Cultural and Arts Studies, 2026, Volume 2, Issue 3
https://www.bbwpublisher.com/journal/CAS
Online ISSN: 3083-3949
Print ISSN: 3083-3957

Digitalization Empowerment and Collaborative Innovation between Henan and Borderland: Research on the Path of Activating Silk Road Textile Heritage from the Perspective of Cultural Enrichment of Borderland

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Abstract: Taking the Cultural Enrichment of Xinjiang strategy as its analytical standpoint, this study adopts cross-provincial collaborative innovation between Henan and Xinjiang as the entry point of investigation. Drawing on the abundant textile cultural heritage accumulated in the Central Plains, its mature industrial infrastructure, as well as the well-preserved, original intangible assets of Silk Road textile heritage in Xinjiang, this paper dissects the internal mechanisms and practical values of heritage revitalization driven by digital technologies. By sorting out the shared cultural roots and resource complementarity of textile civilizations across Henan and Xinjiang, the paper summarizes prevailing practical obstacles facing Silk Road textile heritage. It further establishes an operational framework for heritage activation, where digital technologies serve as technical support, cross-regional cooperation acts as the carrier, and integrated culture-tourism development functions as practical application scenarios. Targeted implementation pathways are put forward accordingly. This research intends to advance the living inheritance and industrial upgrading of Silk Road textile intangible cultural heritage. It also delivers practical references within textile culture research to sustain and regularize the promotion of the Cultural Enrichment of Xinjiang strategy.

Keywords: Cultural enrichment of Xinjiang; Henan-Xinjiang collaborative innovation; Digital empowerment; Silk Road textile heritage

Online publication: June 30, 2026

1. Introduction

The ancient Silk Road functioned as a pivotal channel for economic interaction and intercultural learning between Eastern and Western civilizations, nurturing a sophisticated and diversified textile culture. Textile

traditions of Henan and Xinjiang stem from identical cultural origins and possess mutually complementary resource endowments, laying inherent foundations for cross-administrative collaborative preservation and innovative development. Nevertheless, current cultural exchanges between Henan and Xinjiang mostly rely on short-term performances and episodic exchange events, lacking durable collaborative linkage mechanisms. Such limitations prevent precious Silk Road textile heritage from meeting the cultural development demands of the new era, and the cultural value underpinning Xinjiang's cultural enrichment has not been fully unleashed. Against this backdrop, anchored in the strategic context of Cultural Enrichment of Xinjiang, this paper focuses on two dimensions: coordinated regional development and digital-intelligent empowerment. It systematically examines feasible pathways to revitalize Silk Road textile heritage. The findings offer theoretical foundations and actionable solutions for the conservation-oriented development of Silk Road intangible heritage, deeper integration of cultural industries in Henan and Xinjiang, and the full implementation of the Cultural Enrichment of Xinjiang strategy.

2. Core concepts and theoretical foundations

2.1. Definition of core concepts

2.1.1. Silk Road textile heritage

Silk Road textile heritage constitutes a vital branch within the broader Silk Road cultural heritage system. It encompasses tangible textile relics and intangible cultural resources preserved along the Silk Road, with particular relevance to Xinjiang. Concretely, it covers traditional weaving craftsmanship, ethnic pattern genealogy, manual production workflows, folk cultural contexts, and surviving textile artifacts from successive historical periods. Representative resources include the weaving craft of Adelies silk, West Asian patterned brocade, and ethnic hand embroidery. Distinct from static cultural relics, Silk Road textile heritage represents living cultural heritage. It comprehensively records how Chinese textile techniques spread westward and how multiple ethnic cultures merged and innovated, embodying the inclusive and unified essence of Chinese civilization [1].

2.1.2. Henan-Xinjiang synergy

Henan-Xinjiang synergy refers to a cross-regional linked development model built on shared cultural origins, complementary resources and differentiated industrial strengths of Henan and Xinjiang. Henan boasts deep cultural reserves and mature systems in textile manufacturing, creative design research, digital media communication and university talent training. Xinjiang retains original intangible heritage resources, distinctive Silk Road regional culture, and untapped potential within cultural tourism industries. The core objective of this collaborative model is to break administrative boundaries and facilitate bidirectional flow and optimal allocation of technology, talent, creative ideas and market resources [2].

2.1.3. Digital-intelligent empowerment for heritage revitalization

Digital-intelligent empowerment for heritage revitalization represents an emerging development paradigm for intangible cultural heritage preservation and innovation amid the digital economy. Leveraging intelligent digital tools such as 3D scanning and virtual reality, researchers can carry out digital archiving, cultural content decoding, creative transformation and market-oriented promotion for traditional textile heritage. Unlike conventional passive conservation models, digital-intelligent revitalization follows the philosophy

of living inheritance. It transfers ancient textile craftsmanship out of traditional workshops and museum spaces into digital scenes and modern consumption contexts, enabling permanent preservation, innovative regeneration and sustainable development of cultural heritage.

2.2. Theoretical foundation

2.2.1. Theory of cultural enrichment of Xinjiang

Cultural Enrichment of Xinjiang is guided by advanced socialist culture and nourished by fine traditional Chinese culture. It fosters a positive social atmosphere and spiritual civilization construction in Xinjiang and strengthens cultural belonging and ethnic identity among all local ethnic groups.

2.2.2. Theory of regional coordinated development

The core of regional coordinated development theory lies in dismantling regional segmentation and resource barriers. It promotes free circulation and complementary advantages of production factors, including talent, technology, culture, and industries, across regions, generating overall benefits that a single region cannot achieve independently. Henan and Xinjiang differ greatly in industrial structures, technological levels and cultural resources, forming strong complementarity. The Central Plains' industrial and technological strengths can make up for the weak industrialization of Xinjiang's intangible heritage, while Xinjiang's authentic cultural resources enrich the core content of creative cultural industries. Guided by regional coordination theory, resources from both regions can be efficiently integrated to maximize the cultural and industrial value of Silk Road textile heritage.

2.2.3. Living inheritance theory of intangible cultural heritage

The living inheritance theory of intangible cultural heritage adopts a people-centered core principle. It rejects static, specimen-style conservation thinking and highlights that intangible heritage can sustain vitality only through practical inheritance, market application and cultural communication. Traditional written documents and physical collections merely preserve the outer form of heritage rather than craft details, folk implications and inheritance lineages. Cross-regional collaboration plus digital-intelligent empowerment can expand inheritance channels, enlarge inheritor groups and renovate inheritance forms. This allows ancient textile crafts to escape the confinement of small-scale master-apprentice teaching, integrate into modern society and achieve long-term, sustainable living transmission.

3. Basis and value of coordinated textile cultural development between Henan and Xinjiang from the perspective of cultural enrichment of Xinjiang

3.1. Realistic foundation for coordinated textile cultural development between Henan and Xinjiang

3.1.1. Cultural homology: Continuity of silk textile heritage along the Silk Road

The Central Plains serves as the birthplace of Chinese textile civilization. Textile cultures of Henan and Xinjiang originate from the same cultural root and maintain historical continuity, standing as tangible evidence of long-standing communication and integration among various ethnic groups throughout history. This creates a solid cultural foundation for joint efforts of Henan and Xinjiang to revitalize cultural heritage.

3.1.2. Resource complementarity: Dual empowerment of industry and intangible heritage

Textile cultural resources in Henan and Xinjiang form a clear complementary structure. Xinjiang holds rare, well-preserved Silk Road intangible heritage assets with high cultural recognition and distinctive regional features. Meanwhile, it faces challenges including underdeveloped digital infrastructure, insufficient creative design capacity and low efficiency in market transformation. As a core provincial player in China's textile sector, Henan owns mature systems for creative development, digital communication and talent training. It can deliver comprehensive support in technology, human resources and market channels for Xinjiang's textile intangible heritage. Xinjiang supplies high-value cultural resources, while Henan exports industrial and creative capabilities. This complementary resource structure constitutes core support for collaborative heritage activation.

3.1.3. Policy support: Mutual strategic benefits boost coordinated development

In recent years, China has continuously rolled out strategic deployments covering Cultural Enrichment of Xinjiang, east-west cultural tourism cooperation, digital preservation of intangible heritage and deep culture-tourism integration. Relevant policies explicitly encourage cross-regional cultural collaborative innovation and industrialization of intangible cultural heritage[3].

3.2. Value of collaborative digital empowerment for revitalizing Silk Road textile heritage under Henan-Xinjiang cooperation

3.2.1. Heritage value: Addressing inheritance crises and realizing living sustainability

Traditional textile intangible heritage faces prominent risks of craft discontinuity. Conventional paper records and static archives cannot fully capture weaving skills, material processing methods and implicit knowledge embedded in pattern details. Using 3D scanning, dynamic image recording and cloud database storage, researchers can permanently document complete craft workflows and cultural connotations, realizing permanent digital preservation of intangible heritage resources. Combined with joint talent training programs between Henan and Xinjiang, inheritance channels can be widened, effectively easing the challenge of narrow inheritance groups and guaranteeing continuous living transmission of textile intangible heritage.

3.2.2. Industrial value: Facilitating industrial transformation and increasing cultural tourism revenue

Digital technologies enable modern transformation of traditional textile patterns and ancient weaving techniques. Breaking the limitations of conventional product forms, heritage resources can be combined with contemporary aesthetic tastes and consumption scenarios to develop diversified products and raise the added value of intangible heritage commodities. Drawing on Henan's complete textile industrial chains, e-commerce channels and brand operation experience, Xinjiang's textile intangible heritage can transform from manual craftsmanship into market-oriented, industrial cultural products. This extends cultural tourism industrial chains, fosters new business formats and drives local cultural tourism economy and income growth of grassroots communities in Xinjiang.

3.2.3. Communication value: Innovating Silk Road narratives and telling Chinese stories

Digital platforms, including cloud exhibition halls, short-video distribution, and VR immersive experiences, break geographical restrictions. Border-region ethnic textile intangible heritage can transcend regional boundaries and gain nationwide public exposure.

4. Practical dilemmas in activating Silk Road textile heritage and Henan-Xinjiang coordinated development

4.1. Simplified digital conservation and limited application scenarios for digital-intelligent empowerment

Most intangible heritage resources in Xinjiang have only undergone basic text and image archiving, lacking in-depth digital construction. Digital technologies are applied in relatively narrow scenarios, mostly limited to static online display. Deep integration between digital technology and heritage conservation, industrial development and cultural communication remains insufficient. Furthermore, inconsistent data collection standards for intangible heritage across regions lead to isolated, independent data storage and severe data silo issues. High-quality cultural resources cannot be shared and reused, resulting in resource waste.

4.2. Incomplete Henan-Xinjiang collaboration mechanism and low efficiency of linked development

At present, Henan and Xinjiang have not established specialized long-term collaborative mechanisms targeting Silk Road textile heritage revitalization. Regular communication platforms between the two regions are absent, hindering the free flow of talent, technology, creative resources and capital. Existing cooperation tends to prioritize publicity and exhibitions while neglecting practical implementation and transformation. In-depth joint initiatives such as co-research and development, industrial incubation, brand co-construction and collaborative technology innovation remain scarce. Cross-regional cooperation also lacks targeted policy and financial support. Ambiguous rights and responsibilities among stakeholders reduce participation willingness, making it hard to form stable, long-term bidirectional empowerment patterns.

4.3. Deficient talent system and severe shortage of high-skilled professionals

Insufficient talent supply acts as the core bottleneck restricting the revitalization of Silk Road textile heritage.

4.4. Weak industrial transformation capacity and severe product homogenization

The industrial development of Silk Road textile heritage stays at the preliminary exploratory stage with obvious shortcomings. In terms of product innovation, most cultural derivatives merely copy traditional patterns without digging deep into cultural connotations and historical contexts, leading to serious homogenization. Such products fail to meet modern aesthetic preferences and market demands. From the perspective of industrial chains, the industry remains confined to primary manual processing, missing core value-adding links and resulting in low product added value. Regarding culture-tourism integration, textile intangible heritage is not closely integrated with tourism scenes and digital consumption scenarios. New business models develop slowly, and distinctive cultural brands are lacking [4].

5. Optimized pathways for digital empowerment and cultural enrichment to revitalize Silk Road textile heritage from Henan-Xinjiang cultural integration

5.1. Build standardized digital conservation systems to achieve precise and living heritage preservation

Centered on digital technologies, a dedicated digital conservation system for Silk Road textile heritage should be constructed. Cultural and tourism authorities of Henan and Xinjiang, university research teams

and heritage protection institutions can jointly carry out comprehensive surveys of regional textile heritage resources. High-definition shooting, 3D scanning and digital twin technologies can record weaving workflows, pattern styles, material characteristics, folk contexts and historical backgrounds comprehensively, supporting the construction of a dedicated Silk Road textile heritage digital resource database. Unified technical standards shall be formulated to break regional data barriers and realize joint construction, shared access and collaborative utilization of heritage resources between the two provinces. Meanwhile, expand digital application scenarios and build cloud-based digital exhibition halls for textile heritage, delivering permanent digital preservation and panoramic communication of Silk Road textile heritage.

5.2. Improve Henan-Xinjiang collaborative mechanisms and build cross-regional coordinated development patterns

Efforts should be made to fully remove administrative barriers and establish sustainable collaborative development frameworks linking Henan and Xinjiang.

5.3. Cultivate compound talent teams to consolidate industrial development foundations

Targeting weaknesses in talent cultivation, a two-way connected, multi-level training system for interdisciplinary talents should be established between Henan and Xinjiang. Regular empowerment training for traditional inheritors will be organized to strengthen their innovative capacity.

5.4. Deepen industrial innovation and transformation to foster new intangible heritage tourism business forms

Guided by market demand, researchers can further explore cultural symbols, Silk Road civilization connotations and narratives of ethnic integration carried by heritage resources. Simple pattern replication should be abandoned to realize modern creative transformation of cultural meanings. Henan's design resources and digital strengths, alongside its industrial bases, e-commerce platforms and sales channels, can be leveraged to expand market access for heritage products. Further culture-tourism integration can incorporate weaving experience activities, digital exhibitions, creative consumption and intangible heritage study tours into Xinjiang's tourism systems. Immersive experiences and themed study tour products can be developed to build unique cultural IP themed on Silk Road textiles.

5.5. Innovate digital-intelligent communication paradigms and strengthen practical outcomes of cultural enrichment of Xinjiang

Reconstruct the cultural communication system of the Silk Road textile industry. Centered on the core goal of Cultural Enrichment of Xinjiang, optimize communication content and forms. Adjust narrative priorities to highlight cultural homology, ethnic integration and symbiotic relations along the Silk Road. Produce high-quality content including short videos, digital illustrations and special documentary series, vividly narrating stories of ethnic unity and cultural integration behind Silk Road textile heritage.

6. Conclusion and outlook

Silk Road textile heritage serves as a vital carrier for inheritance and development of Silk Road civilizations. It records the formation of the pattern of multi-ethnic unity within Chinese civilization and constitutes

valuable cultural resources for advancing Xinjiang's cultural revitalization projects in the new era. Under the rapid development of the digital economy, digital-intelligent empowerment and Henan-Xinjiang cooperation represent core approaches to tackle inheritance difficulties and realize living activation of Silk Road textile heritage. Textile cultures of Henan and Xinjiang share common origins and coexist with complementary resource endowments and differentiated industrial advantages, creating favorable conditions for coordinated development. By constructing standardized digital-intelligent preservation systems, improving cross-regional collaboration mechanisms, cultivating interdisciplinary talent teams, promoting industrial innovation and transformation, and renovating digital communication modes, stakeholders can comprehensively advance protective inheritance, innovative development and industrial upgrading of Silk Road textile heritage. These measures consolidate the cultural foundation of cultural enrichment in Xinjiang and help forge a strong sense of community for the Chinese nation.

Funding

General Project of Humanities and Social Sciences Research in Henan Universities, "Research on Digitalization and Collaborative Innovation between Henan and Xinjiang from the Perspective of Cultural Enrichment of Xinjiang" (Project No.: 2027-ZDJH-253)

Disclosure statement

The author declares no conflict of interest.

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