

Research on the Business Model Innovation Path of Cross border Integration of Culture, Sports, Tourism and Business Driven by Digital Technology

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Abstract: Through an analysis of the current state of integration among culture, sports, tourism, and commerce, this study identifies several business models-including platform-based ecosystems, immersive experience-oriented approaches, data-driven strategies, IP-integrated solutions, and smart service platforms. It highlights existing challenges in this integration process, such as insufficient industrial synergy, inadequate data utilization, simplistic experiential scenarios, and severe homogenization of business models. The research concludes that digital technologies can drive business model transformation by redefining industry boundaries, unlocking data value, building robust platform ecosystems, and enhancing intelligent experiences. To address these issues, it is essential to strengthen industrial collaboration mechanisms, deepen data value utilization, innovate digital experience scenarios, and promote the development of differentiated models. Additionally, policy support in areas such as digital infrastructure and data security, along with robust mechanisms for cultivating interdisciplinary talent, must be enhanced.

Keywords: Digital Technology; Integration of Culture, Sports, Tourism and Commerce; Business Model Innovation; Cross-sector Integration

1. Introduction

With the ongoing advancement of the digital economy era, new-generation digital technologies-including artificial intelligence, big data, cloud computing, and the Internet of Things-have permeated various sectors such as culture, sports, tourism, and commerce. These technologies are continuously eroding traditional industry boundaries while driving resource reallocation and value chain restructuring across industries. As a key approach to meeting diverse

consumer demands and fostering industrial transformation, the integration of culture, sports, tourism, and commerce is evolving from conventional single-sector models toward digitalization, intelligentization, and ecosystem development. While transforming production methods and operational models in these sectors, digital technologies also create new opportunities for cross-industry innovation by consolidating data resources, building platform ecosystems, and pioneering novel consumption scenarios.

2. Analysis of the Current Development Status of Cross-sector Integration among Culture, Tourism, and Commerce Driven by Digital Technology

2.1 The Development Context of Digital Technology Empowering the Integration of Culture, Sports, Tourism, and Commerce

The rapid growth of the digital economy and emerging digital technologies-including artificial intelligence, big data, cloud computing, the Internet of Things, and virtual reality-are increasingly permeating cultural, sports, tourism, and commercial sectors, providing technological support and innovative momentum for industrial integration^[1]. Traditional industries in these fields often operate with isolated business models characterized by fragmented resources, short consumption chains, and rigid service frameworks. The application of digital technologies breaks down spatial barriers and organizational boundaries between industries, fostering closer value linkages among cultural content, sporting events, tourism resources, and commercial consumption. On one hand, digital technologies enable precise identification of consumer needs and efficient allocation of industry resources through data collection, analysis, and sharing, shifting the sector from resource-driven to data-driven operations. On the other hand, digital platforms and smart

technologies facilitate integrated development of online and offline experiences, expand consumption spaces and service boundaries, and give rise to new integrated formats such as digital exhibitions, smart tourism, esports events, and immersive entertainment.

2.2 Main Practical Models for Cross-sector Integration of Culture, Tourism, and Commerce

The cross-sector integration of culture, tourism, commerce, and business has fostered a diversified development landscape, evolving from mere resource aggregation to profound value convergence. First, the "culture-tourism-business" integration model transforms local cultural resources into tourism appeal and commercial value through developing cultural IPs, creating distinctive travel routes, and establishing consumption scenarios such as historical districts and themed cultural parks that achieve synergistic cultural dissemination and economic benefits. Second, the "sports-tourism-business" strategy leverages major sporting events, outdoor activities, and sports facilities to boost tourism consumption, local product sales, and urban brand promotion, forming an integrated ecosystem combining event-driven economy, sports leisure, and commercial services. Third, multi-functional "cultural-tourism complexes" combine cultural exhibitions, travel experiences, retail shopping, and dining entertainment to create a cohesive consumption ecosystem. Fourth, digital platforms facilitate new integration models by connecting content creators, service providers, and consumers through online channels, enabling digital marketing, user interaction, conversion of consumer behavior, and industry collaboration. Platforms like short-video apps, online travel sites, and digital content platforms are increasingly becoming key drivers for this integrated development.

2.3 Application Scenarios of Digital Technology in the Integration of Culture, Sports, Tourism, and Commerce

The application of digital technologies in integrating culture, sports, tourism, and commerce continues to expand significantly, driving profound transformations in industry operations, consumer experiences, and business management approaches. In the consumer services sector, big data analytics enables the

analysis of consumer behavior, creation of user profiles, and precision marketing, empowering businesses to deliver personalized products and services tailored to diverse needs^[2]. Taking smart tourism platforms as an example, data-driven recommendations for travel routes, cultural events, and dining options enhance user experience and service efficiency. In scenario innovation, advanced technologies such as virtual reality (VR), augmented reality (AR), and artificial intelligence have been widely adopted in digital exhibitions, immersive performances, smart tourist attractions, and sports event experiences, allowing consumers to transcend temporal and spatial constraints for richer interactive engagements. From an operational perspective, cloud computing and IoT technologies facilitate intelligent management of scenic areas, venue operations, and commercial services, improving resource utilization efficiency and management standards. Digital platforms connect cultural institutions, sports organizations, tourism enterprises, and commercial entities, fostering collaborative development across the industry chain and fostering an open industrial ecosystem. Digital payment systems, intelligent recommendation algorithms, and live streaming further expand the commercial value potential of this integrated development model.

3. Analysis of Business Model Types Driven by Digital Technology for Cross-sector Integration of Culture, Tourism, and Commerce

3.1 Platform-based Ecological Business Model

The platform-based ecosystem business model is supported by internet platforms, big data platforms, and digital ecosystems, integrating resources across culture, sports, tourism, commerce, and other sectors to achieve collaborative operation among multiple stakeholders and value co-creation. This platform connects governments, enterprises, content creators, consumers, and service providers, establishing an open, shared industrial ecosystem that facilitates the flow of information, capital, and services, thereby promoting efficient resource allocation and coordinated development of the industrial chain^[3]. Driven by digital marketing, online transactions, and intelligent recommendation systems, the platform has enhanced user engagement and conversion rates,

continuously expanded industry boundaries, and fostered a development framework that integrates content production with product transactions. The integrated consumer-service commercial ecosystem has enabled simultaneous growth in both platform value and industry value.

3.2 Immersive Experience-Based Business Model

The immersive experience-based business strategy prioritizes consumer experience, leveraging advanced digital technologies such as virtual reality (VR), augmented reality (AR), digital twins, and holographic projection to create innovative consumption scenarios that are interactive, participatory, and highly experiential. This model achieves deep integration of cultural exhibitions, sports events, tourism, and commercial consumption, transforming consumers from passive observers into active participants and enhancing their emotional engagement and value perception during the shopping experience. Through new formats like digital performances, immersive exhibition halls, and smart scenic areas, it extends customer dwell time, increases purchase frequency and loyalty, and establishes new profit growth drivers for the integrated development of culture, sports, tourism, and commerce.

3.3 Data-driven Business Model

A data-driven business model is one that treats data resources as its core production factor, creating commercial value and optimizing operational processes through data acquisition, analysis, mining, and intelligent decision-making. Enterprises build user profiles using consumer behavior data, market demand insights, and operational metrics to accurately identify consumer needs, thereby providing a scientific foundation for product design, marketing strategies, and service improvement. Furthermore, data analysis enables the prediction of market trends, optimization of resource allocation, enhancement of operational efficiency, and implementation of features such as precision marketing, intelligent recommendations, and dynamic pricing. This approach continuously improves customer satisfaction and corporate profitability, driving the integration of culture, sports, tourism, and commerce toward greater refinement and intelligence.

3.4 IP-integrated Business Model

The IP-integrated business model treats cultural IPs, event IPs, tourism IPs, and urban brand IPs as core corporate assets, leveraging digital technologies to enable cross-industry development and value extension. Driven by advancements in digital media, short-video platforms, live streaming, and digital content creation, IPs can transcend traditional dissemination boundaries and achieve deep integration across cultural promotion, tourism marketing, commercial campaigns, and product development. By focusing on IPs to develop derivative products, thematic events, digital cultural creations, and online/offline consumption scenarios, this approach builds a comprehensive industrial chain encompassing content production, brand management, and consumer engagement, continuously enhancing IP influence and commercial viability while strengthening integrated competitiveness in the culture, sports, tourism, and commerce sectors.

3.5 Smart Service-Oriented Business Model

The smart service-oriented business model leverages artificial intelligence, the Internet of Things, cloud computing, and mobile internet as digital foundations to drive intelligent upgrades across the entire cultural, sports, tourism, and commercial service ecosystem. By implementing smart scenic areas, smart venues, smart hotels, intelligent navigation systems, and contactless payment solutions, it enables digital management of key service processes-including reservations, route guidance, ticket purchasing, transactions, and evaluations-thereby enhancing service efficiency and operational quality. Furthermore, technologies such as intelligent customer service, personalized recommendations, and real-time monitoring deliver tailored services based on user needs, continuously improving consumer experiences and boosting satisfaction and loyalty. This model not only optimizes resource utilization but also transforms the cultural, sports, tourism, and commerce sectors from traditional service models toward smarter, more refined, and personalized approaches.

4. Current Practical Challenges in the Integrated Development of Culture, Tourism, and Commerce

4.1 Insufficient Industrial Collaboration

While the integration of culture, sports, tourism, and commerce has demonstrated trends such as cross-sector collaboration, resource sharing, and scenario synergy, stable and effective coordination mechanisms remain lacking among stakeholders. Significant differences exist in management systems, operational objectives, resource attributes, and business models across these sectors. Each entity typically pursues projects driven by self-interest, leading to resource fragmentation, redundant investments, and fragmented approaches. Many integrated initiatives remain at superficial levels-limited to event integration, spatial clustering, or product combinations-without achieving deep alignment between industrial chains, value chains, and innovation ecosystems. Inadequate division of responsibilities among government agencies and insufficient policy coordination, coupled with the absence of sustained information-sharing mechanisms and profit-sharing frameworks among enterprises, public cultural institutions, sports organizations, tourist attractions, and digital platforms, further undermine collaborative stability. Small and medium-sized enterprises face challenges including limited technical capabilities, restricted financing channels, and difficulty accessing resources when engaging in cross-sector integration, making it difficult for them to integrate into core industry ecosystems. The lack of industrial collaboration not only constrains the efficiency of resource integration, but also makes it difficult for integrated projects to generate economies of scale and sustainable profits, thereby restricting the integration of cultural, sports, and tourism businesses from surface combination to systematization and ecologicalization.

4.2 Inadequate Utilization of Data

Data resources serve as crucial production factors in advancing the integration of culture, sports, tourism, and commerce driven by digital technologies. However, current data utilization by relevant stakeholders remains at a relatively low level. On one hand, cultural institutions, sports venues, tourist attractions, commercial complexes, and internet platforms each possess diverse types of user and operational data. Due to significant challenges such as inconsistent data standards, incompatible platform interfaces, and departmental barriers, effective data

aggregation and interoperability remain difficult, resulting in pronounced "data silos." On the other hand, many organizations still limit their data applications to basic functions like visitor statistics, online ticketing, user segmentation, consumer preferences, and behavioral analysis, lacking in-depth insights into purchasing power and scenario-specific needs. The potential of data for product development, precision marketing, service optimization, and business decision-making has yet to be fully realized. Incomplete mechanisms for data ownership clarification, authorized usage, revenue distribution, and privacy protection have raised concerns among enterprises regarding data sharing and commercial exploitation. Small and medium-sized businesses, particularly those lacking specialized data analysts and technological investment, struggle to transform fragmented data into actionable insights, leaving the full potential of data resources untapped.

4.3 The Experience Scenarios are too Limited in Variety.

While many current cultural, sports, tourism, and commercial integration projects have incorporated digital displays, online reservations, virtual tours, and interactive installations, practical implementation still faces challenges such as simplistic experience scenarios, insufficient interactivity, and slow content updates. Some projects overemphasize audio-visual equipment and visual effects, reducing digitization to mere technical additions while neglecting deeper integration of cultural significance, sporting spirit, local characteristics, and consumer emotional needs. This results in homogenized designs for immersive districts, digital exhibition halls, and themed commercial spaces across different regions. Many experiences primarily rely on photo-taking check-ins, light shows, and static displays, lacking narrative storytelling, character interactions, participatory activities, or sustained engagement mechanisms that limit visitor involvement and dwell time. Online experiences and consumption remain incomplete ecosystems, with digital content failing to effectively extend to dining, accommodation, shopping, event participation, and cultural product consumption. The absence of age-specific, interest-driven, and consumption-tier differentiated design in experiential settings further diminishes project appeal, hindering sustained consumer

engagement and repeat visits.

4.4 Homogenization of Business Models

While the integration of culture, tourism, sports, and commerce has developed rapidly, issues such as regional and corporate bandwagon development and model replication have emerged, exacerbating homogenization in business models. Many projects adopt similar frameworks like "cultural districts + specialty dining," "sports events + travel routes," or "attraction tickets + cultural product sales," lacking thorough exploration of local cultural resources, sports characteristics, consumer behavior, and market demands. Some operators primarily utilize digital technologies for online promotion, ticket sales, and venue branding, yet fail to innovate systematically in user engagement, value creation, revenue streams, and collaborative networks, resulting in a disconnect between technological application and commercial operations. Certain projects exhibit excessive reliance on ticket sales, venue leasing, commercial partnerships, and government subsidies, with insufficient revenue sources from derivative products, membership services, digital content subscriptions, and brand licensing, leading to relatively simplistic business models. Without original content or distinctive intellectual property support, these projects often face challenges such as high construction costs, short operational lifecycles, and inadequate visitor traffic. The homogenization of business models not only weakens the market recognition of projects, but also hinders the formation of a sustainable competitive advantage in the integrated development ecosystem.

5. The Mechanism of Business Model Innovation Driven by Digital Technology for Cross-sector Integration Among Culture, Tourism, and Commerce

5.1 The Mechanism by Which Digital Technology Reconfigures Industrial Boundaries

Digital technology reduces costs in information acquisition, resource integration, and cross-sector collaboration, breaking down the relatively rigid boundaries between industries such as culture, sports, tourism, and commerce, while facilitating the reintegration of production factors, business processes, and value creation

activities across various domains. Traditional industries are often defined by product attributes and administrative divisions, with loose connections between entities and value creation typically confined to individual industrial chains. The application of digital platforms, cloud computing, the Internet of Things, and virtual reality enables cultural content, sporting events, tourism spaces, and commercial services to interconnect in real-time within a unified digital ecosystem, fostering new relationships characterized by co-created products, shared distribution channels, and synergistic revenue streams. For instance, cultural resources can be transformed into tourism experiences; sporting events can boost urban consumption; and commercial spaces can serve as comprehensive hubs for cultural dissemination and leisure entertainment. Digital technology has also empowered enterprises to evolve from standalone product providers into integrated scenario operators, shifting industrial competition from rivalry among individual companies to competition within cohesive ecosystems. The original industrial division of labor system is constantly being restructured, and cross disciplinary resources can be dynamically allocated around consumer needs, providing organizational foundation and value space for the innovation of cultural, sports, tourism and commercial business models.

5.2 Innovation in Value Creation Models Driven by Data Resources

Data resources can permeate the entire lifecycle of cultural, sports, tourism, and commercial enterprises—from product development and marketing to operational management and consumer services—serving as a critical foundation for transforming value creation models from experience-based approaches to precise, dynamic ones. By collecting information such as user browsing history, travel patterns, event preferences, consumption frequency, and feedback, businesses can build multidimensional user profiles to accurately identify diverse consumer needs and optimize product portfolios and service offerings accordingly. Data analysis also enables companies to predict visitor flow trends, assess project popularity, adjust ticket pricing, and improve spatial layouts, thereby enhancing resource allocation efficiency and refining operational decisions. From a value realization perspective, businesses can leverage

data for targeted marketing, personalized recommendations, membership management, and cross-scenario customer engagement, facilitating the transition from one-time transactions to sustained user relationships. Data sharing among different industry entities can reveal the connections between elements such as cultural participation, sports activities, tourism travel, and commercial consumption, promoting innovation in joint product development and revenue models. Data is not only a technical means to assist operations, but also a core factor in connecting supply and demand, optimizing the consumption process, expanding profit sources, and promoting the integration of cultural, sports, and tourism businesses to form a user demand-oriented value creation system.

5.3 The Platform Ecosystem Promotes Collaborative Innovation among Multiple Stakeholders

The platform ecosystem integrates government departments, cultural institutions, sports organizations, tourism enterprises, commercial entities, technology service providers, and consumers into a unified value network through an open digital connectivity framework, serving as a vital catalyst for collaborative innovation among multiple stakeholders. This platform consolidates fragmented resources—including content, venues, events, visitor traffic, and commercial services—by employing standardized interfaces, transaction protocols, and profit-sharing mechanisms to reduce collaboration costs and enhance efficiency across the industry chain. Within this ecosystem, participants transcend traditional linear supply-demand relationships, focusing on user needs to jointly develop products, create immersive experiences, promote brands, and manage services, thereby achieving resource sharing, complementary strengths, and co-created value. For instance, scenic areas can collaborate with cultural institutions to develop digital content; partner with sports organizations to plan events; or leverage commercial enterprises to innovate derivative products and consumer services. Driven by network effects, the platform attracts growing numbers of suppliers and users, expanding the integrated ecosystem while enabling rapid product iteration through user feedback.

5.4 Intelligent Technologies Enhance the

Consumer Experience

Advanced technologies such as artificial intelligence, virtual reality, augmented reality, the Internet of Things, and intelligent sensing have the potential to reshape consumer interactions with cultural, sports, tourism, and commercial offerings, transforming consumption experiences from standardized and passive to personalized, immersive, and end-to-end services. Before consumption, smart recommendation systems can match cultural events, sporting competitions, travel itineraries, and commercial projects based on user interests, schedules, and budget constraints, enhancing decision-making efficiency. During consumption, virtual reality, digital twins, and smart navigation systems enhance scene interactivity and narrative engagement, turning consumers from spectators into active participants and fostering deeper emotional connections. Post-consumption, digital membership programs, AI-powered customer service, and review analytics continuously collect user feedback, laying the foundation for service optimization and targeted marketing. IoT devices enable real-time monitoring of visitor flow, facility operations, and demand patterns, enabling operators to dynamically adjust resources and mitigate issues like queue congestion and information asymmetry. These intelligent technologies integrate fragmented consumption segments into a cohesive service ecosystem, boosting customer satisfaction and loyalty while driving growth in subscription models, content monetization, value-added services, and collaborative partnerships.

6. Digital Technology-Driven Exploration of Cross-sector Integration Among Culture, Tourism, and Commerce: Pioneering Innovative Business Models

6.1 Strengthening the Industrial Collaboration Mechanism

Leveraging digital technology to foster cross-sector integration among culture, sports, tourism, and commerce requires establishing a collaborative industrial mechanism characterized by government guidance, market leadership, platform support, and participation from multiple stakeholders^[4]. It is essential to dismantle the fragmented management structures across cultural, sporting, tourism, and commercial sectors by creating

interdepartmental coordination mechanisms and project collaboration frameworks, thereby achieving unified industrial planning and resource development while preventing redundant projects and inefficient competition through standardized regulatory oversight. By utilizing key initiatives, specialized parks, and digital platforms, long-term partnerships should be promoted between cultural institutions and sports organizations, tourism enterprises and commercial complexes, as well as technology service providers, enabling joint efforts in product design, content creation, brand marketing, and operational scenario development to effectively align industrial, innovation, and value chains. Concurrently, mechanisms for benefit distribution, risk sharing, and intellectual property protection must be refined, with revenue allocated based on factors such as resource investment, technological contributions, and operational performance to enhance partnership stability. Leading enterprises should be supported in leveraging their resource integration capabilities to guide small and medium-sized businesses, cultural innovation teams, and individual operators into the industrial ecosystem, while collaborative barriers should be lowered through industry associations, industrial alliances, and public service platforms.

6.2 Deepening the Application of Data Value

To deepen the application of data value, efforts must focus on data aggregation, governance, analysis, and transformation, establishing a comprehensive data application system that integrates culture, sports, tourism, and commerce. It is essential to facilitate data interoperability among cultural venues, sports facilities, tourist attractions, commercial complexes, and public service platforms, achieving standardized data formats for visitor flow, ticketing, consumption patterns, event data, and evaluation metrics. Under legal compliance, cross-domain data repositories should be developed to eliminate data silos. Leveraging big data analytics, AI algorithms, and digital profiling technologies enables comprehensive identification of consumer interests, travel behaviors, purchasing power, and context-specific needs, laying the foundation for product development, event planning, visitor forecasting, precision marketing, and service optimization. For instance, user profiles can be

utilized to create personalized solutions that integrate cultural visits, sports experiences, travel routes, and commercial consumption, thereby enhancing cross-scenario conversion rates. Additionally, data should evolve from management tools into operational assets through applications such as membership data management, joint marketing campaigns, dynamic pricing strategies, intelligent business partnerships, and consumption trend prediction, thereby maximizing data-driven value creation. At the same time, it is necessary to clarify the rules for data collection, authorized use, revenue distribution, and security protection, strengthen data anonymization, access control, and risk monitoring, and balance data circulation and personal privacy protection, so that data can become a true production factor for enterprises to optimize supply and demand matching, improve operational efficiency, innovate business models, and so on.

6.3 Innovating Digital Experience Scenarios

To create innovative digital experience scenarios, it is essential to deeply integrate technological applications with cultural content, sports events, tourism spaces, and commercial consumption, avoiding simplistic equating of digitization with mere device stacking or visual packaging. Business entities can leverage technologies such as virtual reality, augmented reality, digital twins, artificial intelligence, and holographic projection to develop immersive projects centered around local cultural narratives, distinctive events, natural landscapes, and urban commercial spaces-projects characterized by narrative depth, interactivity, and participatory engagement. Methods like virtual character guidance, scenario-based tasks, digital treasure hunts, event simulations, and interactive performances can transform consumers from passive observers into active participants. It is crucial to establish a comprehensive digital service ecosystem spanning pre-, mid-, and post-consumption stages, offering features such as intelligent recommendations, ticket booking, route planning, and post-purchase digital tours, alongside real-time interaction and seamless payment solutions through digital membership programs, community engagement, and content delivery. Tailored scenario-based content should be designed for diverse audiences-including families, young adults, senior travelers, and professional sports enthusiasts-with regular

updates to enhance user satisfaction. Integrating online and offline content distribution across sectors like dining, accommodation, retail, events, and cultural consumption extends consumer engagement duration, shifting one-time visits into sustained spending behaviors and ultimately fostering a sustainable experiential economy.

6.4 Promoting Innovation in Diverse Operational Models

To foster differentiated innovation in business models that integrate culture, sports, tourism, and commerce, efforts must be grounded in regional resource endowments, target market characteristics, and corporate core competencies-avoiding simplistic adoption of popular projects or established frameworks. Regions should leverage their unique historical heritage, intangible cultural traditions, distinctive sports programs, natural landscapes, and commercial traditions to transform these assets into distinctive product offerings and brand value. For instance, areas rich in cultural resources could focus on digital performances, IP licensing, and cultural innovation-driven consumption; regions with prominent ecological assets may develop smart outdoor sports and leisure tourism experiences; while areas with strong event infrastructure can build comprehensive revenue streams through live event streaming, urban tourism, and brand sponsorships. Regarding monetization strategies, companies should reduce overdependence on ticket sales, rental fees, and government subsidies, instead cultivating diversified income sources through digital content subscriptions, membership programs, brand licensing, merchandise sales, platform commissions, event sponsorship, and data-driven value-added services. Additionally, enterprises should strategically differentiate themselves by focusing on specific domains-platform operations, content creation, technical services, or integrated scenario management-to establish competitive differentiation. We should establish small-scale pilot projects, market feedback and rapid iteration mechanisms, and adjust product combinations and operational strategies in a timely manner to shape competitive barriers through original content, distinctive IPs, and refined services, so that business models can move from imitation and follow-up to specialization, specialization, and sustainable

innovation.

7. The Safeguard Mechanism for Digital Technology-Driven Innovation in Cross-Sector Integration Business Models Among Culture, Tourism, and Commerce

7.1 Strengthening the Development of Digital Infrastructure

As a critical foundation for resource integration, scenario innovation, and intelligent operations in the cross-sector convergence of culture, sports, tourism, and commerce, digital infrastructure must enhance fundamental capabilities across network facilities, computing platforms, sensing devices, and public digital platforms. Accelerate the deployment of 5G networks, gigabit optical networks, IoT systems, and cloud computing infrastructure across cultural venues, sports stadiums, tourist attractions, commercial districts, and rural tourism destinations to strengthen data transmission capacity and service stability during peak visitor periods, ensuring reliable support for live event streaming, immersive experiences, smart navigation, and mobile payments^[5]. Coordinate the development of regional integrated digital platforms that unify ticketing reservations, transportation services, accommodation, dining, event management, cultural exhibitions, and commercial consumption, eliminating redundant system development among different stakeholders and reducing digital transformation costs for small and medium-sized enterprises. Simultaneously, promote intelligent upgrades of venues, scenic areas, and commercial spaces through strategic configurations of crowd monitoring systems, environmental sensing technologies, smart parking solutions, intelligent security systems, and accessibility equipment to enhance refined management of public spaces. The construction of digital infrastructure should focus on balanced development between urban and rural areas and regions, and improve the level of digital access in underdeveloped areas through financial investment, social capital cooperation, and public service procurement. Establishing mechanisms for facility operation and maintenance, technological upgrading, performance evaluation, etc., to avoid the situation of heavy construction and light operation, and to achieve continuous upgrading of infrastructure with technological progress and consumer demand, providing a stable, open, and

scalable technological foundation for business model innovation.

7.2 Improving the Data Governance and Security Protection Framework

The cross-sector integration of culture, tourism, sports, and commerce encompasses diverse data categories including consumer identities, location trajectories, payment records, interest preferences, and biometric information. This necessitates the establishment of a comprehensive governance and security framework covering the entire lifecycle of data collection, storage, utilization, circulation, and destruction. Clear definitions of authority, responsibilities, and boundaries must be established among government agencies, platform providers, cultural venues, and technology service providers regarding data processing. Data collection should be regulated in accordance with principles of legality, propriety, and necessity to prevent excessive authorization or uncontrolled development. Unified classification systems, coding standards, interface specifications, and quality benchmarks should be implemented for cross-industry data, along with mechanisms for data cataloging, authorized usage, and quality assessment to facilitate secure data sharing while protecting personal privacy and commercial secrets. For applications such as user profiling, targeted marketing, and cross-platform recommendations, robust mechanisms for informed consent, permission revocation, and dispute resolution must be established to safeguard consumers' control over their personal information. Additionally, enhanced capabilities including data encryption, identity authentication, access control, data masking, and security auditing are essential, complemented by risk monitoring and emergency response protocols for cybersecurity threats, data breaches, and system failures. It is also possible to explore the application of trusted data space, combining privacy computing with blockchain authentication, so that data can be used collaboratively without directly exposing the original information. In addition, it is necessary to strengthen the compliance review of third-party platforms and algorithm service providers, conduct regular security assessments and responsibility tracing, and comprehensively consider technical protection, institutional norms, and industry self-discipline to create a secure and trustworthy environment for data value

development.

7.3 Cultivating Versatile Professionals for the Digital Industry

The cross-sector integration of culture, tourism, sports, and commerce encompasses multiple dimensions including content innovation, industrial operations, and technological application. It requires cultivating a multidisciplinary workforce proficient in both digital technologies and the principles of culture, sports, tourism, and business. Universities and vocational institutions should transcend disciplinary boundaries to foster interdisciplinary collaboration between digital technology, cultural creativity, tourism management, sports industry studies, and marketing, establishing programs in digital cultural tourism planning, smart venue management, data analysis, and immersive content design while strengthening project-based teaching and practical training. Enhanced university-industry partnerships are essential, with schools collaborating with scenic areas, venues, platform providers, and tech companies to establish training bases that incorporate real-world projects, operational data, and practical applications to enhance students' problem-solving skills. Enterprises should implement structured training programs tailored to managers, content creators, technical staff, and frontline service personnel, fostering digital literacy, data utilization capabilities, and cross-departmental collaboration skills.

8. Conclusion

The integration of culture, sports, tourism, and commerce driven by digital technology goes beyond merely installing technological equipment in traditional projects; it entails a systematic transformation across industrial organization models, resource allocation logic, consumer relationships, and revenue structures. Regions and business entities should leverage their respective resource advantages and cater to consumer needs to foster a synergistic development pattern among cultural content, sporting events, tourism spaces, and commercial services, while avoiding blind replication and low-level competition. It is essential to properly balance data utilization and security protection, technological investment and content innovation, as well as government guidance and market mechanisms, thereby truly transforming digital

infrastructure into enhanced operational efficiency and greater consumer value.

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