

A Comparative Analysis of Cross-Border E-commerce Payment Tools and User Profiling for Shadow Puppetry Intangible Cultural Heritage

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Abstract: With the booming development of cross-border e-commerce, the international sales of shadow puppetry intangible cultural heritage products have gained new opportunities, where the application of fintech tools plays a crucial role. This paper conducts a comparative analysis of operational efficiency and risk control differences between shadow puppetry e-commerce enterprises that utilize cross-border payment systems, supply chain finance, and robo-advisory tools, and those that do not. By leveraging cross-border e-commerce platform data, the study delves into user characteristics across different age groups, interests, and geographic demographics, ultimately designing targeted fintech marketing strategies. These efforts aim to enhance financial service capabilities for shadow puppetry e-commerce and promote its sustainable growth in international markets. The research demonstrates that strategic fintech applications can significantly improve operational efficiency and risk management for overseas enterprises, while precision marketing solutions effectively attract target audiences and expand market share.

Keywords: Shadow Puppetry Intangible Cultural Heritage; Cross-Border E-commerce; Payment Tools; User Profiling; Fintech

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1.Introduction

Amid the deep integration of globalization and the digital economy, cross-border e-commerce has emerged as the driving force behind Chinas foreign trade transformation. According to data from the General Administration of Customs, Chinas cross-border e-commerce import and export volume reached 2.63 trillion yuan in 2024, marking a 10.8% year-on-year increase that significantly outpaced the overall foreign trade growth rate during the same period. Meanwhile, the commercialization and internationalization of intangible cultural heritage continue to accelerate. Shadow puppetry, a traditional art form with over two millennia of history, combines painting, carving, music, and performance into a unique cultural treasure. Its profound cultural heritage and distinctive aesthetic value are gradually unlocking cross-border sales potential.

But shadow puppetry is an intangible cultural heritage^[1]Cross-border e-commerce continues to face multiple practical challenges: cultural barriers in market perception, difficulties in aligning manual production with cross-border logistics, inefficient payment settlement systems, and insufficient understanding of target market demands. Among these, the

compatibility of financial services and precise alignment with user needs have become critical constraints. The security, timeliness, and cost-effectiveness of cross-border payments directly impact transaction conversion efficiency, while gaps in understanding overseas users lead to wasted marketing resources and hinder effective market penetration. Against this backdrop, innovative applications of fintech tools and precise user profiling offer new pathways for the sustainable development of shadow puppetry cross-border e-commerce as an intangible cultural heritage.

1.1 Research Significance

The theoretical significance of this study lies in filling existing research gaps: While current academia predominantly focuses on comparing cross-border e-commerce payment tools or marketing models for single intangible cultural heritage (ICH) products, systematic analysis of fintech tools impact on enterprise operations for categories with strong cultural attributes and unique product forms—such as shadow puppetry—along with user profiling-based service optimization remains relatively scarce. Grounded in the distinctive characteristics of shadow puppetry ICH, this study integrates fintech applications with cross-border user profiling analysis. By enriching the research framework for ICH cross-border e-commerce, it reveals the practical value and operational mechanisms of fintech in specific scenarios, providing new perspectives for related academic research.

In practical terms, research findings can directly serve industrial development: They provide payment tool selection guidance for cross-border e-commerce enterprises in the shadow puppetry intangible cultural heritage sector, helping reduce transaction costs and manage cross-border risks. Additionally, they enable the design of targeted marketing strategies based on user profiles, enhancing market promotion efficiency and user retention. Furthermore, the research conclusions can inform government policies supporting the global expansion of intangible cultural heritage and assist financial institutions in optimizing cross-border services, ultimately achieving a win-win outcome for both cultural dissemination and commercial value of shadow puppetry.

1.2 Research status

A review of global and domestic research reveals distinct priorities: international studies emphasize security and cost control in cross-border e-commerce payment tools, while domestic research focuses on applicability and risk management. In the realm of intangible cultural heritage (ICH) cross-border e-commerce, foreign scholars prioritize international market acceptance of cultural products, whereas domestic research concentrates on development models and marketing strategies. Regarding user profiling applications, international studies have accumulated extensive big data modeling expertise, while domestic research predominantly targets general product categories. However, existing studies exhibit three critical limitations: lack of specialized research on shadow puppetry ICH, insufficient integration of fintech with user profiling, and weak empirical data support. This study establishes theoretical foundations through literature review, conducts case analyses of representative enterprises, and employs cross-border platform transaction data for empirical verification. By applying comparative analysis to clarify tool value and user differences, we construct an integrated framework of “tool comparison-user insights-solution optimization,” achieving innovative advancements in research perspectives, methodologies, and practical applications.

2.Relevant Theoretical Basis

Cross-border e-commerce refers to international commercial activities where trading entities from different customs territories conduct transactions through e-commerce platforms, complete electronic payment settlements, and deliver goods via cross-border logistics. Its core characteristics include globalized transactions, digitized processes, and cross-border logistics. The theoretical framework encompasses transaction cost theory, long-tail theory, and platform economy theory. Transaction cost theory suggests that cross-border e-commerce significantly reduces information search and fulfillment costs by simplifying processes and eliminating intermediaries, enabling niche intangible cultural heritage products like shadow puppetry to break geographical barriers and reach global target audiences. Long-tail theory indicates that the combined market potential of niche products in the internet era can rival mainstream products. Through the aggregation effect of cross-border e-commerce, shadow puppetry can meet global niche demands and achieve economies of scale. Platform economy theory emphasizes that cross-border e-commerce platforms lower entry barriers through improved regulations and services, allowing shadow

puppetry enterprises to rapidly enter international markets by leveraging platform traffic.

FinTech (Financial Technology) is an innovative business model that leverages big data, artificial intelligence, blockchain, and other technological advancements to enhance financial services. Its core objectives are to improve efficiency, reduce costs, and strengthen security, encompassing three key theories: technology-driven theory, financial innovation theory, and risk control theory. The technology-driven theory posits that big data provides precise credit evaluation for shadow enterprises supply chain financing, while artificial intelligence optimizes capital allocation recommendations. Financial innovation theory highlights how real-time exchange rate conversion for cross-border payments and digitalized supply chain processes can precisely meet the operational needs of shadow enterprises in global markets. Risk control theory demonstrates that blockchains tamper-proof characteristics combined with intelligent risk monitoring systems can enhance operational efficiency while effectively managing transaction risks.

User profiling is a virtual model constructed through data collection and analysis, with its core value lying in accurately understanding user needs. The theoretical framework encompasses three key components: data acquisition, feature extraction, and profile application. The data acquisition theory emphasizes integrating multidimensional data including demographics, behavioral patterns, and preference preferences. For shadow puppet e-commerce, it specifically requires collecting user preferences regarding themes and craftsmanship. The feature extraction theory focuses on extracting core attributes from massive datasets, such as identifying purchasing frequency and price preference characteristics of high-value users. The profile application theory advocates integrating user profiles with business scenarios to enhance conversion efficiency through personalized recommendations and targeted marketing.

3. Development Status of Cross-Border E-Commerce of Shadow Puppetry Intangible Cultural Heritage and Application of Fintech Tools

The cross-border e-commerce of shadow puppetry, a UNESCO Intangible Cultural Heritage, currently operates through three primary models. The first involves listing on global platforms like Amazon, eBay, and Alibaba International Station, leveraging their massive traffic to drive sales. This approach, with its low entry barriers and quick returns, has become the preferred choice for most small and medium-sized shadow puppetry businesses. The second model focuses on building dedicated e-commerce sites, utilizing social media platforms like Facebook and Instagram to showcase traditional craftsmanship and performance videos, ideal for companies with established brand recognition. The third strategy partners with overseas cultural institutions such as museums and art galleries, combining customized product sales with cultural exhibitions to significantly enhance cultural value. In terms of target markets, Europe and America dominate as consumers in these regions demonstrate strong cultural affinity and purchasing power for Eastern traditions. Southeast Asia is experiencing rapid growth through geographical and cultural proximity coupled with efficient logistics. Meanwhile, Japan and South Korea maintain stable demand due to their appreciation for traditional craftsmanship.

The industry still faces three core challenges. In payment processing, traditional wire transfers suffer from lengthy processing times and high fees, while payment methods remain underdeveloped in certain markets—such as Southeast Asian users preferred e-wallet channels that are not fully integrated. Regarding market positioning, companies lack clear understanding of overseas user needs, resulting in product and marketing homogenization that fails to account for regional cultural preferences. Supply chain issues include time-consuming shadow puppet production, inconsistent cross-border logistics, and delayed responses from traditional supply chain financing, making it difficult to meet capital turnover demands.

Fintech tools^[2] The application of shadow puppetry in cross-border e-commerce has formed a differentiated landscape: In cross-border payment sectors, third-party platforms like PayPal have become mainstream choices due to their multi-currency support and short settlement cycles. Their commercial collection rates range between 3.4%-4.4%, with fixed fees per transaction and mandatory handling fees for withdrawals to domestic accounts. Blockchain payments, despite offering lower fees (0.5%-1%) and minute-level settlement times, remain limited to large transactions due to user unfamiliarity. Traditional wire transfers continue to shrink in application due to high costs and delayed processing. In supply chain finance, order financing has gained popularity among shadow puppetry enterprises for its quick application and disbursement processes, allowing companies to secure loans for raw material procurement through platform orders. Warehouse receipt pledge

financing, however, remains underutilized as shadow puppetry products are difficult to value, with most SMEs still relying on self-funded operations and weaker risk resilience. Regarding smart tools, high-threshold robo-advisors are adopted mainly by medium-to-large enterprises for fund management, while intelligent risk control tools are more widely used to monitor abnormal transactions and reduce fraud risks. Companies without these tools exhibit significantly higher risk incidence rates compared to their users.

4.Comparative Analysis of Cross-border E-commerce Fintech Tools for Intangible Cultural Heritage Shadow Puppetry

Among cross-border payment solutions, third-party payment systems demonstrate the most comprehensive advantages. Platforms like PayPal, which operate globally across major markets, support multi-currency settlements with 1-3 day processing times. While their fees exceed blockchain-based solutions, they align well with shadow puppet product manufacturers preference for small-to-medium transactions and enjoy high user acceptance. Blockchain payments excel in high-value transactions, offering near-real-time processing and competitive fees that meet demands like overseas theater procurement orders. However, limited market awareness and regulatory constraints prevent full-scale adoption. Traditional wire transfers remain suitable only for large supplier settlements with low time sensitivity. Their 3%-5% fees and 3-7 day processing cycles no longer meet shadow puppet enterprises capital turnover requirements.

Among supply chain financial instruments, order financing proves most suitable for shadow puppet enterprises. This tool requires only platform-verified orders and business licenses for application, with a 1-2 day disbursement cycle and financing coverage reaching 60%-80% of order value. The funds are specifically allocated for raw material procurement, precisely aligning with shadow puppet production cycles of 15-30 days. In contrast, warehouse receipt pledge financing demands complex documentation including warehouse receipts and valuation reports, with a 3-5 day disbursement period and financing coverage limited to 50%-60% of goods value. Due to the significant variations in shadow puppet craftsmanship complexity, valuation challenges make this financing method only applicable for temporary working capital needs of enterprises with excess inventory.

Comparative analysis of intelligent tools reveals that smart risk control systems demonstrate broader applicability. Their core functions—fraud detection and credit risk assessment—effectively maintain low fraud rates without requiring specific enterprise size, making them particularly suitable for small and medium-sized shadow enterprises with weaker risk resilience. In contrast, robo-advisors primarily provide capital allocation recommendations for medium-to-large enterprises with substantial annual transaction volumes. While these tools can enhance annualized returns by 1%-2% and reduce foreign exchange losses, they show relatively low demand among most small and medium-sized shadow enterprises.

5.Empirical Analysis of Cross-Border E-commerce User Profiles of Shadow Puppetry Intangible Cultural Heritage

Based on cross-border e-commerce platform transaction data and market research reports on intangible cultural heritage (ICH) products, the core characteristics of ICH cross-border users can be defined through three aspects. Demographically, the age distribution shows significant concentration, with users aged 25-45 forming the core group. Notably, the proportion of 18-30 year-olds has increased significantly. Data from 2024 indicates that 40% of ICH product buyers are post-95s generation, a demographic that values cultural identity while pursuing social attributes. Geographically, users from Europe and America account for the largest share, with the United States, United Kingdom, and Germany being primary source countries. Southeast Asian markets like Indonesia and Malaysia are experiencing rapid growth, while Japan and South Korea maintain stable market shares. Regarding income levels, middle-to-high-income groups earning over \$8,000 monthly constitute the main consumer base, demonstrating stronger willingness to pay for high-quality shadow puppet products.

In terms of consumer behavior characteristics, purchase frequency shows seasonality^[3]The purchasing patterns show distinct regional variations. During holiday gift shopping and cultural events, users with an average of 2-3 annual purchases dominate the market. Price preferences indicate a clear hierarchy: mid-range products (US\$500-2000 per order) account for over 70% of transactions, while premium customized items primarily target collectors. Payment methods reveal regional preferences:

PayPal remains the top choice for Western users (over 50% of transactions), whereas Southeast Asian consumers prefer local e-wallets like GrabPay and Gcash, with credit cards and bank transfers being less common.

In terms of interest preferences, product demand exhibits a dual trend of traditional and innovative elements. Classic historical themes like “Journey to the West” and “Romance of the Three Kingdoms” remain dominant, while customized products such as family portraits and corporate shadow puppet logo designs are experiencing rapid growth. Regarding purchasing motivations, cultural collectibles and holiday gift-giving account for over 70% of purchases, reflecting users high recognition of shadow puppet cultures value. For information acquisition, social media dominates with Facebook and Instagram driving 50% of traffic, followed by cross-border platform recommendations and cultural websites, while recommendations from friends and family are the least popular.

6.Design of Fintech Marketing Solutions Based on User Profiles

Product promotion requires tailored strategies for different user groups: For core users aged 25-45 in Europe and America, share shadow puppetry short videos and cultural stories on Facebook and Instagram. Leverage AI-powered business assistants on platforms like Alibaba International Station to optimize product detail pages, boost search visibility, and launch a “Shadow Puppet Products + Online Intangible Cultural Heritage Courses” collection package. For Southeast Asian users, design themed products aligned with local festivals like Eid al-Fitr and Songkran, and push discount information through local e-wallet channels. For high-frequency buyers, establish a membership system offering exclusive customization services and priority access to cultural events.

Payment service optimization^[4]Prioritize adaptability and security: To address regional preference differences, we will enable multi-channel payment interfaces between PayPal and Southeast Asian local e-wallets. Users paying through local e-wallets will enjoy reduced fees to boost payment conversion rates. For customized orders exceeding \$2,000 per transaction, we will introduce blockchain payment options highlighting their “10-minute settlement” advantage, along with real-time payment progress tracking. A comprehensive smart risk control system will be deployed to monitor suspicious transactions in real-time, with secondary verification through SMS codes. We will also publicly disclose our “Zero Loss for Fraudulent Transactions” policy to strengthen user trust.

Supply chain finance must precisely align with enterprise needs: To support stable orders from core users, we promote order financing services for shadow puppet production enterprises by simplifying application procedures. Businesses only need to upload platform orders and business licenses to complete the process, with loan disbursement within 24 hours. First-time users receive preferential interest rates. Through partnerships with overseas warehouses, we establish standardized evaluation systems for shadow puppet products, setting assessment criteria based on production complexity and market popularity. This enhances the efficiency of warehouse receipt-backed financing, while providing targeted financial support for inventory overstock products during holiday seasons.

The implementation of the plan requires establishing a three-tiered safeguard system: Technologically, we collaborate with licensed fintech companies to ensure stable operation of payment interfaces and risk control systems, while regularly updating algorithms to adapt to market changes. Data-wise, we strictly comply with the EU GDPR and Southeast Asian personal information protection regulations, establishing data security management and backup mechanisms to protect user information. In terms of training, we provide fintech tool usage training covering payment system operations and financing application processes, while offering 24/7 online customer support to promptly resolve enterprise issues.

7.Research Conclusions and Prospects

The study demonstrates that fintech tools significantly enhance operational efficiency in cross-border e-commerce for shadow puppetry, a UNESCO Intangible Cultural Heritage. Third-party payment solutions reduce costs by 30%-40% and cut processing times by 60%-70% compared to traditional wire transfers. Companies utilizing order financing achieve 50% faster capital turnover and 25% higher order fulfillment rates, while implementing smart risk control systems further optimizes operations.^[5]Enterprises with fraud risk mitigation systems demonstrate significantly lower fraud rates compared to those relying on manual audits. The core cross-border shadow puppetry intangible cultural heritage users exhibit distinct

characteristics: predominantly middle-to-high-income individuals aged 25-45 from Western countries, who prefer traditional themes and mid-range products. Their purchasing motivations focus on collecting and gifting, while they actively seek information through social media and utilize third-party payment platforms. A user profiling-based fintech marketing strategy, combining targeted promotions, payment optimization, and financial support, can effectively enhance corporate market share and customer satisfaction.

This study has two limitations: First, user data primarily originates from mainstream cross-border platforms, with insufficient coverage of emerging markets and independent site users. Second, the impact of cultural differences on users acceptance of financial tools remains underanalyzed, requiring further validation of the solutions cross-cultural adaptability. Future research should expand data sources to include multiple platforms and emerging markets, enhancing the generalizability of conclusions. It should also explore the mechanisms behind cultural influences to optimize regional adaptability of solutions. Additionally, investigating new technologies like metaverse exhibition halls and virtual payment systems could improve user experience through immersive shadow puppet performances, thereby promoting deeper global dissemination of shadow puppet culture.

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Conflict of Interests

The authors declare that there is no conflict of interest regarding the publication of this paper.

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