

The Digital Empowerment Path and Sustainable Development Practice of Traditional Culture Inheritance under the Cultural Digitalization Strategy

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Abstract

Driven by the dual goals of the Global Sustainable Development Goals (SDGs) and national cultural digitization strategies, the deep integration of digital technology and the inheritance of excellent traditional Chinese culture have become the core path to achieving sustainable cultural development. This article will be based on the philosophy of technology and sustainable development theory, systematically analyzing the empowering mechanism of digital technology in the sustainable preservation of cultural resources, the innovation of communication paradigms, and the low-carbon transformation of industrial ecology; Revealing the current sustainability challenges such as data sovereignty risks, technological ethical dilemmas, and digital divide; And propose an innovative path to connect with SDGs from the three dimensions of "technology system value", providing theoretical reference for building a sustainable development system that combines cultural subjectivity and global compatibility.

Keywords

Digital intelligence technology; Sustainable inheritance of traditional culture; SDG; Digital governance; Global Partnership

Introduction

The "Opinions on Promoting the Implementation of the National Cultural Digitalization Strategy" in 2022 positions digital technology as the core production factor for cultural inheritance, which resonates strategically with the goal of "protecting cultural heritage to promote social inclusion" in the United Nations' 2030 Agenda for Sustainable Development. The digital twin technology of Dunhuang murals and the low-carbon production model of the Palace Museum's cultural and creative industries all reflect the strategic coupling between cultural digitization and sustainable development. (Chen et al., 2025) Digital technology is reconstructing the cultural dimension of sustainable development through the path of "digitalization of cultural genes - dissemination networking - industrial greening". As a technology cluster with AI as its core, the autonomous and predictive characteristics of digital technology also provide possibilities for solving the sustainability problems in cultural heritage. On the one hand, technologies such as 3D laser scanning break through physical space limitations and build a "cloud based cultural relic library" to cope with the threat of natural

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disasters to cultural heritage; On the other hand, blockchain technology ensures cultural data sovereignty through distributed storage, laying a foundation of trust for cross-border cultural cooperation, which is in line with global sustainable development goals. However, when algorithmic logic is involved in cultural inheritance, how to maintain cultural diversity and intergenerational equity in technological empowerment becomes a key proposition for aligning with sustainable development goals. Therefore, this article will analyze the empowerment mechanism, practical challenges, and breakthrough paths of digital intelligence technology from three aspects, aiming to provide theoretical references for building a sustainable development system that combines cultural subjectivity and global compatibility.

Methodology

This article mainly adopts the method of conceptual analysis, which takes the philosophy of technology and sustainable development theory as the core analytical framework to systematically deconstruct key concepts and internal logic; At the same time, select representative cultural digitalization practice cases to concretely verify and supplement the theoretical logic derived from conceptual analysis, and leverage the auxiliary role of case study methods. This article systematically explores the digital empowerment path and sustainable development practice of the inheritance of excellent traditional Chinese culture under the cultural digitization strategy through a combination of conceptual analysis and case studies.

Results and Discussion

Empowering with Digital Intelligence

Digital intelligence has become a key driver in aligning cultural digitization with sustainable development, particularly through mechanisms of preservation, communication, and industrial transformation.

Sustainable preservation mechanism of cultural resources

At present, digital technology deeply reflects the strategic coupling between cultural digitization and sustainable development in the preservation and development of cultural resources. For example, digital intelligence technology achieves permanent retention of cultural resources through "digital twins + cloud storage". Taking the 3D scanning of the Terra Cotta Warriors in the Mausoleum of the First Qin Emperor as an example, the laser point cloud technology controls the surface error of cultural relics within 0.1mm, and the digital model built can withstand physical damage such as earthquakes and weathering. This method directly serves the SDG 11.4 goal of "protecting cultural heritage". In addition, the "Nine Songs" system at Tsinghua University uses AI semantic analysis to extract cultural genes from 300000 Tang poems, forming an iterative digital knowledge base. This "algorithm decoding symbol reconstruction" model provides technical support for the intergenerational transmission of traditional culture, which corresponds to SDG 4.7 "Cultural Values in Education" (Liu & Li, 2025).

Inclusive innovation of communication paradigm

Apart from the preservation mechanism, we can see the strategic alignment between cultural digitization and sustainable development, which can also be reflected in the dissemination paradigm. The dual track communication system of "digital twin + virtual native" constructed by VR/AR technology breaks through the temporal and spatial barriers of cultural

communication (Zhao, 2021). For example, Sanxingdui Archaeological Live uses AR technology to allow global audiences to participate in excavations from a "first person perspective", making professional archaeological knowledge open to the public and promoting the practice of SDG 16.7 "Inclusive Decision making" in the cultural field. For another example, the collaborative filtering algorithm of the Tiktok platform accurately pushes intangible cultural heritage content to 260 million young users, increasing the contact rate of traditional opera in Generation Z by 40%, which is highly consistent with the goal of SDG 10.2 "reducing inequality in cultural access".

Low carbon reconstruction of industrial ecology

Of course, we can also see a high degree of consistency between the content of cultural digitalization construction and the global sustainable development strategy goals in the construction of industrial ecology. At present, digital technology has given birth to a low-carbon industry model of "cultural IP + blockchain + virtual economy". For example, the mobile game developed by the Palace Museum transforms architectural skills into game mechanics, replacing traditional physical production in cultural and creative industries. In the first month, it achieved over 10 million downloads while reducing carbon emissions by about 30 tons, fulfilling the requirement of SDG 12.5 to "reduce waste". The Suzhou Pingtan industry relies on a "digital music library + intelligent accompaniment system" to achieve cloud based collaborative creation of traditional folk art and modern music. While the number of newly created songs increases by 80%, the production energy consumption is reduced by 50%, providing a practical sample in the cultural field for SDG 9.4 "Sustainable Production of Industries". Whether it is the preservation mechanism of cultural resources, the dissemination paradigm, or the construction of industrial ecology, we can clearly perceive the driving role of digital technology in the entire process. At the same time, we can also clearly see the high degree of integration between cultural digitalization and global sustainable development. Therefore, digitalization is a global trend, and we need to keep up with the trend of the times to achieve sustainable cultural development (Shen, 2024).

Realistic Challenge - The Game between Data Sovereignty and Cultural Security

Undoubtedly, digital technology has provided strong support for the inheritance and sustainable development of culture, but this process inevitably faces practical challenges and conflicts with the cultural dimension of sustainable development goals. This is first manifested in the game between data sovereignty and cultural security. Currently, 80% of digital resources in China's museums are stored on overseas cloud servers, and some multinational corporations' smart devices have data cross-border transmission vulnerabilities, which poses a risk of "digital colonization" of cultural resources and directly threatens SDG 16.8 "Enhancing the Representation of Developing Countries in Global Governance" (Zeng & Sang, 2024). At the same time, algorithmic bias on commercial platforms further damages cultural diversity - the recommendation weight of niche cultures such as calligraphy on short video platforms is only 1/5 of entertainment content, and the average weekly exposure time of young users to traditional opera is less than 8 minutes, which goes against the goal of SDG 10.3 to promote inclusivity.

The imbalance between technological alienation and humanistic values

Secondly, the culture empowered by digital intelligence also faces an imbalance between technological alienation and humanistic values. Although the participation of intelligent robots in intangible cultural heritage performances (such as robotic arm shadow puppetry) solves the problem of lost skills, it leads to the dissolution of the subjectivity of inheritors, violates the definition of UNESCO that "the core of intangible cultural heritage is the dynamic interaction

between humans and the environment", and challenges the sustainable development goal of "disseminating humanistic values through education". What is even more severe is the cultural identity gap caused by the digital divide: the coverage of digital technology applications in rural areas of China is less than 30%, and the digital reading rate of people over 60 years old is only 18.7%, resulting in the marginalization of rural culture in the process of digitization and violating the sustainable development goal of "reducing urban cultural inequality" (Xue & Shi, 2025).

The contradiction between short-term benefits and long-term inheritance

In addition, some local governments have excessively transformed ethnic minority cultures into entertainment in pursuit of GDP growth (such as "virtual worship" packaged with blockchain technology), which violates the cultural authenticity principle of "providing legal identity for all" in the global sustainable development goals. According to statistics, in 2024, the proportion of excessively entertaining cultural content on a certain short video platform reached 37%, resulting in semantic decay of traditional cultural symbols in intergenerational transmission, directly affecting the cultural foundation of "inclusive decision-making" in SDGs. These are the challenges to cultural sustainability brought about by the process of digital empowerment. Only by resolving these real-life conflicts can we truly achieve sustainable cultural development.

Breakthrough Path - Technological Innovation

So how to solve the sustainable conflicts in the process of empowering cultural development with digital intelligence? This article proposes a solution path from three dimensions: technology, system, and value. Firstly, we need to carry out technological innovation and build a green and intelligent cultural infrastructure. Developing a low-carbon technology system with cultural adaptability: introducing the aesthetic principle of "harmony between man and nature" in VR scene design to reduce the need for high-energy rendering; Embedding classical literature semantic networks in intelligent translation systems can improve cultural fidelity while reducing algorithm iteration energy consumption. Building a "National Cultural Big Data Alliance Chain" based on blockchain technology to achieve distributed storage and decentralized management of cultural resources not only responds to the goal of "enhancing global institutional effectiveness" in the global sustainable development strategy but also references SDG "Climate Action" to reduce carbon emissions by 30% through the construction of green data centers (Nie & Li, 2025).

Institutional construction

Secondly, we need to complete institutional construction and form a global governance system of diverse co governance. According to the SDG principle of "cracking down on illegal financial flows", the "Convention on Sustainable Development of Digital Culture" is formulated to clarify the ethical bottom line of digital technology application: establish a "negative list of digital utilization of cultural heritage" and strictly prohibit excessive entertainment modification of sensitive content such as religious culture. Establish a tripartite collaborative mechanism of "government enterprise community": for example, in the digitalization of Suzhou Pingtan, the Cultural and Tourism Bureau formulates inheritance standards, technology enterprises provide low-carbon technology support, and artist associations are responsible for content supervision, forming a closed-loop management of "technology culture environmental protection" (Duan & Zhang, 2024).

Value driven

Finally, we also need to integrate the core values of SDGs into algorithm design by

incorporating the "Sustainable Development Values in Education": setting a "cultural sustainability weight" in the intelligent recommendation system to increase the recommendation priority of classic literature and increase the exposure rate of traditional cultural content by 50% (Shao, 2025). Building a 'semantic bridge' for cultural dialogue between ancient and modern times: such as transforming bronze inscriptions into animated monologues through short videos, interpreting ancient wisdom in modern language. This 'translation' 'is not a symbol transplant, but a contemporary reconstruction of cultural genes through technological intermediaries, providing a cultural carrier for SDG' national identity recognition'. (Kilis et al., 2025). Through these measures, we can break through the challenges to sustainable goals that arise in the process of empowering cultural development with digital intelligence, build a sustainable development framework that aligns with SDGs, and promote the sustainable development of culture.

Conclusion

In summary, digital technology is not only a catalyst for the inheritance of excellent traditional Chinese culture, but also a cultural infrastructure for implementing the global Sustainable Development Goals (SDGs). In the future, we need to uphold the creative subject status of human beings in "human-machine collaboration", build a solid cultural sovereignty bottom line in "data flow", and achieve innovative development of the value system in "ancient and modern mutual construction". Only in this way can cultural heritage serve both the material space construction of SDG "Sustainable Cities and Communities" and provide spiritual and cultural support for SDG "Peace and Justice", ultimately achieving a leap from "cultural resources" to "global cultural identity" and contributing Chinese solutions to the sustainable development goals in the world's transformation.

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