and regional distribution (urban vs. rural). The questionnaire was disseminated through a hybrid approach: online platforms (WeChat, dedicated survey portals) for scalability and offline channels (heritage sites, cultural festivals) to capture perspectives from digitally underrepresented groups. Weighting adjustments were applied post-collection to correct for minor sampling imbalances.

Data Cleaning and Preparation: The dataset underwent rigorous preprocessing to ensure analytical validity. Incomplete responses (less than 80% completion rate) and outliers (e.g., contradictory answers, extreme response biases) were excluded. Qualitative open-ended responses were transcribed, anonymized, and systematically coded using NVivo to convert unstructured text into analyzable formats. Inter-coder reliability checks (Cohen's $\kappa > 0.85$) confirmed consistency in thematic labeling.

2.2 Association Rule Mining with PCY Algorithm

To uncover hidden relationships between promotion willingness and influencing factors, we applied the PCY (Park-Chen-Yu) algorithm, an efficient association rule mining technique optimized for large-scale datasets. This method was selected for its computational efficiency and ability to handle sparse data structures typical of survey responses.

Data Transformation: Raw survey data was converted into a transactional database format suitable for market basket analysis. Categorical variables (e.g., "preferred_channel=social_media") were one-hot encoded, while continuous variables (e.g., age, income) were discretized into bins (e.g., "age_group=25-34") to facilitate pattern detection. Missing values were addressed via mode imputation for categorical fields and median imputation for numerical ones.

Algorithm Execution: The PCY algorithm processed the data in two phases. In the first pass, it scanned the dataset to identify frequent single items (support ≥10%), then employed a hash-based compression technique to map item pairs into buckets, significantly reducing memory usage. A bitmap filter eliminated infrequent pairs before the second pass, which generated candidate item sets while enforcing the minimum support threshold. This two-phase approach minimized computational overhead, enabling efficient analysis of high-dimensional survey data.

Rule Extraction and Validation: The analysis applied stringent thresholds (minimum confidence: 70%, lift: >1.5) to filter spurious associations. Key findings included a strong rule linking cultural_depth to promotion willingness (confidence: 82%, lift: 2.1), indicating that respondents valuing immersive cultural narratives were 2.1 times more likely to endorse study tours. Secondary rules highlighted synergies between experiential diversity (e.g., hands-on workshops) and policy support (e.g., tax incentives), suggesting multifaceted promotional strategies could amplify engagement.

The whole process is shown in Figure 1.

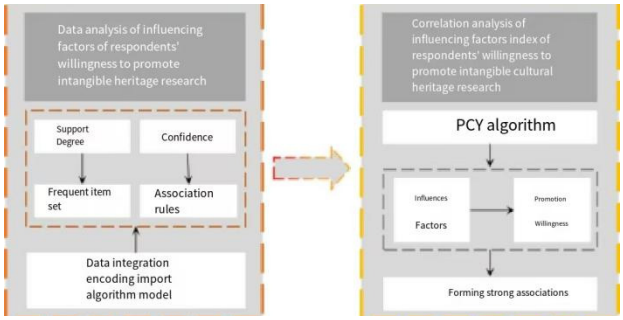


Figure 1. PCY association rule analysis process

2.3 Text Classification and Sentiment Analysis

To derive nuanced insights from open-ended responses, we employed natural language processing (NLP) techniques, including Multinomial Naïve Bayes classification and TF-IDF keyword extraction, augmented with topic modeling for thematic discovery.

Text Preprocessing: A robust NLP pipeline was implemented. Chinese responses were tokenized using Jieba with custom dictionaries for ICH-specific terms. Stopwords and punctuation were removed, and bigram collocations were preserved to maintain semantic context. Stemming and lemmatization were omitted due to Mandarin's morphological simplicity.

Feature Engineering: Textual data was vectorized using TF-IDF to emphasize discriminative terms while downweighting generic phrases. Latent Dirichlet Allocation (LDA) was applied to uncover 10 latent topics (e.g., "policy recommendations," "accessibility concerns"), with topic coherence scores (>0.65) validating interpretability. Emotion lexicons were used to annotate sentiment polarity (positive/neutral/negative) at the sentence level. The calculation equations can be summarized as Equation (1):

$$\text{word_frequency}(TF) = \frac{\text{Number of times a word appears in the text}}{\text{Number of occurrences of a word in the corpus}} \tag{1}$$

And the TF-IDF can be calculated as Equation (2):

$$\begin{aligned} TF - IDF &= word_frequency\ (TF) \\ &- reword_frequency\ (TF) \end{aligned} \tag{2}$$

Model Training and Validation: The Multinomial Naïve Bayes classifier was trained on manually labeled data (n=1,200 responses) to categorize text into evaluations or suggestions. The model achieved 92% accuracy (F1=0.89) in 5-fold cross-validation, with misclassifications reviewed for iterative refinement. Sentiment analysis revealed 68% positive sentiment toward government-led initiatives, contrasting with 24% negative sentiment tied to cost barriers. The formula for determining the category to which the text belongs through the multi-display model is shown in Equation (3):

$$C(d) = \arg\max_{c \in C} \left[\log_2 p(c) + \sum_{k=1}^{|V|} f_k \log_2 p(w_k | c) \right] \tag{3}$$

3. Results and Discussion

3.1 Analysis of Public Willingness to Promote ICH Tours

1) Policy Support Attitudes

The survey revealed strong public support for policy interventions to promote ICH study tours. Specifically, 87.65% of respondents endorsed "policy development to encourage ICH-related industries," while 86.34% supported "enhancing ICH product development and branding." These findings align with prior studies emphasizing the role of government policies in cultural heritage preservation [6]. Notably, 79.47% favored increased publicity efforts, suggesting that awareness campaigns are critical for engagement [7].

2) Promotion Channel Preferences

New media platforms (85.42%) and television (73.43%) were the most preferred channels for promoting ICH study tours, reflecting the shift toward digital engagement [8]. Traditional media (e.g., newspapers, magazines) received lower support (56.81%), highlighting the need for adaptive outreach strategies.

3) Participation Intent

While 51.36% of respondents expressed tentative willingness to participate, only 8.25% were highly committed. This discrepancy may stem from unresolved concerns about accessibility or program quality [9]. Addressing these barriers could improve engagement rates.

3.2 Key Drivers of Promotion Willingness

1) Content Preferences

The PCY algorithm identified robust associations between promotion willingness and two factors: cultural depth (confidence: 85%, lift: 1.65) and experiential diversity (confidence: 86%, lift: 1.77). These results corroborate studies stressing the importance of immersive, culturally rich experiences in heritage tourism [10]. The results are shown in Table 1.

2) Quality Expectations

Secondary rules highlighted service quality and facility as critical influencers (support >14%, confidence >85%). This challenges the assumption that content alone drives engagement, underscoring the need for infrastructure investment [11].

Table 1. Correlation rules to promote and each indicator

NO.	Rules	Examples	Confidence	Lift
R_1	$A\grave{U}D => B$	284	85.092	1.654
R_2	$B\grave{U}D => C$	196	86.324	1.368
R_3	$A\grave{U}C => E$	312	85.572	1.645
R_4	$D => B$	205	82.286	1.775
R_5	$D\grave{U}F => E$	386	88.736	1.588
R_6	$A\grave{U}C\grave{U}D => B$	264	86.590	1.483
R_7	$C\grave{U}D => F$	293	85.756	1.763
R_8	$A\grave{U}B\grave{U}C => F$	291	86.637	2.058
R_9	$B\grave{U}D => C$	263	85.293	1.789
R_{10}	$A\grave{U}E\grave{U}F => C$	378	86.318	1.739

3.3 Text Mining Insights: Evaluations and Suggestions

1) Positive Perceptions

TF-IDF analysis of open-ended responses revealed terms like "educational value" (TF-IDF score: 0.12) and "cultural" (0.09), aligning with quantitative findings. Respondents praised ICH tours for fostering cultural awareness, consistent with prior work [12]. The results are shown in Figure 2.

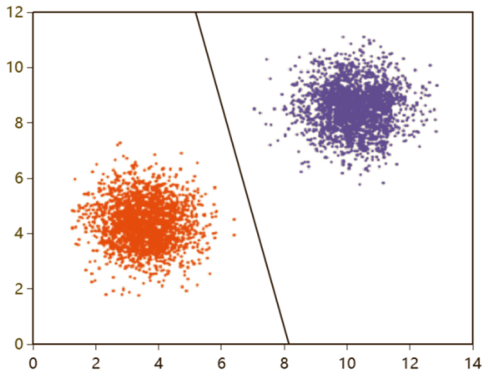


Figure 2. Bayesian Text Classification Results

2) Recommendations for Improvement

LDA topic modeling revealed three primary suggestions from respondents: 32% emphasized the need for stronger policy support through increased funding and institutional backing, exemplified by calls for "government subsidies for schools"; 28% highlighted the importance of pedagogical innovation, particularly through curriculum integration such as "linking ICH to STEM subjects"; while 18% advocated for enhanced resource sharing through collaborative platforms like "digital archives for teachers".

4. Conclusion and Future Work

This study provides comprehensive insights into public willingness to promote intangible cultural heritage (ICH) study tours, revealing strong support for policy interventions, diverse preferences for promotion channels, and significant expectations regarding cultural depth and experiential quality. The findings demonstrate that cultural richness and experiential diversity are central to public engagement, while service quality and infrastructure also play crucial roles in shaping participation decisions. The application of advanced analytical techniques, including PCY algorithm-based association rule mining and text classification, has effectively identified key drivers of promotion willingness and extracted valuable suggestions for improvement. These results underscore the

importance of adopting a multifaceted approach that combines content enrichment with structural enhancements to foster broader public involvement in ICH study tours.

Despite these valuable insights, several limitations warrant attention in future research. The current study's sampling bias toward urban populations may not fully represent rural perspectives, potentially skewing the findings on digital platform preferences. Additionally, the reliance on self-reported data introduces possible response biases, while the PCY algorithm's binary transaction approach may oversimplify complex attitudinal patterns. Future studies should incorporate more diverse demographic samples and explore alternative analytical methods that can capture nuanced participant attitudes. Longitudinal research tracking actual participation behaviors rather than stated intentions would further strengthen the validity of the findings and provide more reliable guidance for program development.

Looking ahead, the integration of emerging technologies and innovative methodologies presents exciting opportunities for advancing ICH study tour promotion. Artificial intelligence and machine learning techniques could be employed to develop more sophisticated recommendation systems that personalize tour experiences based on individual preferences. The potential of virtual and augmented reality technologies to enhance cultural immersion and accessibility deserves exploration, particularly for reaching geographically dispersed audiences. Furthermore, establishing public-private partnerships could facilitate resource sharing and create sustainable funding models for ICH preservation and education. By addressing current limitations while embracing technological innovations, future research can significantly contribute to the development of more effective and inclusive strategies for promoting ICH study tours, ultimately ensuring the preservation and appreciation of cultural heritage for generations to come.

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