

Mechanism Evolution, Effects, and Adaptive Pathways of Digital-Intelligent-Driven Deep Integration of Culture and Tourism: A Case Study of Henan Province

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ABSTRACT

In the context of the digital economy, digital-intelligent transformation is profoundly reshaping the modes through which culture and tourism are integrated, yet the internal mechanisms through which it drives deep integration remain insufficiently examined. Taking Henan Province as the research context, the integration of culture and tourism has undergone a staged transition from policy-driven to data-driven development and from exogenous promotion to endogenous evolution. Digital-intelligent transformation facilitates the shift from resource-based aggregation to mechanism-based co-evolution by reconfiguring factor allocation patterns, cultural production logic, and governance structures. However, the realization of its effects is still constrained by uneven digital infrastructure, insufficient creative supply, imbalanced industrial collaboration, and lagging institutional adaptation. Addressing these challenges requires systematic adjustment and restructuring of the driving mechanisms, particularly through factor integration, creative integration, industrial coordination, and collaborative governance.

KEYWORDS

Digital-intelligent transformation; Culture tourism integration; Driving mechanisms; Effects; Henan Province

1. INTRODUCTION

The Report to the 20th National Congress of the Communist Party of China explicitly calls for “shaping tourism with culture and highlighting culture through tourism, and promoting the deep integration of culture and tourism” [1], while simultaneously emphasizing the need to “advance the deep integration of the digital economy and the real economy” [2]. These strategic directives provide fundamental guidance for the transformation and upgrading of the cultural and tourism industries in the new era. Furthermore, the Third Plenary Session of the 20th CPC Central Committee proposes to “improve institutional mechanisms for the deep integration of culture and tourism”, thereby strengthening institutional support for high-quality development in this field. Against this backdrop, digital-intelligent transformation has become a critical variable driving culture tourism integration from resource-based aggregation toward systemic reconstruction. As an important cradle of Chinese civilization and a major cultural province, Henan possesses abundant cultural resources and a profound historical heritage, occupying a distinctive position within China’s cultural and tourism landscape. In recent years, Henan has regarded the integration of culture, tourism, and cultural creativity as a key lever for high-quality development, actively promoting practices such as smart scenic areas, digital museums, immersive performances, and digital exhibitions of intangible cultural heritage. These initiatives have significantly enhanced the scale and vitality of the cultural and tourism industries.

However, from a holistic perspective, Henan's culture tourism integration still faces challenges such as insufficient integration depth, fragmented digital platforms, inconsistent technical standards, and inadequate support from interdisciplinary talents. As a result, the systemic empowering effects of digital-intelligent transformation have not yet been fully realized. With the rapid development of the digital economy, the digitalization and intelligent transformation of the cultural and tourism industries is no longer merely a technological option, but rather a profound transformation of industrial structures and operational mechanisms. Under these circumstances, understanding the internal logic through which digital-intelligent transformation enables deep culture tourism integration at the mechanism level, and promoting a shift from policy-driven and project-driven integration toward mechanism-driven integration, has become a critical issue for achieving high-quality development of culture and tourism.

2. EVOLUTIONARY LOGIC OF DIGITAL-INTELLIGENT-DRIVEN DEEP CULTURE-TOURISM INTEGRATION IN HENAN

In the context of digital-intelligent transformation, deep culture-tourism integration in Henan has not occurred instantaneously. Instead, it has gradually evolved under the combined influence of policy guidance, technological progress, and market demand. Its driving mechanisms have experienced a phased transition from policy dominance to data-driven dynamics, and from exogenous promotion to endogenous evolution.

Following the establishment of the Ministry of Culture and Tourism in 2018, culture tourism integration was elevated to a national strategy. Henan took the lead in proposing and implementing a "culture-tourism-creativity integration strategy" as an important lever for high-quality development. The Henan Province 14th Five-Year Plan for Integrated Development of Culture and Tourism clearly articulated the overall approach of "culture-led development, tourism-driven growth, creativity-driven innovation, and technology-enabled empowerment", marking Henan's entry into a stage of systematic advancement [3]. During this period, integration was primarily characterized by policy-driven resource integration and project-based promotion. Through the construction of key projects and the cultivation of cultural brands, cultural resources were transformed into visible and marketable products. Nevertheless, integration largely remained at a relatively superficial level, characterized by the attachment of cultural elements to tourism projects, with limited industrial interaction and innovation mechanisms.

With the continuous improvement of digital infrastructure, Henan's culture tourism integration gradually shifted from resource integration toward technology-enabled development. Practices such as smart scenic areas, digital museums, cloud exhibitions, and online platforms for intangible cultural heritage transformed cultural resources from static displays into dynamic experiences. At the same time, data platforms integrating information on ticketing, transportation, accommodation, and consumption enhanced tourist experiences and provided technical support for governmental decision-making [4]. During this stage, the driving forces of integration evolved from unilateral policy promotion toward the synergistic interaction of policy guidance, technological innovation, and market demand. The relationship between culture and tourism shifted from physical aggregation to data connectivity, while interactions between government and market actors moved from one-way supply to diversified collaboration.

At present, Henan's culture tourism integration has entered a stage of systemic transformation with digital-intelligent transformation as the core driving force. Digital-intelligent technologies are no longer merely instrumental tools, but have become deeply embedded in cultural production, tourism services, industrial collaboration, and governance systems, serving as endogenous elements that reconstruct the operational logic of integration. Technologies such as big data, artificial intelligence, blockchain, and cloud computing collectively promote a shift in cultural production from resource orientation to creativity orientation, in tourism services from sightseeing-based models to scenario-

based experiential models, and in governance from departmental management to data-driven coordination.

The integration of culture and tourism empowered by digitization is characterized by "data elementization, algorithm platformization, and intelligent decision-making" as its core features. Big data and artificial intelligence enhance the accuracy of cultural content creation and tourism services, blockchain ensures the security of cultural digital asset ownership and circulation, and cloud computing provides efficient computing power support, significantly reducing cultural production costs and improving the personalized level of tourism experience. At the same time, the scale of Henan's digital economy continues to expand, emerging technology industry clusters are accelerating their formation, cultural consumption structures are constantly upgrading [5], and young people's preferences for digital and immersive experiences provide a solid economic foundation and market demand support for the integration of digitalization, culture, and tourism.

At the mechanism level, Henan's culture tourism integration exhibits three prominent evolutionary characteristics. First, the driving force has shifted from policy dominance to data-driven dynamics, forming an endogenous cycle of "data generation-algorithm optimization-service innovation-market feedback". Second, the industrial structure has transformed from linear integration to networked collaboration, with cultural creativity, digital content, tourism services, and consumption platforms forming highly coupled collaborative networks. Third, the development model has evolved from the experience economy toward the intelligent economy, in which culture tourism products and services achieve personalized matching and rational optimization through data analysis and algorithmic support.

Overall, digitalization has promoted the integration of culture and tourism in Henan, forming a multidimensional and resonant evolutionary system. Policy guidance provides institutional space, technological innovation provides structural support, and market demand provides sustained momentum. The three are deeply coupled on a digital platform, forming a driving mechanism for the continuous evolution of cultural and tourism integration. This evolutionary logic lays a theoretical foundation for further in-depth analysis of the intrinsic mechanism and its effectiveness of the driving mechanism.

3. EFFECTS OF DIGITAL-INTELLIGENT-DRIVEN DEEP CULTURE TOURISM INTEGRATION IN HENAN

As digital-intelligent transformation becomes increasingly embedded in the operational mechanisms of culture tourism integration [6], its effects have extended beyond industrial scale expansion and have been transformed into comprehensive systemic outcomes across economic, cultural, governance, and experiential dimensions.

Economically, digital-intelligent transformation has significantly optimized Henan's cultural and tourism industrial structure and extended its value chain. Data platforms improve the matching efficiency between cultural resources and tourism services, enabling the supply side to dynamically adjust to changes in demand [7]. Meanwhile, emerging business forms such as digital performances, virtual exhibitions, online ticketing, and digital cultural products have transformed the culture tourism value chain from a linear structure into a multilayered network structure. Under digital-intelligent empowerment, a circular system of "creative production-digital processing-intelligent dissemination-online consumption-data regeneration" has gradually taken shape.

Culturally, digital-intelligent transformation has substantially enhanced the dissemination capacity and brand-building capability of Henan culture. Digital technologies transcend the temporal and spatial constraints of traditional cultural dissemination, enabling a shift from offline displays to online extensions and from one-way output to interactive co-creation [8]. Through cloud exhibitions, virtual reality, and digital intangible cultural heritage platforms, Henan culture has achieved broader

coverage and higher-frequency public engagement. As a result, the image of Henan's culture tourism brand has shifted from historical display to technology-enabled cultural experience, facilitating the creative transformation and innovative development of traditional culture.

From a governance perspective, digital-intelligent transformation has promoted a shift from experience-based management to intelligent governance. Smart culture tourism platforms enable real-time monitoring of tourist flows, risk early warning, public opinion analysis, and public service coordination, thereby transforming governmental decision-making from reactive responses to proactive anticipation. At the same time, digital-intelligent transformation encourages the participation of multiple governance actors, promoting a transition from government-dominated governance to collaborative governance involving governments, enterprises, platforms, and the public.

At the experiential level, digitization reshapes the participation and emotional structure of cultural tourism. Immersive and interactive technologies transform tourists from passive recipients to active participants, and cultural experiences shift from ornamental consumption to deep participation and emotional resonance [9]. Through the analysis of tourist behavior data, cultural and tourism products and services can achieve personalized matching and continuous optimization, and the experience process becomes a dynamic co-creation cycle. More importantly, digitization enhances the emotional dimension of cultural dissemination through interactive storytelling and immersive expression, allowing cultural identity to be strengthened and reproduced in the experiential process.

It can be seen that the integration of Henan's culture and tourism under the empowerment of digitalization has formed a synergistic resonance in four dimensions: economy, culture, governance, and experience. Economic efficiency is reflected in the optimization of industrial structure and the extension of value chain, cultural efficiency is reflected in the enhancement of communication power and brand reshaping, governance efficiency is reflected in intelligent supervision and collaborative governance, and experiential efficiency is reflected in immersive interaction and emotional resonance. Four types of efficiency interact with each other under the support of the digital intelligence platform, promoting the integration of culture and tourism from "physical superposition" to "system reconstruction". Digitization has become an endogenous driving force for the integration of culture and tourism in Henan, promoting industrial upgrading while achieving synergistic enhancement of cultural value, economic value, and social value.

4. PRACTICAL CHALLENGES OF DIGITAL-INTELLIGENT-DRIVEN DEEP CULTURE-TOURISM INTEGRATION IN HENAN

Although Henan has made some progress in promoting the integration of culture and tourism and digital transformation, from a systemic perspective, its driving mechanism is still in the mid-term stage of transitioning from policy driven to mechanism stable operation. At present, the integration of culture and tourism in Henan has a relatively complete policy system and a certain technological foundation, but there are still structural bottlenecks that restrict the full release of digital efficiency in key links such as factor allocation, creative supply, industry collaboration and governance system. These issues are intertwined and have become the main constraints for Henan's cultural and tourism integration to move from "preliminary integration" to "deep symbiosis".

The premise of element integration is the interconnection of data infrastructure [10], and the uneven construction of data infrastructure restricts the overall efficiency of digital empowerment. There are significant differences in the level of informatization, data collection capabilities, and platform construction among different regions within the province, which makes it difficult to achieve unified standards and global sharing of cultural and tourism data. Some cities still use relatively independent data systems, with insufficient connection with provincial platforms. Information on cultural resources, scenic area operations, and tourist behavior cannot be aggregated in real time, and the

problem of data silos is more prominent. At the same time, the application of digital technology in the cultural and tourism field still has a tendency towards "display", and some projects have not deeply embedded technology into production, marketing, and management processes. Small and medium-sized enterprises have limited absorption capacity for new technologies, forming a "technology availability, insufficient capacity" application gap.

At the level of creative integration mechanism, the lack of content innovation and homogenization issues are more prominent. Although Henan has a rich variety of cultural resources, cultural and tourism products still rely mainly on traditional display and symbol replication in cultural narrative and creative expression, and digital means are more reflected in form updates rather than content reproduction. Some projects have the phenomenon of "technological excitement and cultural emptiness", which makes it difficult to continuously attract young consumer groups [11]. In addition, the collaborative mechanism between the cultural and creative industries and the technology industry is not yet sound, there is insufficient interaction between creative and technical talents, and the innovation chain is not well connected, which restricts the deep role of digitization in cultural value transformation.

The synergy of the industrial chain is a key link in the deep integration of culture and tourism [12], but there is still a structural imbalance in the integration of the cultural and tourism industry chain. On the one hand, there is a lack of systematic linkage between cultural creativity, digital technology, tourism operation, and market promotion, resulting in low efficiency in information sharing and resource allocation; On the other hand, small and medium-sized cultural and tourism entities are in a disadvantaged position in the collaborative network, making it difficult for them to participate in the construction of core platforms and data sharing. Some large entities tend to operate in a closed manner during the collaborative process, resulting in more "formal collaboration" than "substantive collaboration". At the same time, the profit distribution mechanism in the integration of culture and tourism is not yet perfect, and the profit relationship between the government, enterprises, communities, and content creators lacks clear definition. Especially in the digital scene, the ownership of cultural data and digital assets has not yet formed a reasonable institutional arrangement, which affects the enthusiasm of multiple parties to participate.

The integrated governance system of culture and tourism in Henan is still dominated by administration and has not fully adapted to the networked collaborative needs under the background of digitization. Regarding new issues such as cultural data ownership, privacy protection, and artificial intelligence content generation, institutional norms are relatively lagging behind, and enterprises face certain compliance risks in data utilization and technological innovation. At the same time, with the rapid expansion of cultural and tourism data, data security and ethical risks are becoming increasingly prominent. The insufficient data protection capabilities of small and medium-sized enterprises further amplify security risks.

In summary, the challenges faced by the deep integration of Henan's cultural and tourism industries in the context of digitization are mainly reflected in four types of mechanistic bottlenecks, namely data mismatch and technological discontinuity in element integration, insufficient innovation and content homogenization in creative integration, structural imbalance and benefit distribution dilemma in industrial collaboration, and institutional lag and security risks in collaborative governance. These issues reflect the necessary adjustment stage that cultural tourism integration must go through in the process of transitioning from a "policy driven" to a "mechanism driven" approach. The key to solving the above challenges lies in the coordinated promotion of institutional innovation, technological deepening, and governance optimization, gradually opening up the linkage channels between elements, creativity, industries, and governance, and promoting the evolution of Henan's cultural and tourism integration towards a more stable and sustainable deep symbiotic stage.

5. ADAPTIVE PATHWAYS FOR DIGITAL-INTELLIGENT-DRIVEN DEEP CULTURE TOURISM INTEGRATION IN HENAN

Driven by digitalization, the cultural and tourism industry in Henan has a relatively solid foundation for development. However, the key to achieving deep integration and sustainable development of culture and tourism lies not in repairing local structures, but in promoting the systematic reshaping of driving mechanisms. Unlike traditional "structural adjustments" that focus on optimizing resource allocation, mechanism reshaping emphasizes promoting deep coupling between culture and tourism in terms of element allocation, value creation, and governance structure through institutional innovation and technological system reconstruction, thereby achieving self-organizing evolution of cultural tourism integration [13]. Therefore, the optimization path for the integration of culture and tourism in Henan should revolve around four mechanisms: element integration, creative integration, industry collaboration, and collaborative governance.

First, it is necessary to build a unified and efficient "cultural and tourism data base" as the core, and consolidate the foundation of digital intelligent empowerment. On the one hand, accelerate the integrated construction of provincial-level cultural and tourism data platform, promote the interconnection of multi-source data such as culture, tourism, transportation and commerce under the unified standards and interfaces, and form a closed-loop system of "data collection governance service" to avoid regional fragmentation and data isolation. On the other hand, we should promote the institutionalized configuration of data elements, bring cultural and tourism data into the configuration framework of factor market, clarify the rules of data assets confirmation, use and income distribution, and promote data sharing and value transformation on the premise of security and privacy. At the same time, by improving the digital infrastructure and strengthening the training of compound talents, it provides stable support for the long-term operation of the cultural tourism data system.

second, we should strive to build a cultural innovation ecology enabled by science and technology, and promote the deep transformation of cultural values. Under the background of digital intelligence, cultural and tourism integration not only needs technology application, but also depends on the reproduction of cultural content. Henan should promote the collaborative innovation of cultural and creative subjects and scientific and technological enterprises, universities and scientific research institutions, and promote the deep embedding of artificial intelligence, virtual reality and other technologies in cultural expression and narrative structure, so as to avoid the technology application staying at the formal level [14]. on this basis, we should cultivate a cultural and tourism IP system with sustained vitality by digital means, and achieve collaborative communication between the main brand and regional and product brands through the unified brand architecture, so as to enhance cultural influence. At the same time, through the establishment of a multi-level talent incentive and training mechanism, the endogenous power of creative supply is enhanced.

Third, we should promote the evolution of cultural and tourism industry from linear linkage to network collaboration, and build an open and shared industrial ecology. On the one hand, through the platform mechanism to integrate cultural creativity, digital technology, tourism services and other types of subjects, promote content co creation, data sharing and win-win income, and improve the overall operation efficiency of the industry. On the other hand, we should improve the interest distribution mechanism of multi-agent participation, clarify the rights and responsibilities of the government, enterprises, communities and content creators in the cultural tourism integration, and enhance the participation enthusiasm of small and medium-sized subjects and local communities [15]. in addition, through the establishment of the industrial chain digital monitoring and evaluation system, the dynamic perception and precise regulation of the operation status of the cultural and tourism industry are realized, providing technical support for collaborative development.

Fourth, we should promote the modernization of the governance system with digital intelligence and build an intelligent and efficient governance pattern. The role of the government should be changed

from a single manager to a coordinator and a service provider, and real-time monitoring and dynamic response to cultural and tourism security, market order and public services can be achieved through the intelligent supervision platform. At the same time, we should speed up the improvement of the system framework of cultural tourism digital intelligence governance, and clarify the rules of data collection, use, privacy protection and responsibility traceability, so as to provide standardized protection for digital intelligence applications. On this basis, the government, enterprises, the public and the media should be promoted to co govern, the transparency and coordination of governance should be improved through data feedback and social participation mechanisms, and data security and ethical governance should be strengthened simultaneously to prevent digital intelligence risks.

In a word, the optimization of the driving mechanism of Henan cultural and tourism integration should take digital intelligence as the center, through the collaborative promotion of factor integration, creative integration, industrial collaboration and collaborative governance, and build a system structure of "technology empowerment cultural guidance institutional guarantee". This path not only helps to break the structural bottleneck in the current cultural and tourism integration, but also provides mechanism support for the transformation of Henan from a "resource rich province" to a "cultural and tourism innovation strong province". Under the background of continuous evolution of digital intelligence, Henan cultural and tourism integration will gradually form a deep symbiotic pattern with mechanism operation as the core, and better demonstrate the era value of Central Plains culture in the process of Chinese modernization.

6. CONCLUSION

Culture tourism integration in the digital-intelligent era is not a natural outcome of technological progress, but rather a dynamic process shaped by the continuous interaction and adjustment of multiple mechanisms. The case of Henan demonstrates the staged, uneven, and context-dependent characteristics of deep culture tourism integration under digital-intelligent transformation. This study suggests that the effectiveness of digital-intelligent empowerment depends not on technology itself, but on the degree of alignment among factor allocation, creative supply, industrial collaboration, and governance structures. Ultimately, the key to advancing culture tourism integration lies in the stable operation and adaptive evolution of its driving mechanisms.

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