Education Insights

Article

Research on the Spread and Market Potential of Shu Embroidery Culture under Public Perception

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Abstract: Shu embroidery, renowned as the "crown of stitches," continues to demonstrate vitality in contemporary times. However, its cultural inheritance still faces considerable challenges. This study focuses on market research and textual data related to Shu embroidery, aiming to identify the key factors that influence the public's willingness to purchase it through a combination of quantitative and qualitative methods. Data analysis was conducted using SPSS 27 and Python. The results indicate that product core competitiveness (Factor 1), brand communication and perception (Factor 2), and cultural foundation value (Factor 3) all have a significant positive impact on purchase intention. Product perception fully mediates the effect of Factor 1 on purchase intention. Overall, the public holds a positive cultural perception of Shu embroidery, and cultural inheritance emerges as a prominent topic of discussion. Based on these findings, the study suggests that leveraging cultural heritage to enhance product value, integrating core product competitiveness with favorable product perception, and strengthening the overall appeal of Shu embroidery are essential strategies for its modernization, emotional resonance, and market development.

Keywords: Shu embroidery; purchase intention; product perception; marketization

1. Introduction

As one of the four renowned embroideries included in intangible cultural heritage, Shu embroidery holds a distinguished artistic status and considerable cultural value. In recent years, with the development of the digital economy and artificial intelligence, Shu embroidery culture has diversified and become increasingly accessible to the public, manifesting in areas such as its integration into the entertainment industry and digital intelligent interaction. Despite benefiting from the era of cultural consumption upgrades and possessing substantial market potential, Shu embroidery remains limited in public popularity. It faces challenges including a small number of inheritors, low levels of innovation, and weak market competitiveness. These issues constrain the social dissemination of Shu embroidery culture and limit its market potential.

Against this backdrop, this study employs questionnaire surveys and natural language processing methods to explore the public's emotional cognition and tendencies toward Shu embroidery through in-depth analysis of numerical and textual data. The study first conducts correlation analysis, principal component analysis, and mediation effect testing on questionnaire data. It then applies natural language processing techniques to perform sentiment granularity analysis and social network relationship analysis, identifying public attention foci under positive, neutral, and negative emotions. The integration of these two types of data provides a complementary empirical analysis.

This research not only contributes theoretically by enriching methodologies for studying public perceptions of intangible cultural heritage but also offers a digital humanities-based analytical framework. Practically, it helps to uncover the real market

Published: 23 October 2025

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demand for Shu embroidery, revitalize cultural resources, and support the continued vitality, inheritance, and preservation of this traditional art form.

2. Literature Review

2.1. The Contemporary Value and Inheritance Path of Shu Embroidery

Shu embroidery embodies the unique humanistic spirit and aesthetic concepts of the Bashu region, with its value reflected in historical continuity, rich cultural connotation, and diverse techniques [1]. The artistry of Shu embroidery is particularly evident in the interplay of new and traditional stitches, the complexity and variability of patterns, and the skillful innovation of embroidery techniques [2]. These characteristics provide a foundation for brand development. Currently, the Shu embroidery brand has cultivated a distinctive cultural expression by combining modern design concepts and digital technology while preserving the authenticity of the craft [3,4]. Such expression requires a balance between contemporary relevance and the integration of humanistic spirit with artistic skill.

Nevertheless, the inheritance of Shu embroidery faces significant challenges, including a shortage of skilled practitioners, limited publicity, a shrinking market, and lagging techniques [5]. Addressing these challenges requires reshaping the contemporary value of Shu embroidery, enhancing perceived value, and allowing consumers to fully appreciate its aesthetic, historical, and cultural significance, thereby increasing their willingness to purchase [6]. Investigations also highlight problems such as interrupted inheritance, talent shortages, and weak national cultural awareness [7]. Solutions proposed include establishing comprehensive protection mechanisms, integrating innovative techniques, reforming publicity methods, and strengthening cultural education. Additionally, enterprises and universities serve as crucial platforms for the protection and innovation of Shu embroidery. The application of digital technology in universities, along with curriculum development, talent cultivation, school-local cooperation, and research platform construction, provides a solid foundation for preserving and advancing Shu embroidery [8]. Strategic brand-building approaches focusing on visual perception, cultural identity, and interactive experience communication further support the contemporary development of Shu embroidery [9].

In summary, most existing studies examine the value and cultural inheritance of Shu embroidery from a "supplier" perspective, with few exploring the issue from the "demand side"-the public. This gap underscores the relevance of using questionnaires and natural language processing as the main analytical methods in this study.

2.2. Public Cultural Perception and Market Potential of Shu Embroidery

Accurately understanding the public's cultural perception and the market potential of Shu embroidery is crucial for guiding its dissemination and inheritance. In terms of design evolution, Shu embroidery patterns have expanded beyond traditional motifs such as flowers, birds, animals, and landscapes, incorporating elements from Western oil painting, contemporary art, and other creative fields. This integration of modern artistic elements with traditional techniques has produced works that better align with the diverse aesthetic preferences of contemporary audiences [10]. In recent years, the "national trend" movement has gained popularity, with Generation Z emerging as a major consumer group. This cohort emphasizes experiential engagement, prioritizes visual appeal, values social sharing, and seeks culturally rich experiences, making them increasingly important for the market of Shu embroidery [11]. Surveys of young tourists aged 18-35 indicate that skill-related experience carries the highest cognitive value, commodity purchases have the strongest emotional impact, and perceptions of other characteristics are relatively balanced [12].

From a market potential perspective, the digital transformation of the Shu embroidery cultural industry has been identified as a key strategy to enhance

competitiveness and market influence [13]. Integrating Shu embroidery with culture and tourism enables the art form to be preserved and innovated, increases its visibility and appeal, and supports cultural experiences that contribute to local economic development [14]. In the context of rural revitalization, incorporating traditional Sichuan and Chongqing embroidery patterns into rural tourism products enriches their cultural content and promotes tourism growth [15]. Expanding the market through multi-party integration-such as combining Shu embroidery with education, commodities, and experiential activities-can stimulate social engagement and public attention [16]. Furthermore, leveraging online marketing strategies, particularly in the "Belt and Road" context, underscores the essential role of Internet platforms in promoting Sichuan embroidery culture and developing new markets [17].

Overall, existing studies primarily address public perception and market context from cultural and economic perspectives, with limited exploration of other dimensions. Nevertheless, this body of literature provides important theoretical guidance for the design of questionnaires, the selection of natural language processing models, and the empirical data analysis in the present study.

3. Research Design

3.1. Research Objects and Data Acquisition

This study targets individuals with a certain familiarity with Shu embroidery and examines user comments related to Shu embroidery content. Data collection is divided into two types: questionnaire scale data and comment text data. The questionnaire employs a ten-level gradient scale. Based on the literature review, this study selects cultural value, attribute perception, market potential, communication perception, and brand image as independent variables, with product perception serving as the mediating variable and purchase intention as the dependent variable (see Table 1 for variable design). An online random sampling method was used for questionnaire distribution, and participants were not restricted by gender, age, or other demographic factors to ensure the comprehensiveness and reliability of the data. The comment text data focuses on the public's attitudes and perceptions of Shu embroidery culture, with all data sourced from well-known domestic platforms such as Douyin, Bilibili, and Xiaohongshu.

Table 1. Variable design**.**

	variable name	variable dimension
independent variable	cultural value	Cultural status, artistic style, cultural confidence, inheritance value
	attribute perception	Quality attributes, scene attributes, skill attributes, modern attributes
	market potential	Market popularity, aesthetic demand, price acceptance, economic gravity
	spread perception	Online exposure, push satisfaction, offline experience, distance from intangible cultural heritage
	brand image	Brand trust, product innovation, brand positioning, image creation
mediating variable		product perception
dependent variable		purchase intention

For text data preprocessing, the procedures included removing empty, irrelevant, or highly repetitive comments, as well as filtering out special characters, emojis, and HTML tags. Word segmentation was performed using the Jieba tool in Python, followed by stop-

word removal after vocabulary normalization, ensuring that the text data could be analyzed accurately and effectively.

3.2. Research Methods and Steps

For the questionnaire data, the study first conducted reliability and validity tests to ensure data quality. Correlation analysis was then performed to identify positive and negative relationships among variables. Principal component analysis was subsequently applied to reduce dimensionality and simplify the set of independent variables. Finally, the relationships between the principal components and the mediating variable were examined to test the significance of the mediating effect, as illustrated in the research hypothesis model (Figure 1).

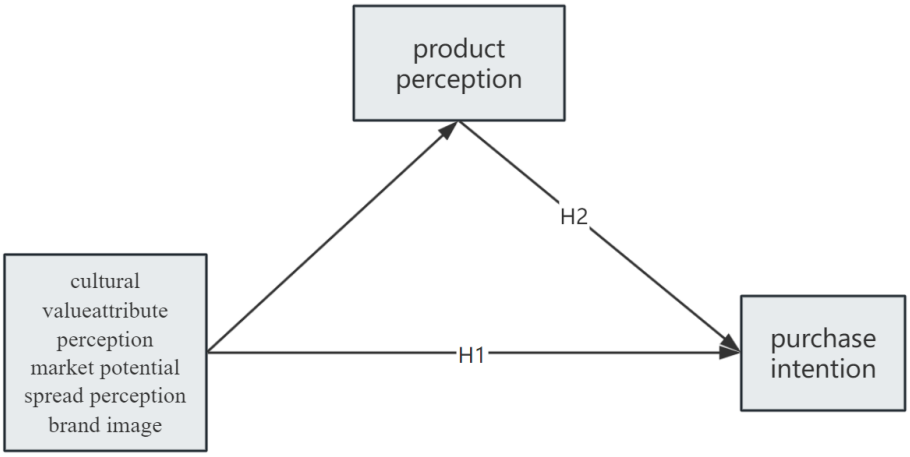

Figure 1. Research hypothesis.

For text data, natural language processing (NLP) was employed as the primary analytical method. The analysis began by calculating the proportions of positive, neutral, and negative comments to assess overall sentiment. A co-word matrix was then constructed to examine the correlation between words across all comments. Finally, word cloud diagrams for each sentiment category were generated to summarize thematic content and identify key topics in public perception, which were further supported and validated by the questionnaire data.

4. Empirical analysis

4.1. Questionnaire Data Analysis

4.1.1. Reliability and Validity Analysis

The results of the reliability analysis are presented in Table 2. The findings indicate that the overall consistency of the questionnaire data is 0.967, with the Cronbach's Alpha for each dimension exceeding 0.80 and remaining largely higher than the Alpha values obtained after item deletion. These results demonstrate that the questionnaire data exhibit high reliability and strong internal consistency across variables.

Table 2. Reliability analysis.

variable name	Overall Alpha	Dimension Alpha	Klonbach's ALPHA after deleting items
cultural value	0.967	0.801	0.669
			0.676
			0.658

attribute perception	0.896	0.799 0.806 0.806
market potential	0.936	0.882 0.874 0.914
spread perception	0.925	0.896 0.919 0.912 0.830
brand image	0.933	0.766 0.756 1.000 0.741 0.730
mediating variable		0.787 1.000 0.963
dependent variable		0.963

The results of the validity analysis are presented in Table 3. The KMO value was found to be 0.848, indicating a strong sampling adequacy. Additionally, Bartlett's test of sphericity yielded a p-value of less than 0.01, demonstrating high statistical significance. These findings suggest that the questionnaire data possess relatively high overall validity, and that both reliability and validity requirements are satisfactorily met.

Table 3. Validity analysis**.**

KMO sampling suitability measure		0.848
Bartlelett's test of sphericity	Approximate Chi_square	1071.785
	Degree of freedom	231
	Significance	.000

4.1.2. Correlation Analysis

This study conducted correlation analysis after processing the independent variable group using the mean method. The results are presented in Table 4. Values of $r > 0$ and $p < 0.05$ indicate a significant positive correlation between the independent variables and the mediating variable, as well as between the independent variables and the dependent variable. Correlations were also observed among the independent variables themselves. Before further exploring the influencing factors through regression analysis, dimensionality reduction of the independent variables was performed using principal component analysis.

Table 4. Correlation analysis results**.**

	cultural value	**attribute perception**	**market potential**	**spread perception**	**brand image**	**product perception**	**purchase intention**
cultural value	1						

attribute perception	.662**	1					
market potential	.604**	.843**	1				
spread perception	.553**	.668**	.711**	1			
brand image	.513**	.755**	.774**	.853**	1		
product perception	.490**	.625**	.697**	.679**	.834**	1	
purchase intention	.673**	.569**	.525**	.713**	.713**	.665**	1

** The correlation is significant at the 0.01 level (two-tailed).

4.1.3. Principal Component Analysis

The results of the principal component analysis are presented in Table 5. The original 20 independent variables were effectively consolidated into three principal components, with variables having absolute coefficient values less than or equal to 0.5 excluded. The three principal components-product core competitiveness, brand communication and perception, and cultural foundation value-represent the essential characteristics across the five dimensions of cultural value, attribute perception, market potential, communication perception, and brand image.

Table 5. Principal component analysis results**.**

	Product core competitiveness(Factor 1)	**Brand communication and perception (Factor 2)**	**Cultural fundamental values (Factor 3)**
Market popularity	0.816		
economic gravity	0.793		
aesthetic demand	0.783		
modern attributes	0.782		
Quality attributes	0.697		
cultural confidence	0.689		
skill attributes	0.677		
scene attributes	0.673		
Online exposure		0.896	
offline experience		0.867	
Brand trust		0.841	
distance from intangible cultural heritage		0.820	
brand positioning.		0.746	
inheritance value			0.870
Cultural status			0.543

4.1.4. Regression Analysis

To further examine whether product perception serves as a mediating variable in the influence of Factors 1, 2, and 3 on purchase intention, this study employed Model 4 of the

PROCESS macro in SPSS. A total of 5,000 bootstrap resampling tests were conducted to assess the significance of the mediating effect, with the results presented in Table 6.

Table 6. regression analysis results**.**

	Model 1(product perception)					Model 2(purchase intention)					Model 3(purchase intention)				
variable	**Beta**	**t**	**P**	**LLCI**	**ULCI**	**Beta**	**t**	**P**	**LLCI**	**ULCI**	**Beta**	**t**	**P**	**LLCI**	**ULCI**
constant	8.2000	51.9182	0.0000	7.8810	8.5190	7.7778	45.8030	0.0000	7.4348	8.1207	4.6955	3.5863	0.0010	2.0359	7.3500
Factor 1	0.8349	5.2269	0.0000	0.5123	1.1574	0.5163	3.0067	0.0045	0.1695	0.8632	0.2025	0.9631	0.3413	-0.2225	0.6275
Factor 2	0.9628	6.0277	0.0000	0.6402	1.2853	1.0669	6.2128	0.0000	0.7201	1.4137	0.7050	3.1515	0.0031	0.2529	1.1572
Factor 3	0.2909	1.8211	0.0759	-0.0317	0.6135	1.1358	6.6139	0.0000	0.7890	1.4826	1.0265	6.0612	0.0000	0.6842	1.3687
product perception											0.3759	2.3601	0.0232	0.0540	0.6978
R square	0.6203					0.6903					0.7281				
F	22.3232					30.4609					26.7847				

Model 1 examines the impact of the independent variables (Factor 1, Factor 2, Factor 3) on the mediating variable. The results indicate that Factor 1 ($\beta = 0.8349$, $p < 0.0001$) and Factor 2 ($\beta = 0.9628$, $p < 0.0001$) exert a significant positive effect on product perception, whereas Factor 3 shows no significant effect. The overall model fit is high ($R^2 = 0.6203$), suggesting that Factor 1 and Factor 2 are important predictors of product perception.

Model 2 analyzes the direct impact of the independent variables on the dependent variable without including the mediating variable. The findings show that Factor 1 ($\beta = 0.5163$, $p < 0.05$), Factor 2 ($\beta = 1.0669$, $p < 0.0001$), and Factor 3 ($\beta = 1.1358$, $p < 0.0001$) all have significant positive effects on purchase intention. The overall model fit is also high ($R^2 = 0.6903$), indicating that Factors 1, 2, and 3 are key predictors of purchase intention.

Model 3 incorporates the mediating variable to explore the role of product perception between the independent and dependent variables. The results demonstrate that product perception has a significant positive impact on purchase intention ($\beta = 0.3759$, $p < 0.05$). After including the mediating variable, Factor 2 ($\beta = 0.7050$, $p < 0.05$) and Factor 3 ($\beta = 1.0265$, $p < 0.05$) continue to significantly influence purchase intention, while the direct effect of Factor 1 becomes non-significant, indicating a complete mediation effect. The overall model fit remains high ($R^2 = 0.7281$), as summarized in Table 7 for the mediation effect analysis.

Table 7. Mediation effect analysis**.**

	Factor 1	Factor 2		Factor 3	
	effect size	effect size	Proportion of total effect	effect size	Proportion of total effect
total effect	0.5163	1.0669	33.92%	1.1358	9.62%
direct effect	--	0.7050		1.0265	
indirect effect	--	0.3619		0.1093	

4.2. Text Data Analysis

As shown in Figure 2, it can be seen from the sentiment classification proportion chart that among the overall comment data, the number of positive comments accounts for 56.1%, neutral comments account for 18.5%, and negative comments account for 25.5%. In the sentiment analysis diagram of Figure 3, the blue circle represents the sentiment score of each comment. The closer the score is to 1, the sentiment of the review is positive. Similarly, the closer the score is to 0, the sentiment of the review is more negative. Overall, the blue circle is mainly concentrated around 0.5 and 1.0 points, indicating that positive comments account for the majority of the sentiment of the text and the sentiment is good.

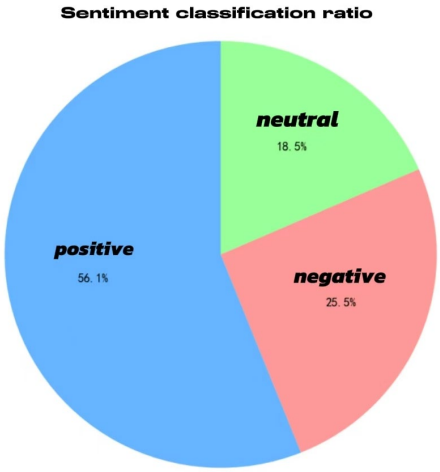

Figure 2. Pie chart of three major emotional proportions.

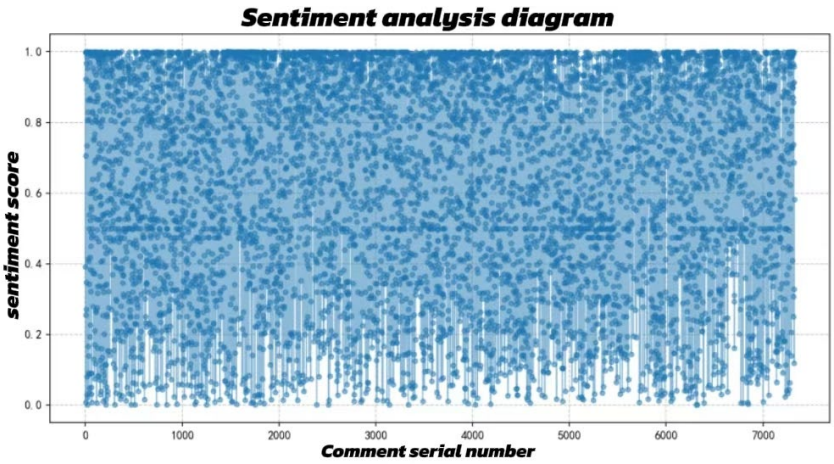

Figure 3. Sentiment analysis diagram.

To construct the co-word matrix from the comments, the study selected the top 20 most frequent words as analysis terms: powerful, Shu embroidery, Ziqi, video, culture, like, embroidery, sister, admire, good-looking, go for it, China, feel, tradition, fairy, clothes, learning, panda, inheritance, and intangible cultural heritage. The social network relationship diagram is presented in Figure 4, illustrating the connections among these words. In the diagram, thicker lines and darker colors indicate stronger correlations, reflecting a higher frequency of co-occurrence between the terms.

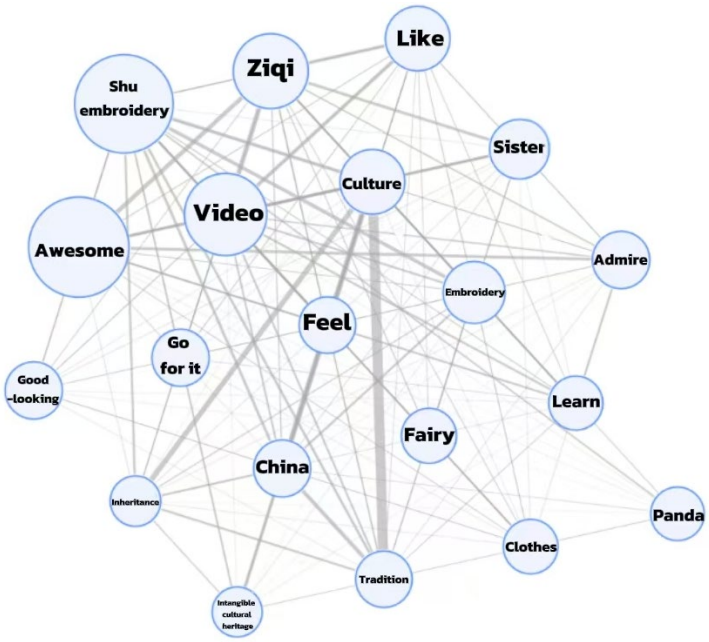

Figure 4. Social network relationship diagram.

To further examine the public's focus on Shu embroidery under different emotional contexts, the study generated word cloud diagrams for three sentiment categories, as shown in Figure 5. For positive comments, the top five keywords are awesome, Shu embroidery, Li Ziqi, like, and admire, reflecting an overall theme of contemporary resonance with skills and cultural pride. In neutral comments, the top five keywords are culture, embroidery, tradition, intangible cultural heritage, and attention, indicating objective recognition and knowledge-focused engagement with traditional craftsmanship. For negative comments, the top five keywords are clothes, panda, time, hard work, and video, capturing a sense of distance between ideals and reality.

Figure 5. Positive (left), neutral (middle), negative (right) word cloud diagram.

5. Research Discussion and Suggestions

5.1. Research Results

The results of the questionnaire study indicate that all three principal components have a significant impact on the dependent variable. Specifically, brand communication and perception exert a significant positive influence on both product perception and purchase intention, while the core competitiveness of the product is not affected by the mediating variable, and the cultural foundation value is partially mediated. When breaking down the principal components, four variable dimensions-online exposure, heritage value, offline experience, and brand trust-demonstrate the most significant effects. This outcome reflects the reality that Shu embroidery, as an intangible cultural heritage, has long been confined to a limited cultural circle. To broaden its audience, strong online exposure is crucial for attracting attention and disseminating Shu

embroidery. Compared to documentaries or written records, dynamic video content effectively engages the public, sparking interest and facilitating understanding.

The cultural value of Shu embroidery outweighs its ornamental value, so consumers' conscious recognition of its role in cultural inheritance enhances emotional engagement. This type of consumption is often associated with moral appreciation, strengthening the connection between consumers and Shu embroidery. Price fluctuations have a comparatively smaller effect on consumer behavior. Online awareness provides the most effective support, while offline experiences further deepen consumer impressions. Observing the production process in person allows the public to appreciate the complexity of stitching techniques and the craftsmanship involved, enhancing product appeal. Although the intricate production increases the price, consumers often lack the ability to assess authenticity directly; thus, brand trust-encompassing quality, craftsmanship, and fidelity-becomes a primary consideration, reducing decision-making costs and promoting purchase intention.

Product perception partially mediates the relationship between brand communication and perception. This may be because brand communication guides consumption behavior but does not directly drive purchasing; consumers subsequently evaluate the core value of Shu embroidery products based on brand perception, indicating a progressive relationship between the two factors.

Text analysis reveals that while the public demonstrates a high degree of identification with Shu embroidery, knowledge of its cultural background remains limited, with most cognitive-related comments falling in the neutral range. The social network analysis highlights strong associations with words such as "culture," "tradition," and "inheritance," suggesting that Shu embroidery has substantial market potential through cultural dissemination and heritage promotion. These findings further corroborate the high impact of online experiences identified in the questionnaire results (as shown in Figure 6).

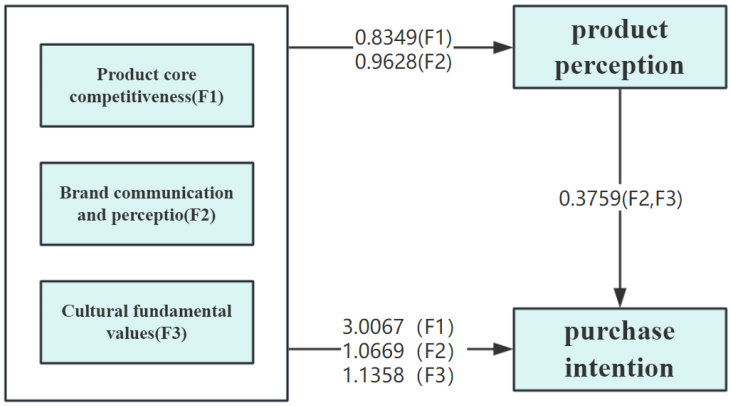

Figure 6. Research results.

5.2. Problem Discovery

Based on the research findings, several issues were identified:

The cultural foundation value does not have a significant impact on product perception but plays a partial mediating role in influencing purchase intention. This highlights a disconnect between the cultural value of Shu embroidery and its product value. While the public recognizes the high cultural value of Shu embroidery, this recognition does not directly enhance perceptions of product quality. Consumers partially reference cultural value when making purchase decisions, so the mediating effect exists but is limited. This suggests that current communication strategies for Shu embroidery rely primarily on cultural promotion and are not effectively linked to its contemporary aesthetics or practical value.

Product core competitiveness significantly affects both product perception and purchase intention, but its effect on purchase intention becomes non-significant once the mediating variable is considered. Although core competitiveness is important for driving purchase intention, integrating product perception into the decision-making process fully absorbs this advantage. This indicates that the core competitiveness of Shu embroidery must be transformed into product identification before influencing purchasing behavior. In other words, product advantages represent a tangible attribute, whereas product perception acts as an emotional driver. Overemphasizing product advantages without cultivating perception may reduce the effectiveness of cultural communication.

Analysis of the negative emotion word cloud from comment data reveals additional insights. Keywords such as "clothes" and "panda" reflect the limited applications and themes of Shu embroidery; terms like "time" and "hard work" convey negative emotions associated with production, which are integrated into public cultural perception and may hinder purchase decisions. The term "Shu brocade" indicates that some consumers confuse Shu embroidery with Shu brocade, reflecting a vague understanding. Words such as "unfortunately," "luxury jewelry," and "cannot afford" directly indicate that the pricing of Shu embroidery has exceeded the financial capacity or psychological expectations of certain consumers.

5.3. Research Recommendations

First, regarding the cultural foundation value of Shu embroidery, because cultural value alone cannot directly enhance product value, the cultural heritage embedded in Shu embroidery should be integrated into production details and product expressiveness. In terms of cultural communication, it is important to highlight both the status and inheritance of this intangible cultural heritage, while also emphasizing its practical value. This includes considering how Shu embroidery can integrate with everyday life and its emotional aesthetic appeal, thereby reducing the practical and psychological distance between the public and the craft. When the public perceives Shu embroidery not merely as a museum exhibit but as a relevant part of modern life, its cultural value can effectively drive market expansion.

Second, the core competitiveness of the product is subject to a complete mediating effect. Therefore, deeply integrating core competitiveness with positive product perception is a key strategy for Shu embroidery to "break the circle." Attributes such as skill and quality should not remain as technical descriptors, but should be communicated in ways that transform them into marketing assets. Through immersive experiences, the contemporary value of Shu embroidery can be conveyed, allowing the craft to establish a more direct, flexible, and emotional connection with consumers, thereby enhancing brand awareness and consumer trust.

Third, to address negative emotions, enhancing the overall product power of Shu embroidery is essential. This can be achieved by incorporating modern elements for aesthetic innovation, expanding product development to create diversified cultural and creative offerings, and implementing strict quality control. At the same time, the pricing of Shu embroidery should not become a market disadvantage. Instead, the inherent production costs can be framed as added value after purchase, fostering emotional resonance among consumers. A tiered pricing strategy based on production costs and difficulty can provide a range of purchasing options, making the products more accessible to the public.

6. Conclusion

From the perspective of public perception, this study empirically investigates the cultural communication and market potential of Shu embroidery by combining questionnaire data and text data. The research not only captures the overall emotional attitude of the public toward Shu embroidery but also identifies the key factors

influencing their willingness to purchase, including product core competitiveness, brand communication and perception, and cultural foundation value. The findings indicate that product perception plays a mediating role, highlighting the importance of integrating core product attributes with positive consumer experiences to enhance market engagement.

Compared with existing literature, this study advances the understanding of Shu embroidery by combining quantitative and qualitative analyses, providing a more comprehensive view of how cultural heritage, product attributes, and public sentiment interact to shape consumer behavior. The text data analysis further reveals that while the public exhibits a high degree of cultural identification with Shu embroidery, there are gaps in cultural knowledge and understanding, pointing to opportunities for educational and promotional interventions. Moreover, the study shows that modern marketing strategies, immersive experiences, and digital communication can effectively expand the audience beyond traditional cultural circles, suggesting practical pathways for the modernization and marketization of Shu embroidery.

Despite these contributions, this study faces limitations, particularly in the sample size and scope of data sources, which may not fully represent the entire population of potential consumers. Future research could expand the sample, explore longitudinal effects, and examine cross-cultural perspectives to deepen the understanding of consumer perception and market potential. Additionally, further studies could investigate the integration of modern design, interactive digital experiences, and diversified product applications to strengthen the connection between Shu embroidery's cultural value and its market appeal.

In summary, this research emphasizes that the modernization, emotionalization, and marketization of Shu embroidery require a coordinated approach: leveraging cultural heritage to enrich product value, enhancing core competitiveness through positive consumer perception, and strategically addressing public emotions and market expectations. By doing so, Shu embroidery can not only achieve broader social dissemination but also sustain its vitality in contemporary cultural and economic contexts.

Funding: Geely College's 2024 school-level scientific research project, Generative Artificial Intelligence Empowers Shu Embroidery Pattern Innovation, 2024xskqp024.

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