

Scene Reconstruction and Value Co-creation: The Implementation Path of Digital Technology Empowering Sports Consumption Upgrading

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Abstract: Against the backdrop of the deep integration of the digital economy and the real economy, sports consumption is undergoing a profound transformation from "physical consumption" to "participatory experience consumption" and from "single-function consumption" to "composite scene consumption." As a disruptive force, digital technology is not only a tool for improving efficiency but also a core engine for reshaping the "people-goods-scene" relationship in sports consumption. Based on Scene Theory and Service-Dominant Logic (S-D Logic), this paper abandons the traditional linear analysis paradigm and constructs a dual-drive analytical framework of "Scene Reconstruction - Value Co-creation." The study finds that digital technology thoroughly reconstructs the spatiotemporal form of sports consumption through three logics: the "intelligent enhancement of physical scenes," the "immersive generation of virtual scenes," and the "boundless extension of social scenes." On this basis, the value generation mechanism of sports consumption has undergone a fundamental paradigm shift: consumers have transformed from passive recipients of value to co-creators (Prosumers), achieving consumption upgrading during the co-creation processes of experiential value, social value, symbolic value, and data value. The article further points out that a long-term mechanism for digital technology to empower sports consumption upgrading should be built by consolidating new digital infrastructure to support the scene revolution, innovating business models to monetize co-created value, and improving digital governance to ensure ecological security.

Keywords: Digital Technology, Sports Consumption Upgrade, Scene Reconstruction, Value Co-creation, High-quality Development, Digital Economy.

1. Introduction

1.1. Research Background and Problem Statement

Currently, the global economy is in a critical period of a new round of technological revolution and industrial transformation. The rapid development of new-generation digital technologies represented by big data, cloud computing, artificial intelligence (AI), blockchain, and the Internet of Things (IoT) is reconstructing the global innovation landscape and reshaping the global economic structure. This transformation is known as the "Fourth Industrial Revolution," the core of which lies in the comprehensive, multi-angular, and full-chain transformation of traditional industries through digitization, networking, and intelligence. In China, the "Digital China" strategy and the construction of a "Leading Sports Nation" resonate deeply at this historical intersection. The report to the 20th National Congress of the Communist Party of China explicitly proposed to "accelerate the development of the digital economy, promote the deep integration of the digital economy and the real economy, and build internationally competitive digital industry clusters." This macro strategy indicates the direction for the digital transformation of various industries and provides fundamental compliance for the high-quality development of the sports industry.

As a new growth point of the national economy and a core component of the "happiness industry," the development level of the sports industry is an important indicator of a country's

soft power and social civilization. The "14th Five-Year Plan for Sports Development" clearly proposes that by 2035, the sports industry should become a pillar industry of the national economy. However, to achieve this grand goal, the core lies in activating sports consumption, especially promoting the optimization and upgrading of the sports consumption structure. For a long time, China's sports consumption market has faced a series of deep-seated structural contradictions: on the supply side, effective supply is insufficient, high-end sports services are scarce, and a large number of sports resources are idle or inefficiently utilized; on the demand side, consumption experience is singular with poor interactivity, making it difficult to meet the increasingly personalized and diversified needs of consumers; on the spatial side, the utilization rate of traditional sports venues is low, scenes are rigid, and it is difficult to form an efficient consumption loop. Traditional sports consumption models are often confined to "presence" in physical space, with short value chains and consumers in a passive recipient position.

However, with the widespread application of digital technology, the boundaries of sports consumption are broken, content is reshaped, and relationships are redefined. The high-speed and low-latency characteristics of 5G technology make ultra-high-definition event live streaming and remote interaction possible; AI technology realizes personalized customization of sports content through algorithmic recommendations and intelligent generation; Virtual Reality (VR) technology breaks physical spatiotemporal limits, creating immersive sports experiences; Blockchain technology provides a trust mechanism for the confirmation

and circulation of sports digital assets. Digital technology is triggering a profound "Scene Revolution" and "Value Revolution."

In this context, a core theoretical question emerges: Through what mechanism does digital technology promote the upgrading of sports consumption? Existing research mostly focuses on the pulling effect of digital technology on the total output value of the sports industry, or is limited to the application analysis of a specific technology (such as live streaming, wearable devices), lacking systematic integrated research on the meso-dimension of "scene" and the micro-mechanism of "value co-creation." This paper argues that the empowerment of sports consumption by digital technology is not just an improvement in efficiency but a paradigm shift. Through scene reconstruction, digital technology solves the problems of "where to consume" and "what to consume"; through value co-creation, it solves the problems of "who consumes" and "how to enhance consumption stickiness." Exploring the coupling mechanism of the two has important academic value and practical significance for clarifying the internal logic of sports consumption upgrading in the digital economy era.

1.2. Literature Review and Theoretical Evolution

To clarify the academic positioning of this study, it is necessary to systematically review and comment on relevant domestic and foreign research, mainly focusing on three dimensions: digital economy empowerment, scene theory evolution, and value co-creation.

1.2.1. Research on Digital Economy Empowering the Sports Industry

In recent years, with the rise of the digital economy, academic research on its empowerment of the sports industry has been fruitful. Jiang Xiaojuan (2021) pointed out that digital technology can greatly improve the efficiency of the service industry and change the traditional perception of the low efficiency of the service industry, which has revolutionary significance for the service-oriented sports industry [1]. She believes that through connection, matching, and empowerment, digital technology enables sports services to be traded across time and space, greatly expanding market boundaries. Ren Bo (2022) and other scholars analyzed the driving mechanism of the digital economy promoting the high-quality development of the sports industry from the perspective of industrial economics, arguing that digital technology empowers the sports industry through paths such as optimizing resource allocation, reducing transaction costs, and promoting industrial integration [2]. Shen Keyin (2020) constructed a theoretical model of the digital economy driving the high-quality development of the sports industry, emphasizing the key role of data factors in industrial chain reconstruction, believing that data has become the fifth major factor of production after land, capital, labor, and technology [3]. These studies have laid the foundation for understanding industrial transformation at the macro level, but they focus more on the production and supply sides, with relatively insufficient discussion on the micro-mechanisms of the consumption side.

1.2.2. Application of Scene Theory in Consumption Research

Scene Theory was originally proposed by Terry Clark and others of the Chicago School, aiming to explain the driving

mechanism of post-industrial urban development. The theory holds that the city is not only a place of production but also a scene of consumption and life, containing three dimensions: "Amenities," "Legitimacy," and "Activity." Scenes promote regional economic development by providing specific cultural facilities and activities to attract specific groups of people. Liu Gang et al. (2022) introduced scene theory into sports consumption research, pointing out that digital technology is reconstructing the spatial form of sports consumption and creating a new type of consumption space that integrates the virtual and the real [4]. He believes that digital scenes are not just extensions of physical space but a completely new social interaction space. However, current scene research mostly stays on the transformation of physical space, with insufficient in-depth analysis of virtual scenes and social interaction scenes, especially lacking research on the micro-mechanism of how scenes trigger consumption behavior.

1.2.3. Evolution and Expansion of Value Co-creation Theory

Value Co-creation theory originates from the field of service marketing and is a subversion of the traditional "value chain" theory. The Service-Dominant Logic (S-D Logic) proposed by Vargo and Lusch (2004) argues that value is no longer created solely by enterprises and destroyed by consumers (Goods-Dominant Logic, G-D Logic), but is co-created by enterprises and consumers during interaction [5]. Under this logic, the consumer is a co-creator of value, and the enterprise is merely a proposer of value propositions. Prahalad and Ramaswamy (2004) further proposed the DART model (Dialogue, Access, Risk assessment, Transparency) as the implementation mechanism for value co-creation. In the field of sports, scholars have begun to focus on how consumers' interactive behaviors in event viewing and fitness communities create value. For example, studies have pointed out that sports fans co-create the atmospheric value and brand value of events through behaviors such as participating in community discussions, purchasing peripherals, and cheering on-site. However, research combining the characteristics of digital technology is still in its infancy, especially regarding new forms of value co-creation in new technological environments such as blockchain and the metaverse.

In summary, although existing research has made progress in respective fields, there is a lack of integrated research that incorporates "digital technology," "scene reconstruction," and "value co-creation" into the same framework. This paper attempts to bridge this gap by constructing a dual-drive model of "Scene Reconstruction - Value Co-creation," hoping to make breakthroughs in theoretical depth and explanatory power.

1.3. Definition of Core Concepts

1.3.1. Scene Reconstruction

In the digital context, this paper defines "Scene Reconstruction" as the process of using digital technology to intelligently transform the physical space of sports consumption, creatively generate virtual space, and network-extend social interaction space, thereby breaking traditional spatiotemporal constraints and creating a new type of consumption space that is symbiotic between virtual and real, and available anytime and anywhere. It involves not only the upgrading of hardware facilities (such as smart venues) but also the reshaping of cultural atmosphere, social relations, and emotional experience. The core of scene reconstruction lies in

"connection" and "experience," that is, connecting scattered consumption elements through technical means to provide consumers with immersive experiences.

1.3.2. Value Co-creation

In sports consumption, value co-creation is manifested in that consumers are no longer passive recipients but active participants. Through behaviors such as participating in sports, sharing data, generating content (UGC), and interacting in communities, they co-create experiential value, emotional value, symbolic value, and data value with enterprises, platforms, and other consumers. Digital technology has greatly reduced the transaction costs of interaction, expanded the scope and depth of interaction, making large-scale, high-frequency value co-creation possible. The result of value co-creation is the enhancement of consumer satisfaction and enterprise competitiveness, representing a positive-sum game.

2. Theoretical Basis and Analytical Framework: From "Technological Embedding" to "Ecological Reshaping"

Digital technology empowering sports consumption upgrading is not a linear stacking of technologies but a complex systematic project. This chapter will construct an integrated analytical framework to explain how digital technology acts as an "enzyme" to catalyze the chemical reaction between scenes and value.

2.1. The Underlying Logic of Technological Empowerment: Connectivity, Datafication, and Intelligence

The empowering effect of digital technology on sports consumption is mainly reflected in three underlying logics, which progress layer by layer and together constitute the cornerstone of empowerment.

2.1.1. Connectivity Logic: Breaking Information Silos

Internet, mobile internet, and IoT technologies have achieved ubiquitous connections between people, people and objects, and objects and objects. In traditional sports consumption, consumers are often isolated from venues, events, and equipment, with serious information asymmetry. Connectivity logic breaks this island effect. According to Metcalfe's Law, the value of a network is proportional to the square of the number of connected users.

(1) Human-Human Connection: Social networks gather scattered sports enthusiasts, forming a huge community effect.

(2) Human-Object Connection: IoT technology makes sports equipment intelligent, providing real-time feedback on sports status.

(3) Object-Object Connection: The Internet of Everything builds intelligent sports scenes. This ubiquitous connection makes supply and demand matching more precise and efficient, reducing consumers' search costs and transaction costs. Connectivity is the most basic feature of the digital economy and the premise of all value co-creation.

2.1.2. Datafication Logic: New Momentum of Factorization

The digitization of sports behavior makes consumers' movement trajectories, physiological indicators, consumption preferences, and social habits recordable, quantifiable, and analyzable. Data has become the fifth major factor of production after land, labor, capital, and technology. Under

data logic, sports consumption is no longer the end point of a one-time transaction but the starting point of data production. Through mining and analyzing massive amounts of data, enterprises can achieve precise profiling, demand forecasting, and reverse customization (C2M), thereby driving structural reform on the supply side. The liquidity, non-rivalry, and zero marginal cost characteristics of data make it the core momentum driving consumption upgrading. The essence of data logic is to transform behaviors in the physical world into assets in the digital world, thereby achieving value multiplication.

2.1.3. Intelligence Logic: From Response to Prediction

AI algorithms, through deep learning and knowledge graphs, can not only passively respond to consumer needs but also proactively predict needs and generate content (AIGC). For example, intelligent coaching systems can adjust training intensity based on users' real-time physical status; event broadcasting systems can automatically edit highlights and push them to interested users. Intelligence logic improves the intelligence level of sports services, making the large-scale supply of personalized and customized services possible. It solves the long-standing "Baumol's Cost Disease" in the service industry, that is, significantly improving service efficiency and quality without increasing manpower. Intelligence logic is the advanced stage of digital technology empowerment, endowing the system with "cognitive" capabilities.

2.2. Spatial Revolution from the Perspective of Scene Theory

Traditional sports consumption relies heavily on specific physical spaces (such as stadiums and gyms). Scene theory holds that consumption is not just the exchange of goods but the acquisition of experience and the identification of identity, all of which depend on specific "scenes." The scene revolution triggered by digital technology is reflected in the following two dimensions:

2.2.1. Disembedding: Breaking Spatiotemporal Constraints

Giddens' "Disembedding" theory points out that one of the characteristics of modernity is the lifting out of social relations from local contexts of interaction. Digital technology enables sports consumption to achieve thorough "disembedding." Sports consumption is no longer limited to specific geographical locations and opening hours.

(1) Spatial Disembedding: Through VR devices, users can watch NBA games "immersively" at home, obtaining perspectives equal to or even better than on-site audiences.

(2) Temporal Disembedding: Through smart treadmills and cloud competition platforms, users can participate in the Boston Marathon at any time, breaking the synchronization limit of events. This liberation of time and space greatly expands the accessibility of sports consumption, allowing high-quality sports resources to cover a wider population.

2.2.2. Re-embedding: Reshaping Spatial Meaning

While disembedding, digital technology is also carrying out "Re-embedding." It creates new virtual fields (such as metaverse sports communities, esports virtual maps) and endows these virtual spaces with real social meaning and economic value. At the same time, digital technology also superimposes digital information (such as AR navigation, holographic projection) in physical fields, endowing traditional physical spaces with new functions and

experiences. This "mixed field" where virtual and real intertwine has become the new carrier for sports consumption upgrading. In the process of "re-embedding," consumers' identity and emotional belonging are reconstructed. For example, on the virtual cycling platform Zwift, although users are physically at home, their consciousness is completely immersed in the virtual "Watopia" track, engaging in real competitive interactions with other riders.

2.3. Value Paradigm Shift under Service-Dominant Logic

In the industrial economy era, the "Goods-Dominant Logic" (G-D Logic) was followed, where value was embedded in products, created by enterprises during production, and consumers were merely destroyers of value. In the digital economy era, the "Service-Dominant Logic" (S-D Logic) is followed.

2.3.1. Blurring Boundaries between Producers and Consumers: The Rise of Prosumers

Toffler predicted the emergence of "Prosumers" in "The Third Wave." In the digital sports ecosystem, consumers are no longer simple "audiences." Their acts of uploading cycling routes on Strava, posting fitness insights on Keep, and commenting on events on Bilibili constitute part of the platform's content ecosystem, creating traffic value and content value. Consumers participate directly in the production process of value. This role transformation is the basis for the formation of the value co-creation mechanism. Under S-D Logic, enterprises provide "value propositions," while Value Realization depends on consumer participation and interaction.

2.3.2. Leap from Use Value to Experience Value

Under S-D Logic, value is "co-created" and perceived "in context." Consumers no longer buy a pair of running shoes (product) but a digital sports solution containing training plans, community rankings, and professional guidance (service). Value is no longer solidified at the moment the product leaves the factory but is dynamically created through interactive experiences during the consumer's use. Experience becomes the core carrier of value. Pine and Gilmore pointed out in "The Experience Economy" that experience is a new economic offering following service, capable of creating lasting memories and higher premiums. Digital technology greatly enhances the experiential value of sports consumption by enhancing interactivity, immersion, and personalization.

2.4. "Scene-Value" Dual-Drive Model

Based on the above theories, this paper constructs a "Scene Reconstruction - Value Co-creation" analytical model. Scene reconstruction is the foundation, providing a new spatiotemporal carrier, interaction interface, and technical environment for sports consumption; Value co-creation is the core, where the frequency and depth of interaction between subjects significantly increase in new scenes, stimulating multi-dimensional value generation. The two intertwine and mutually cause each other: the intelligence and immersion of scenes promote deeper co-creation, while high-value co-creation activities in turn enrich the connotation of scenes. This dual-drive mechanism jointly promotes the upgrading of sports consumption structure from survival-oriented to development-oriented, from physical-oriented to service-oriented, and from single-type to composite-type.

3. Scene Reconstruction: The Spatial Logic of Digital Technology Empowering Sports Consumption

Scene is the "container" where sports consumption occurs and the "trigger" for consumption behavior. Digital technology reconstructs the "people-goods-scene" relationship of sports consumption through the digital mapping of the physical world and the creative construction of the virtual world, greatly expanding the breadth and depth of consumption. This chapter will discuss this from three dimensions: physical, virtual, and social.

3.1. Intelligent Enhancement of Physical Scenes: From "Functional Venues" to "Smart Complexes"

Traditional sports venues often face the "island effect," with low utilization rates during non-event periods, high operating costs, and poor audience experience. Digital technology has comprehensively upgraded physical scenes through IoT, 5G, and big data.

3.1.1. Interactive Reconstruction of Viewing Scenes: Redefining "Presence"

Supported by 5G+8K technology, smart venues can provide multi-angle, ultra-high-definition, low-latency viewing experiences.

(1) Dimensional Elevation of Visual Experience: For example, the "Free Viewpoint" technology applied during the Beijing Winter Olympics collected video streams through hundreds of high-definition cameras surrounding the venue and performed 3D reconstruction, allowing viewers to independently choose viewing angles via mobile phones and even see the athletes' "bullet time."

(2) Facilitation of Service Experience: AR navigation solves pain points such as difficulty in finding seats and toilets in large venues; smart seats can display event data and highlights in real-time.

(3) Smart Operation Management: Through digital twin technology, managers can monitor the flow of people, energy consumption, and safety status of the venue in real-time, achieving refined operation. This technology-enhanced scene upgrades single visual viewing to an interactive immersive experience, significantly increasing the premium capability of tickets and value-added services. Viewers are no longer passive bystanders but participants with a "God's eye view."

3.1.2. Datafied Reconstruction of Fitness Scenes: Spatial Realization of Quantified Self

Traditional gyms are piles of "iron" lacking the ability to perceive user behavior. Smart gyms are hubs of data.

(1) Intelligent Equipment: Smart equipment can automatically identify user identities through RFID technology, collect exercise data (weight, sets, heart rate, power) in real-time, and synchronize it to the cloud to generate analysis reports.

(2) Extension of Home Scenes: Smart home fitness devices like Magic Mirror (Fitness Mirror) utilize Computer Vision (CV) technology to capture user posture in real-time and correct movements through skeletal key point detection algorithms, moving professional private coaching services to the living room.

(3) Digitization of Public Spaces: The construction of smart trails and intelligent sports parks extends digital services to public sports spaces, realizing intelligent management of

national fitness. The intelligence of physical space shifts fitness guidance from relying on expensive human private coaches to an "AI + Human" hybrid model, lowering the threshold for professional services and expanding the consumer group [3]. Physical scenes have transformed from single exercise places into terminals for data collection and health management.

3.2. Immersive Generation of Virtual Scenes: From "Reality Mirroring" to "Metaverse Native"

Digital technology not only transforms the old world but creates a new one. Virtual sports scenes are no longer simple appendages of the physical world but have formed independent consumption ecosystems and economic systems.

3.2.1. The Rise of Esports and Virtual Sports: Breaking Physical Limits

Esports is a sports form based entirely on digital scenes. It breaks human physiological limits and physical rules, creating highly ornamental and competitive scenes. Virtual Sports goes a step further, combining traditional sports with virtual scenes.

(1) Virtual Arenas: For example, virtual cycling, virtual racing, and virtual golf map real sports loads onto virtual tracks through high-precision simulators and force feedback devices. On platforms like Zwift, global users can race virtually on "Isle of France," feeling real gradients and wind resistance.

(2) All-Weather Experience: This native virtual scene opens up a new blue ocean of consumption, driving new types of consumption such as virtual equipment, digital skins, membership subscriptions, and virtual event tickets. It solves the pain points of outdoor sports being restricted by weather and venues, realizing an all-weather sports experience.

3.2.2. Primary Form of Sports Metaverse: The Future of Holistic Internet

The Metaverse depicts a future of the holistic internet. In the sports metaverse, users possess unique digital avatars, can cross geographical limits, interact with stars in a virtual "Camp Nou," or purchase and display digital jerseys (NFTs) in virtual space.

(1) Reshaping Identity: Users can customize virtual images, breaking the limitations of physical conditions in reality and meeting the need for self-expression.

(2) Construction of Economic System: "Nikeland" established by Nike on Roblox allows users to participate in various sports mini-games in the virtual world and purchase equipment with virtual currency.

(3) Immersion of Social Interaction: This scene has strong immersion, interactivity, and sociability, meeting the consumption needs of Generation Z for novel experiences, self-expression, and identity recognition, and is an important pole for future sports consumption growth. In the metaverse, the connotation of sports consumption is infinitely extended from simple exercise to social, entertainment, creation, and other dimensions.

3.3. Boundless Extension of Social Scenes: From "Atomized Individuals" to "Networked Communities"

Sports consumption inherently has strong "tribal" characteristics; people tend to exercise or watch games with like-minded people. Digital technology breaks the restrictions

of geographical fate and reconstructs social interaction scenes based on "interest affinity."

3.3.1. Aggregation Effect of Vertical Communities: Connection of Interest Groups

Digital platforms like Hupu, Dongqiudi, Keep Community, and Strava gather scattered sports enthusiasts from around the world. In this boundless social scene, users share event reviews, equipment evaluations, exercise check-ins, and training insights.

(1) Formation of Community Culture: This high-frequency interaction forms a strong community culture (such as "Straight Man Culture," "Self-discipline Culture," "Gearheads"), greatly enhancing user stickiness and belonging.

(2) Acquisition of Recognition: Consumption is no longer an isolated act of an individual but a passport to gain community recognition. For example, buying a high-end sports watch is not just to check the time but to display professional sports data in the community and gain likes and recognition from peers. This interest-based aggregation allows niche sports projects (such as frisbee, flag football) to form scaled markets.

3.3.2. Monetization of Social Relations: The Rise of Trust Economy

The extension of social scenes directly drives the "Seeding Economy" (Product Recommendation) and "Fan Economy."

(1) Influence of KOL/KOC: Recommendations by KOLs (Key Opinion Leaders) and KOCs (Key Opinion Consumers) in social scenes become key factors influencing consumption decisions. The "Follow-along" mode on Keep is actually a socialized consumption based on trust relationships. Users buy courses or recommended equipment because they trust a certain expert's professionalism.

(2) Mechanism of Social Fission: This scene reconstruction greatly shortens the marketing link of sports consumption, realizing "content as advertising, social as transaction." At the same time, social fission mechanisms (such as group buying, bargaining, invitation challenges) have also become powerful engines for driving sports consumption growth. Through the chain propagation of social relations, the influence of sports consumption spreads exponentially.

4. Value Co-creation: The Power Logic of Digital Technology Empowering Sports Consumption

Scene reconstruction provides the stage for sports consumption, while value co-creation is the script performed on the stage. In the digital ecosystem, consumers participate deeply in the design, production, dissemination, and consumption processes of sports products, realizing multi-dimensional symbiosis and appreciation of value. This chapter will analyze the co-creation mechanisms of experiential value, social value, and data value.

4.1. Experiential Value Co-creation: From "Passive Viewing" to "Immersive Participation"

In traditional sports consumption, viewers are bystanders in the stands, passively accepting event content provided by officials. Under digital empowerment, consumers become co-creators of experience.

4.1.1. Secondary Creation of Event Content: Prosperity of UGC Ecology

On short video platforms like TikTok (Douyin), Bilibili, and Kuaishou, users utilize simple editing tools to edit, commentate, set to music, and spoof sports event live streams, creating massive amounts of User Generated Content (UGC).

(1) Diversification of Content: These secondary creation contents are often more interesting, spreadable, and topical than official broadcasts. Users no longer just consume the standard signal provided officially but consume a diversified content ecosystem co-created by countless netizens.

(2) Real-time Interaction: "Danmu" (Bullet Screen) culture turns the viewing experience into a real-time collective carnival. Viewers express emotions, play memes, and interact in real-time by sending Danmu, and this interaction itself becomes an inseparable part of the event experience. This co-creation behavior greatly extends the life cycle and commercial value of event IPs [4]. It extends the value of sports events beyond the game itself to post-match discussion, fermentation, and cultural re-creation.

4.1.2. Collaborative Production of Customized Services: Deepening of C2M Model

In the field of intelligent manufacturing (C2M model), consumers can directly participate in the design of sports equipment.

(1) Personalized Design: For example, 3D printed running shoes launched by brands like Peak allow users to upload foot data and even participate in appearance color scheme design, realizing "one shoe for one person."

(2) Service Iteration: In fitness services, body feeling data and ratings fed back by users directly feed back to AI algorithms, allowing training plans to iterate and optimize continuously. This "user data input + enterprise algorithm processing" mode is essentially both parties co-creating a higher quality service experience that better fits personal needs. Consumer participation not only improves the use value of the product but also endows the product with unique emotional value. This is a deep customization based on interaction, thoroughly changing the production logic of the traditional industrial age.

4.2. Social Value Co-creation: From "Lonely Exercise" to "Tribal Identification"

The social value of sports consumption is magnified infinitely in the digital age. Through interaction, consumers co-create emotional support, group identification, and social capital.

4.2.1. Emotional Connection of Sports Communities: Companionship of Virtual Presence

On apps like Joyrun (Yuepaoquan) and Codoon, runners like, comment, team up for PKs, and initiate online challenges. This interaction creates a sense of "virtual presence" companionship, alleviating the boredom and loneliness of exercising alone. According to Collins' "Interaction Ritual Chains" theory, a common focus of attention (running) and shared emotional experience (likes, encouragement) can generate group solidarity (Emotional Energy).

(1) Emotional Support: For many users, the motivation to purchase membership services lies not only in the courses themselves but in obtaining the qualification to enter a certain high-level community, thereby gaining a sense of belonging and superiority.

(2) Accumulation of Social Capital: This social value is

maintained and created jointly by the platform and users. For example, Peloton's success is largely due to the deep emotional connection established between instructors and members, and among members themselves; users feel great satisfaction when hearing instructors shout out their names during live classes.

4.2.2. Monetization of Fan Culture: Transformation of Emotional Capital

Against the backdrop of "Fan Circle" culture penetrating the sports circle, fans directly improve the commercial value of sports stars or clubs through organized behaviors such as crowdfunding support, purchasing peripherals, and voting on charts.

(1) Co-creation of Symbolic Value: The popularity of digital collectibles (NFTs) like NBA Top Shot is precisely because fans endow a few seconds of video clips with huge scarcity value through trading and collecting behaviors. The value here does not stem from the production cost of the video itself but from the establishment of community consensus.

(2) Confirmation of Identity: By owning these digital assets, fans confirm each other's identities, forming a tight value community [5]. This consensus mechanism is a unique value generation method in the digital economy era, directly transforming emotional capital into economic capital.

4.3. Data Value Co-creation: From "Digital Exhaust" to "Asset Elements"

In the digital economy, data is a core asset. In traditional concepts, data generated by users was often seen as "digital exhaust." From the co-creation perspective, every click, every step run, and every heartbeat recorded by consumers constitutes the cornerstone of big data.

4.3.1. Data Feedback Optimizing Supply: Decision Making Based on Data

After consumer behavior data is collected by the platform, processed, desensitized, and analyzed, it becomes key evidence for optimizing supply chains, guiding product R&D, and improving service processes.

(1) Precise Prediction: For example, Decathlon accurately predicts sports preferences in various regions by analyzing online sales data and search keywords, thereby optimizing product selection and inventory management in offline stores.

(2) Product Iteration: Runner data collected by the Nike Run Club APP helps Nike design running shoes that are more ergonomic. In this value loop, consumers unconsciously contribute data elements, substantially participating in the enterprise's value creation process. The scale effect and network effect of data mean that the more users participate, the higher the platform's service quality, forming a positive feedback loop.

4.3.2. Commercial Circulation of Data Assets: Move to Earn

With the rise of the Web 3.0 concept, the confirmation of rights and return of value for user data have become possible. In some blockchain-based "Move to Earn" applications (such as StepN), users' sports data (steps, distance, speed) are directly converted into token rewards.

(1) Value Return: This marks that consumer data value has obtained direct economic monetization, and consumers have truly become stakeholders in the industrial chain.

(2) Incentive Mechanism: This model greatly stimulates users' enthusiasm for sports. Although it has also triggered controversies about Ponzi schemes and sustainability, it is

undoubtedly a radical exploration of data value co-creation. It attempts to build a new type of production relation, letting data producers directly share the dividends generated by data.

5. Implementation Path: Strategy Selection for Digital Economy Empowering Sports Consumption Upgrade

Based on the theoretical logic of scene reconstruction and value co-creation, to further release the empowering effect of digital technology on sports consumption upgrading, it is necessary to explore specific implementation paths from four dimensions: infrastructure, business models, industrial ecology, and governance systems, to build a long-term mechanism.

5.1. Infrastructure Path: Consolidating the Digital Base to Support Scene Revolution

Scene reconstruction cannot be separated from solid digital infrastructure support. New sports infrastructure must be included in the overall plan of national "New Infrastructure" to provide hardcore guarantees for consumption upgrading.

5.1.1. Promoting "All-Optical Network" and "IoT" Transformation of Sports Venues

The government should guide and support large sports venues in deploying full 5G network coverage and IoT sensors.

(1) Hardware Upgrade: Build a "City Sports Brain" to access data from scattered community fitness paths, sports parks, and commercial gyms into a unified platform, realizing digitized and visualized management of sports resources.

(2) Experience Optimization: This can not only improve venue operation efficiency but also provide consumers with convenient experiences like "one-click booking," "one-code pass," and "smart navigation."

(3) Low-Cost Transformation: For old venues, lightweight digital transformation solutions should be encouraged, such as installing smart gateways and edge computing boxes, to reduce transformation costs and avoid large-scale demolition and construction. At the same time, promote "Cloud-Edge-End" collaboration in venues to improve the real-time performance and reliability of data processing.

5.1.2. Constructing a National-Level Sports Data Sharing Platform

Break the data silos between current internet platforms, sports administrative departments, and sports enterprises.

(1) Unification of Data Standards: Establish a standardized and interconnected sports big data center. Meanwhile, formulate sports data exchange standards and interface specifications to lower the technical threshold for data circulation [6].

(2) Data Opening and Application: Under the premise of ensuring privacy and security, open public sports data (such as national physical fitness monitoring data, public venue flow data) to society in accordance with laws and regulations, encouraging enterprises to use public data to develop innovative sports consumption applications, such as national fitness maps and scientific fitness guidance systems.

(3) Trusted Transaction Mechanism: Build a trusted data transaction and exchange mechanism through blockchain technology to promote market-oriented allocation of data factors.

5.2. Business Model Path: Innovating Monetization Logic to Activate Value Co-creation

The traditional "Ticket + Sponsorship + Merchandising" model has hit a ceiling; digital technology must be used to explore new business models based on value co-creation.

5.2.1. Developing the "Hardware + Content + Service" Subscription Model

Drawing on Peloton's successful experience, promote the transformation of sports manufacturing enterprises into service providers.

(1) Entry and Retention: Use the sale of smart hardware as a traffic entry point, and high-quality streaming content (live courses, gamified competitions) and community services as retention means, achieving continuous cash flow through membership subscriptions.

(2) Lifetime Value: This model transforms one-time consumption into continuous consumption throughout the life cycle, greatly enhancing Customer Lifetime Value (LTV). Enterprises should focus on continuous content updates and refined community operations to maintain high renewal rates.

(3) Flexible Pricing: Explore flexible pricing strategies such as "free hardware + high subscription" or "high-priced hardware + free basic service" to lower consumption thresholds.

5.2.2. Exploring Blockchain-Based Digital Asset Trading Models

Encourage sports IP holders (events, clubs, stars) to develop Web 3.0 products such as digital collectibles (NFTs) and fan tokens.

(1) Confirmation and Co-creation: Use blockchain technology for rights confirmation, allowing fans to participate in value co-creation and gain returns during purchasing, collecting, and circulating. This can not only open up new revenue sources but also enhance fan stickiness.

(2) Copyright Fragmentation: Explore fragmented trading of sports copyrights, allowing more small and micro enterprises and individual creators to obtain event copyrights for secondary creation with low thresholds, prospering the content consumption ecology [7]. This model will completely change the business logic of sports copyright, moving from "exclusive monopoly" to "open co-creation."

5.3. Industrial Ecology Path: Breaking Industry Barriers to Promote Cross-Border Integration

Scene reconstruction requires the sports industry to break through its own limitations, deeply integrate with related industries, and build a "Sports+" digital new ecology.

5.3.1. Deepening the Digital Integration of "Sports + Medical"

Break the barriers between sports data and electronic medical record data.

(1) Data Interoperability: Promote the inclusion of smart wearable device data into resident health records and support doctors in issuing "digital exercise prescriptions."

(2) Insurance Innovation: Insurance companies can customize health insurance products based on users' sports data, offering premium discounts to users who maintain good exercise habits (interactive policies). This integration elevates sports consumption from "interest-oriented" to "rigid demand-oriented," with huge market potential. For example,

"digital therapeutic" products for chronic disease patients combining exercise monitoring with drug treatment have broad application prospects.

5.3.2. Expanding the Immersive Experience of "Sports + Tourism"

(1) Online Seeding: Use VR/AR technology to develop "Cloud Tourism + Cloud Events" products, allowing users to get interested online ("plant grass").

(2) On-site Experience: Implant smart sports facilities (such as smart trails, AR treasure hunts) in tourist attractions to improve the interactivity and fun of tourism.

(3) One-Stop Service: Integrate event registration, hotel accommodation, transportation, and specialty dining through OTA platforms to provide one-stop sports tourism digital solutions. Build a digital brand of "Travel Following Events," accurately push tourism products through big data analysis of tourist profiles, and realize traffic mutual guidance and value superposition between sports and tourism.

5.4. Governance Path: Perfecting Digital Rules to Ensure Consumption Safety

Digital technology is a double-edged sword; while empowering, it also brings risks such as privacy leakage, algorithmic price discrimination, and virtual fraud. A governance system must be perfected to escort sports consumption upgrading.

5.4.1. Strengthening Data Security and Privacy Protection

Strictly implement the detailed rules of the "Data Security Law" and the "Personal Information Protection Law" in the sports field.

(1) Defining Boundaries: Clearly define the collection boundaries and usage specifications of biometric information (face, fingerprint, gait), adhering to the "principle of least necessity."

(2) Technical Guarantee: Promote privacy computing technology to achieve "data available but invisible," eliminating consumers' anxiety about "privacy exposure" and establishing digital trust. Stricter protection measures should be implemented for sports data of special groups such as children and adolescents to prevent data abuse.

5.4.2. Regulating Algorithmic Ethics and Platform Monopoly

Strengthen supervision of sports internet platforms and severely crack down on price discrimination behaviors like "big data backstabbing."

(1) Algorithmic Transparency: Require platforms to disclose algorithmic logic and grant consumers the right to turn off personalized recommendations, breaking "information cocoons."

(2) Ecological Governance: Guide platforms to establish a healthy community ecology, govern cyber violence, chaotic fan circle behaviors, and false advertising, creating a rational, positive, and sunny sports consumption cultural atmosphere [8]. Establish a third-party algorithm audit mechanism to periodically evaluate platform recommendation algorithms to ensure they conform to mainstream values.

6. Case Analysis

To illustrate the above theoretical logic more intuitively, this chapter selects representative cases for in-depth analysis.

6.1. Keep: Scene and Value Evolution from Tool to Platform

As China's leading sports technology platform, Keep's development history perfectly interprets the path of "Scene Reconstruction" and "Value Co-creation."

6.1.1. Scene Reconstruction: From Living Room to Full Scene

Keep was initially a mobile fitness tool that solved the pain points of "not knowing how to train" and "no time to go to the gym," moving the fitness scene from the gym to the living room (extension of physical scene). Subsequently, Keep launched hardware like smart bikes, wristbands, and treadmills, realizing software-hardware interconnection and data interoperability. Recently, Keep has vigorously developed its medal business, creating a new type of scene combining virtual and real through the model of "online registration, offline running, and mailing physical medals." In addition, Keep also opened offline Keepland gyms, exploring the Online-Merge-Offline (OMO) model. Through continuous scene iteration, Keep has always occupied the user's sports entry point.

6.1.2. Value Co-creation: Community-Driven Growth

Keep's core moat lies in its community. Training trajectories uploaded by users, photos of body changes, and shared healthy recipes constitute the platform's most valuable assets.

(1) Symbolic Value: The popularity of Keep medals is essentially due to the symbolic value of "self-discipline," "sense of achievement," "ACG love," and "social currency" endowed by users to this piece of metal.

(2) Brand Co-creation: Users' active dissemination on Xiaohongshu (Red) and WeChat Moments to obtain medals is essentially co-creating brand value with the platform. Keep continuously stimulates users' creative enthusiasm through forms like "influencer courses" and "user challenges," maintaining high activity.

6.2. NBA Top Shot: Value Reshaping of Sports Digital Assets

NBA Top Shot is a digital collectibles platform based on the Flow blockchain, which mints exciting moments from NBA games into NFTs for sale.

6.2.1. Scene Reconstruction: Digitized Collecting Experience

Traditional trading card transactions occur in offline card shops or e-commerce platforms like eBay, facing problems such as difficulty in distinguishing authenticity, difficulty in grading condition, slow logistics, and high transaction costs. Top Shot built a purely digital trading scene where confirmation, trading, and circulation are completed instantly on the chain. Users can open packs and display their collections like playing a game, obtaining a cool visual experience. It completely migrates collecting behavior from the physical world to the digital world.

6.2.2. Value Co-creation: Economics of Consensus Mechanism

The value of Top Shot depends entirely on community consensus. Fans' love for a certain star and shared memory of a buzzer-beater moment are transformed into the price of the NFT. Users are not only buyers but also investors and promoters. Community members discuss market trends and predict player performance through channels like Discord,

and this high-frequency interaction reinforces consensus. This model directly transforms fans' emotional investment into measurable economic value, creating a new paradigm for sports IP monetization and providing a model for the digital transformation of sports leagues [9].

7. Challenges and Limitations

Despite the broad prospects for digital technology to empower sports consumption upgrading, there are still many deep-seated challenges in the advancement process.

7.1. "Digital Divide" Restricting Inclusiveness

Sports consumption should be a right for all. However, the elderly, low-income groups, and residents in underdeveloped areas face obvious obstacles in acquiring smart devices and using digital platforms.

(1) Access Gap: Network infrastructure in rural areas is relatively weak.

(2) Usage Gap: Highly intelligent venues may shut out "digital refugees" due to complex operation processes, exacerbating inequality in sports consumption. How to carry out age-appropriate adaptation, promote the sinking of digital infrastructure to rural areas, and bridge the "access gap" and "usage gap" are urgent problems to be solved.

7.2. "Virtual-Real Disconnect" and "Pseudo-Demand"

Currently, some so-called smart sports products on the market tend to "emphasize technology over experience." Some smart venues merely install facial recognition gates without truly improving the sports experience; some metaverse sports projects have rough graphics and laggy interaction, becoming mere conceptual hype. If digital technology cannot truly solve consumers' pain points but instead increases operational complexity, this "pseudo-upgrade" is destined not to last. Technology should return to the essence of serving people and avoid technological alienation.

7.3. Shortage of Composite Talents

Scene reconstruction and value co-creation require composite talents who understand sports laws, digital technology, and business operations. Under the current education system, barriers between sports majors and computer/management majors are strict, leading to a lack of leading talents in the industry capable of coordinating digital transformation. Sports practitioners generally lack data thinking and digital operation capabilities, limiting the depth and breadth of innovation [10].

8. Conclusion and Outlook

Digital technology empowering sports consumption upgrading is a comprehensive transformation involving space, relationships, and models. The research in this paper, through the "Scene Reconstruction - Value Co-creation" analytical framework, shows that:

First, Scene Reconstruction is the premise. Digital technology breaks the physical walls of sports consumption through intelligent, virtual, and networked means, creating a new consumption space-time that is all-time and all-domain, greatly expanding market boundaries.

Second, Value Co-creation is the core. The logic of sports consumption is shifting from "buying products" to "co-

creating value." Consumers and enterprises co-create experiential, social, symbolic, and data values during interaction, which is the endogenous power for achieving consumption structure upgrading.

Third, Ecological Synergy is the guarantee. Achieving this path requires the hard support of infrastructure, the soft innovation of business models, and the steady escort of governance systems.

Looking ahead, with the maturity of frontier technologies such as Generative AI (AIGC), Brain-Computer Interfaces (BCI), and holographic communication, sports consumption will enter a new stage of "Human-Machine Symbiosis." Future sports consumption will pay more attention to spiritual satisfaction and self-actualization. We need to maintain a cautiously optimistic attitude, embracing the dividends brought by technology while being alert to the risks of technological alienation, always adhering to the "people-oriented" sports development concept, and letting digital technology truly serve the comprehensive development of people. Future research can further focus on frontier topics such as the reshaping of sports content production relations by AIGC, ethical issues in sports metaverse, and psychological mechanisms of digital sports consumption.

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