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In an era defined by rapid technological advancements, dynamic market landscapes, and complex global challenges, the business world stands at the precipice of constant transformation. It is in this context that we proudly introduce *The Journal of Contemporary Business Review*, a platform meticulously crafted to serve as a nexus for scholars, practitioners, and thought leaders to exchange cutting-edge ideas, empirical research, and innovative perspectives on the most pressing issues in contemporary business.

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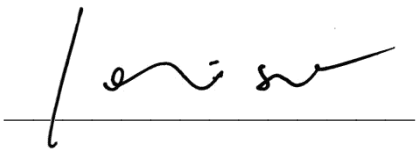

Head of the Editorial Department

2nd July, 2025 in Shanghai

CONTENT

Article

Research on Enhancing the Adaptability Between Tax Governance and Digital Economic Development

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Abstract: The digital economy has now become a driving force for China's high-quality development and a new engine for economic growth. Different from the traditional economy, the digital economy features virtuality, concealment, and cross-border characteristics, posing severe challenges to tax system design and tax collection. Traditional tax governance models can no longer address a series of tax issues in the digital era. This paper first elaborates on the connotation and characteristics of the digital economy, then analyzes the asynchronous dilemmas between China's tax governance and the digital economy from the perspectives of tax systems, tax collection systems, tax supervision capabilities, and talent demand. Finally, it explores specific countermeasures to enhance the adaptability, including improving the tax legal system and tax registration system, enhancing the adaptability of traditional taxes to the digital economy, optimizing tax collection systems, and cultivating professional talents, aiming to promote the quality and efficiency of China's tax governance.

Keywords: Tax governance; Digital economy; Adaptability

1. Introduction

As a new engine for global economic growth, the digital economy is profoundly reshaping the global economic landscape and value creation models. While bringing unprecedented opportunities, its virtuality, cross-border nature, and data-driven characteristics pose systemic challenges to the tax governance system based on traditional physical entities and fixed locations. For example, issues such as ambiguous taxpayers in platform economies and tax base erosion caused by cross-border profit shifting have emerged. As a global leader in digital economic development, China's adaptive reform of tax governance systems carries special strategic significance. However, contradictions exist between China's current tax governance level and the development of the digital economy. Against this backdrop, how to enhance tax governance capabilities to adapt to the digital economy has become an urgent issue.

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2. The Digital Economy from a Tax Perspective

The digital economy is a new economic model driven by digital technologies, with data resources as key factors and networked and platform-based organizational forms. On August 27, 2024, the China Academy of Information and Communications Technology released the Research Report on China's Digital Economy Development (2024), showing that China's digital economy reached 53.9 trillion yuan in 2023, accounting for 42.8% of GDP. According to data from the State Taxation Administration, the core digital economy industries contributed 12.1% of total sales revenue and 10% of GDP in 2023. Evidently, the digital economy is increasingly becoming a pillar of stable economic growth, yet its rapid development also places higher demands on China's tax governance mechanisms.

Distinct from agricultural and industrial economies, the digital economy exhibits the following distinctive features:

Data as a core factor: The replacement of physical capital by data capital is its most essential characteristic. Data, as a key production factor, integrates deeply into production, distribution, circulation, and consumption, accumulating massive resources and driving industrial upgrading and the emergence of new business forms through internet platforms. However, the value of data is difficult to accurately calculate or standardize, complicating tax base determination. Additionally, digital service transaction information can be concealed via encrypted payment channels, creating new challenges for tax collection.

Decentralized value creation: In the digital era, economic activities increasingly shift to virtual spaces, eroding traditional tax bases. Non-monetary activities such as user behavior data analysis and algorithm optimization, though unincorporated into tax bases, are crucial for corporate profits. Multinational corporations can also bypass corporate income tax by leveraging digital operations to avoid the "permanent establishment" rule.

Cross-border transactions: Digital products and services (e.g., cloud computing, online advertising) can be delivered instantaneously, transcending geographical boundaries and facilitating global trade. However, this increases difficulties in determining tax jurisdiction, including identification of revenue types, taxable locations, and applicable tax rates. For instance, in complex transactions involving buyers, sellers, platforms, and payment providers across different jurisdictions, the definition of taxable locations and rates becomes ambiguous.

Networked and platform-based organization: Platform economies, as the dominant organizational form, connect producers and consumers to form multi-sided markets. New business models blur the line between producers and consumers, with a large number of natural persons becoming transaction subjects. Frequent transactions involving scattered and mobile taxpayers make traditional tax registration and collection models ineffective. For example, individual livestreamers with diverse income sources (tips, advertising revenue, platform shares) pose challenges for accurate tax calculation.

While the digital economy creates opportunities, it also challenges China's tax governance mechanisms. Enhancing tax governance capabilities and improving tax system adaptability to the digital economy has thus become a critical task.

3. Tax Challenges Posed by the Digital Economy

3.1. Asynchronous Dilemmas Between Tax Systems and the Digital Economy

3.1.1.Difficulties in Defining Taxpayers

The digital economy's new business models have diversified transaction subjects and forms, making tax sources more concealed. Information asymmetry exacerbates difficulties in identifying taxpayers. Digital transactions, unconstrained by time and space, have expanded corporate profits and created more employment opportunities, leading to a surge in individual practitioners and the rapid growth of C2C business models. These taxpayers, characterized by mobility and dispersion, are hard to register and supervise. For example, Didi Express drivers, as independent individuals with diverse and unstable incomes, only require identity verification rather than tax registration, increasing collection difficulties. Moreover, digital transactions relying on the internet, electronic currencies, and blockchain are highly concealed and virtual, hindering tax authorities' tracking of tax-related information and identification of scattered taxpayers. Additionally, high-income groups such as internet celebrities and livestreamers, with complex settlement methods, are poorly covered by current collection systems, risking tax evasion.

3.1.2.Ambiguity in Tax Objects

Traditional economies primarily tax tangible goods, labor, and services with differentiated standards. In the digital economy, however, emerging forms such as virtual goods, digital services, and data transactions challenge tax object definitions. The shift from tangible to intangible assets (e.g., digital assets) renders existing criteria obsolete, making accurate identification of tax objects in digital transactions difficult for tax authorities.

3.1.3.Breaking the "Physical Presence" Principle of Permanent Establishments

Permanent establishments, defined by the OECD Model Tax Convention as "fixed places of business" or dependent agents, determine a country's taxation rights based on the industrial-era logic that "physical presence equals value creation." In the digital economy, value creation relies on user data collection, algorithm optimization, and market interaction—activities that require no physical presence. Corporations can thus provide digital services or facilitate transactions without establishing permanent establishments, evading corporate income tax.

3.2. Asynchronous Dilemmas Between Tax Collection Systems and the Digital Economy

3.2.1.Mismatch Between Taxpayer Shifts and Collection Methods

As transaction models evolve, taxpayers have shifted from traditional enterprises to online platforms and individual merchants, with natural persons gaining prominence as economic subjects. China's current collection methods for natural persons are inadequate: high-income groups like internet celebrities use complex settlement methods and conduct most transactions online, making tax nodes hard to track. This mismatch increases tax loss risks. In C2C models, individuals switch between consumer and supplier roles without tax registration, and transactions are highly concealed, further straining collection systems. Even registered taxpayers may lack fixed business locations, complicating the determination of taxable locations.

3.2.2.Mismatch Between Economic Models and Collection Systems

Digital economy tax collection can no longer rely solely on tax authorities. E-commerce generates massive, complex, and diverse data stored on third-party platforms rather than tax departments, limiting authorities' access to real transaction information. China's reliance on source withholding and lack of monitoring mechanisms for virtual or network-based potential tax sources further exacerbate tax losses.

3.3. Asynchronous Dilemmas Between Tax Collection Systems and the Digital Economy

Tax supervision methods lag behind the objects of supervision. On one hand, in digital transaction activities, key information such as capital flows, transaction timing, and transaction locations is highly concealed, making it difficult to define tax elements such as taxpayers and taxable objects. Transaction participants often use technical means to evade supervision, which results in tax authorities being unable to accurately detect tax violations. Moreover, tax departments lack efficient technical means in the process of tax law enforcement, exposing tax governance to risks and challenges in tax law enforcement.On the other hand, there is a shortage of professional talents. The digital economy involves complex information technologies, business models, and tax policies, requiring a team of professional talents to effectively deal with various new problems arising in the digital economy. However, at present, it takes time for China's tax personnel to change their ideological awareness and improve their management capabilities. They are insufficient in mastering and applying emerging technologies, making it difficult for them to adapt to the rapidly changing tax environment.In addition, some multinational enterprises, taking advantage of the characteristics of the digital economy, the imperfection of China's tax system, and the differences in international tax rules, carry out cross-border tax planning through certain means to evade tax supervision, which brings difficulties to China's tax audit work.

4. Strategies to Enhance Adaptability Between Tax Governance and Digital Economic Development

4.1. Improve the Tax Legal System and Tax Registration System

Laws such as the Value-Added Tax Law and the Enterprise Income Tax Law are in urgent need of improvement to provide clear legal basis for digital economy transactions and reduce disputes between tax collectors and taxpayers. In the context of the digital economy, the subjects of taxation are diverse and extensive, including not only enterprises but also a large number of individual practitioners such as personal online stores and live streamers, with their business activities not restricted by geographical regions. Based on this, an internet-based electronic tax registration system can be established to bring various new types of economic businesses into the scope of management, thereby realizing a unified, standardized, convenient-to-operate, intelligent and efficient tax registration management, so as to meet the needs of the development of the digital economy.

4.2. Improve the tax system and precisely implement preferential tax policies

On the one hand, it is necessary to improve policies related to existing taxes and enhance the adaptability of traditional taxes to the development of the digital economy. For instance, in terms of value-added tax, the scope of taxation should be further clarified, with consideration given to incorporating digital economy-related products and services. In terms of enterprise income tax, the criteria for determining permanent establishments should be improved, shifting from physical entities to substantive existence. China should actively participate in the formulation of international tax rules, safeguard the rights and interests of developing countries, provide "Chinese solutions" for international tax rules, and enhance its international discourse power.

On the other hand, focus should be placed on the collection of new taxes such as digital tax and digital service tax. At present, tax elements in China's digital transactions—including taxpayers, taxable objects, and tax rates—cannot be accurately defined, and there are no corresponding tax categories. However, many countries around the world have already started or are planning to impose digital taxes, so close attention should be paid to the practical effects of such new taxes in other countries.

In addition, at the level of preferential tax policies, it is essential to ensure that relevant policies are implemented precisely and effectively, promoting the digital economy onto a path of standardization and healthy development. In the context of the digital economy, more targeted preferential tax policies should be implemented based on the unique characteristics of the digital industry. For example, for innovative enterprises, policies on additional deductions for research and development expenses can be improved to stimulate their enthusiasm for technological innovation; for emerging business models such as platform economies, special preferential tax policies can be formulated to guide the healthy development of the industry. Meanwhile, it is also necessary to strengthen supervision, control, and effect evaluation of relevant policies to ensure their effective implementation.

4.3. Improve the Tax Collection and Administration System

In the era of the digital economy, tax collection and administration face challenges such as highly mobile tax sources, integration of multiple business formats, and strong concealment of income. Governance upgrading can be achieved through the collaborative innovation of big data, artificial intelligence, and blockchain technologies to improve the efficiency and transparency of tax collection and administration. For example, big data technology can integrate multi-source data (such as financial statements, bank transactions, and electronic invoices) to build a comprehensive database of taxpayer information, enabling tax authorities to achieve precise profiling and dynamic risk monitoring. The distributed ledger and encryption technology of blockchain can ensure that tax-related data remains unaltered. Artificial intelligence can automatically generate tax returns, reducing the workload of tax authorities.

It is also feasible to introduce a third-party collaborative tax governance and administration model and implement a supporting tax withholding system for third-party platforms. Third-party transaction platforms in the digital economy, as hubs for massive tax-related data, inherently possess significant advantages of convenient information exchange and efficient supervision, playing an increasingly important role in tax collection and administration. Based on this, a dual tax governance model featuring close collaboration between the government and platforms can be established to strengthen the cooperative ties between tax authorities and third-party platforms. Relevant laws can stipulate the responsibilities and obligations of third-party platforms to regularly report tax-related information to tax authorities, thereby expanding the scope of information available to tax authorities. Additionally, it is necessary to enhance communication between the government and enterprises, and mobilize the enthusiasm of industry associations and intermediary organizations, so that they can play a role in addressing the problem of information asymmetry and promote China's tax collection and administration toward greater scientificity and efficiency.

Strengthening inter-departmental cooperation is crucial to encouraging multi-subject participation and the application of diverse means in tax supervision, fostering a collaborative governance model among different government departments, and building a multi-level tax co-governance system. Information sharing between tax authorities and other departments (such as industry and commerce, banking, and market supervision) should be enhanced to break the limitations of single-party governance. Special inter-departmental working groups can be established to increase information exchange, regularize intelligence sharing, and achieve interconnection of tax-related information. Furthermore, a case database related to tax collection and administration practices in digital economic activities can be developed to better guide the work of tax authorities and improve the accuracy of tax law enforcement.

4.4. Cultivate Professional Talents

The tax issues brought about by the digital economy are complex and diverse, placing higher demands on professionals in terms of knowledge reserves, policy interpretation capabilities, and technical operation skills. Therefore, it is necessary to cultivate professional talents specialized in digital economy taxation. Universities should be encouraged to add interdisciplinary programs such as "Digital Economy and Taxation" and "Smart Tax Administration", and offer technical courses on big data, blockchain, and artificial intelligence to cultivate interdisciplinary talents. We should deepen university-enterprise cooperation, encourage tax authorities to hold lectures in universities, and support the joint establishment of training bases by tax authorities and universities to improve practical capabilities. International exchange programs should be promoted: talents can be selected to participate in international tax forums to learn cutting-edge theories and practices, and overseas experts can be invited to give lectures to broaden the perspective on cross-border tax governance.

5. Conclusion

In the era of the digital economy, China's tax governance system faces various problems and opportunities. Firstly, it is difficult to define tax subjects and taxable objects; permanent establishments have broken through the "physical presence" principle, making cross-border tax collection and administration more complex and leading to severe base erosion. Secondly, the relative lag of tax collection and administration increases the risk of tax loss. Finally, tax supervision methods are relatively backward compared to the objects of supervision, and there is a shortage of professionals specializing in digital economy taxation.

In the face of these challenges, we need to further improve the tax legal system and tax registration system, promote tax system reform, use new technologies to improve the efficiency of tax collection and administration, and cultivate professional interdisciplinary talents. Through

these measures, we can enhance the adaptability of tax governance to the development of the digital economy.

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Article

Reshaping Electronics Supply Chain Dynamic Capabilities and Resilience through AI-driven Generative Design: A Theoretical Framework Integrating Design-as-a-Service (DaaS) and Flexible Response

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Abstract: Amidst the dual challenges of vulnerability and customization facing the global electronics supply chain, where traditional PCB design has emerged as a critical bottleneck constraining corporate agility, this study investigates how AI-driven generative design reconfigures supply chain dynamic capabilities and resilience. Employing a mixed-methods approach that combines multiple case study analysis with system dynamics simulation, the findings reveal that AI-driven generative design fosters a novel corporate dynamic capability centered on 'Design-as-a-Service' (DaaS). By decoupling the design and manufacturing stages, this capability significantly enhances the supply chain's flexibility in responding to market volatility and its resilience against external disruptions. Consequently, this paper proposes a theoretical framework that integrates DaaS with flexible response, elucidating the core mechanisms through which AI empowers supply chains and offering strategic guidance for firms navigating digital transformation to build sustainable competitive advantage.Do not regard AI as a mere tool, but rather as a strategy to reshape core corporate capabilities and supply chain ecosystems.

Keywords: Generative Design 1; Dynamic Capabilities 2; Flexible Supply Chain 3

0. Introduction

The global electronics industry is experiencing unprecedented "new normal" challenges, including escalating geopolitical risks, persistent component shortages (particularly chips), and highly personalized and rapidly iterating consumer demands [1]. The traditional linear design-procurement-production model, with its lengthy processes, has shown evident fatigue under unexpected shocks, leading to significant "bullwhip effects" and insufficient response capabilities. PCB design and manufacturing, as the "mother of electronic products," has become a critical bottleneck for rapid product market entry due to its long cycles, high costs, and poor flexibility.

The emergence of AI (Artificial Intelligence) generative design brings hope for breaking through this bottleneck. It can autonomously generate and optimize thousands of design solutions based on preset constraints such as performance, cost, materials, and manufacturability, transforming the traditionally human experience-dependent "creation" process into "human-machine collaborative exploration" [2]. However, existing research primarily focuses on the application of AI algorithms in engineering fields, with insufficient exploration of their business and strategic value. While management research has addressed supply chain flexibility, it rarely delves into the implementation mechanisms from the core link of "design origin." The internal mechanisms of how AI design technology empowers enterprise core capabilities and drives supply chain model transformation have not been adequately revealed in current literature.

This study aims to fill this gap by deeply exploring how AI-driven generative design reshapes the dynamic capabilities and resilience of the electronics industry supply chain, and by integrating "Design as a Service" (DaaS) and flexible response mechanisms, constructs a comprehensive theoretical framework.

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Part I: Research Background and Problem Statement

1.1 Macro Context: The "New Normal" of Electronics Industry Supply Chain

The electronics industry supply chain, due to its inherent complexity and globalization characteristics, appears particularly vulnerable when facing external shocks. Currently, from the ongoing impact of the COVID-19 pandemic to geopolitical conflicts (such as the Russia-Ukraine conflict and US-China trade friction) and frequent natural disasters, the multiple uncertainties in the global economy are continuously amplifying this vulnerability [3]. The recent semiconductor chip shortage serves as compelling evidence, severely impacting key industries such as automotive and consumer electronics, highlighting the risk of core component supply disruption. Simultaneously, consumer market demand for personalized and rapidly iterating products continues to rise, posing severe challenges to traditional mass production models and exacerbating the "bullwhip effect" in supply chains due to distorted supply and demand signals.

1.2 Industry Bottleneck: PCB Design and Manufacturing

PCB is a core component of all electronic products, and its design and manufacturing cycle directly determines the speed of new product market entry. Traditional PCB design processes heavily rely on engineers' experience and skills, often requiring multiple iterations and manual adjustments to meet requirements. Moreover, information asymmetry between the design process and manufacturing side makes it difficult for design solutions to achieve optimal manufacturability, ultimately resulting in high design costs, long development cycles, and difficulty in rapidly responding to market changes, becoming a critical bottleneck in electronic product innovation [4].

1.3 Technological Breakthrough and Research Gap: AI Generative Design

AI generative design technology provides a breakthrough for addressing the aforementioned bottlenecks. Through machine learning, optimization algorithms, and other techniques, AI can rapidly generate numerous design variants that satisfy specific constraints (such as dimensions, performance, cost, materials, manufacturing processes, etc.) and conduct rapid evaluation and optimization. This transforms the design process from traditional serial, iterative mode to parallel, exploratory mode, greatly improving design efficiency and the breadth of design space exploration [5]. For example, in PCB design, AI can automatically route and place components based on electrical performance, thermal requirements, space limitations, and manufacturability rules, and even recommend optimal component selection and material combinations.

Existing research exhibits significant limitations and disconnection when exploring the intersection of artificial intelligence (AI) and supply chain management. On one hand, literature in the engineering and technology fields primarily focuses on the mathematical principles and technical implementation of AI algorithms, while generally lacking in-depth exploration of their potential value and impact at more macro business and strategic levels such as supply chain management. On the other hand, although the management academia has conducted extensive research on supply chain flexibility, resilience, and digital transformation, these discussions rarely trace back to the "source" link of product design, failing to adequately elucidate how AI fundamentally enhances overall supply chain performance by restructuring design processes [6]. Consequently, current literature lacks a clear and complete logical chain that effectively reveals the intrinsic connections between "AI design technology application," "enterprise core capability enhancement," and "supply chain model transformation," making it difficult to systematically understand and comprehensively present AI's deeper strategic value in supply chains.

1.4 Core Research Questions

Based on the aforementioned background and research gaps, this study will focus on the following core questions:

RQ1: How does AI generative design fundamentally change the PCB design process and give rise to new enterprise capabilities?

RQ2: Through what mechanisms do these AI-enabled new capabilities transform into supply chain flexibility and resilience?

RQ3: How should enterprises construct strategic frameworks to maximize the supply chain advantages brought by AI generative design and form sustainable competitive barriers?

Part II: Theoretical Architecture

This study will construct an integrative theoretical framework with supply chain management theory, dynamic capabilities view, and digital transformation and platform ecosystem theory as core pillars.

2.1 Supply Chain Management Theory: Flexibility and Resilience

Supply chain flexibility and resilience are critical capabilities for enterprises to respond to market environment changes and external shocks. Among these, flexibility primarily refers to the supply chain's ability to rapidly adapt and adjust to foreseeable or anticipated changes (such as product customization, demand fluctuations, etc.), aiming to enhance operational efficiency and meet diversified market demands. Resilience, on the other hand, focuses on the supply chain's ability to resist, adapt to, and recover from sudden, unforeseen events (such as natural disasters, supplier disruptions, etc.), to ensure the continuous and stable operation of the supply chain [7].

This study posits that AI-driven generative design can synergistically enhance both supply chain flexibility and resilience: on one hand, through rapid iteration and multi-solution generation, it promotes product and service customization, enhancing supply chain flexibility; on the other hand, by accelerating the validation of alternative solutions and dynamic reconfiguration of manufacturing resources, it improves the supply chain's response and recovery capabilities to sudden events, thereby strengthening its resilience.

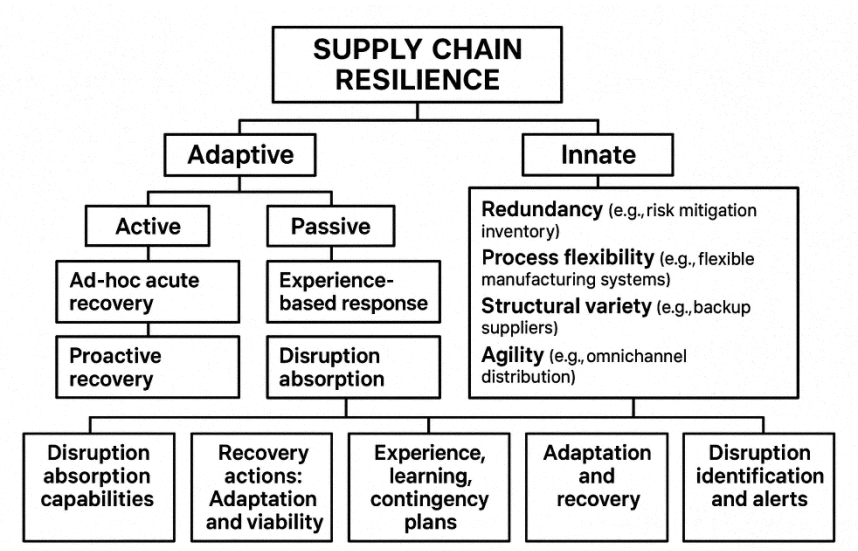

Figure 1. This is the supply chain resilience classification diagram.

Supply chain resilience can be further subdivided into innate resilience and adaptive resilience. Innate resilience is primarily reflected in the inherent redundancy in supply chain design (such as safety stock and backup suppliers), process flexibility (such as rapid production line switching), and structural diversity (such as multi-channel distribution). These factors provide fundamental protection for supply chains in dealing with risks. Adaptive resilience refers to the supply chain's ability to achieve immediate response and proactive recovery to emergencies through continuous learning, experience accumulation, and contingency planning when encountering disruptions, thereby enhancing its overall recovery capability and dynamic

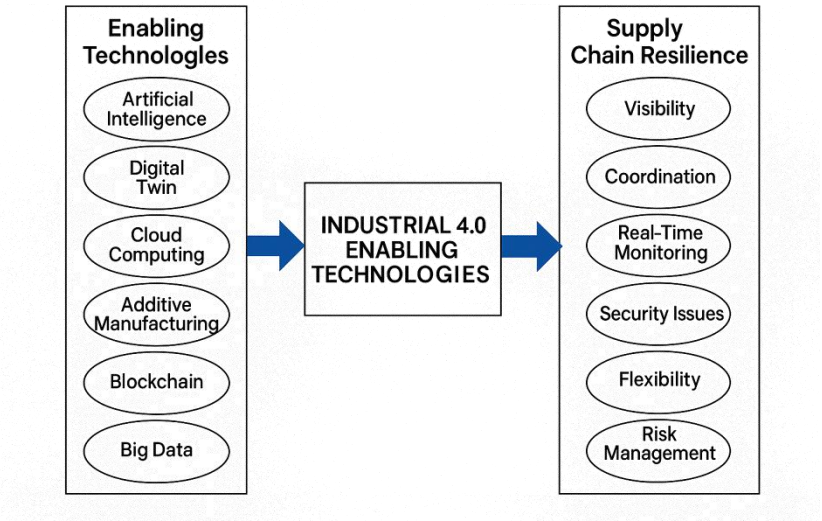

Figure 2. This is the supply chain resilience classification diagram.

2.2 Dynamic Capabilities View: AI-Driven Design as a Core Tool

The Dynamic Capabilities View emphasizes that in rapidly changing environments, enterprises should possess the ability to sense, seize, and reconfigure internal and external resources and capabilities, thereby continuously maintaining and strengthening competitive advantages [8]. This study views AI-driven generative design as a core tool for building dynamic capabilities in the digital age, specifically manifested in the following three aspects:

Sensing: AI enables enterprises to more rapidly and accurately sense new market demands, technological trends, and potential supply chain risks. Through deep analysis of massive data (such as customer feedback, market trends, component supply information, and geopolitical dynamics), AI can identify potential patterns, predict demand changes, and even provide early warnings for possible supply chain disruption risks. For example, AI can quickly evaluate the feasibility of different component substitution options, helping enterprises identify and avoid risks at early stages.

Seizing: AI's efficient design and simulation capabilities enable enterprises to quickly grasp fleeting market opportunities [9]. Once new market demands are sensed, AI-driven generative design tools can generate and optimize design solutions within seconds, dramatically shortening new product development cycles. Enterprises can therefore launch products targeting specific needs more quickly and respond to market changes in a timely manner. Additionally, AI can rapidly assess the feasibility of alternative components or materials, helping enterprises effectively seize opportunities to mitigate risks.

Reconfiguring: The platformization of AI-driven design promotes the decoupling of design and manufacturing processes, providing strong support for dynamic supply chain reconfiguration. Enterprises can allocate the same design solution to different production bases globally almost in real-time based on multiple factors such as cost, capacity, and geopolitical risks, achieving flexible configuration of manufacturing resources. For example, in PCB design, AI can automatically adjust and optimize design solutions according to the process capabilities and cost structures of various manufacturing facilities, thereby facilitating dynamic reconfiguration of supply chain assets [10].

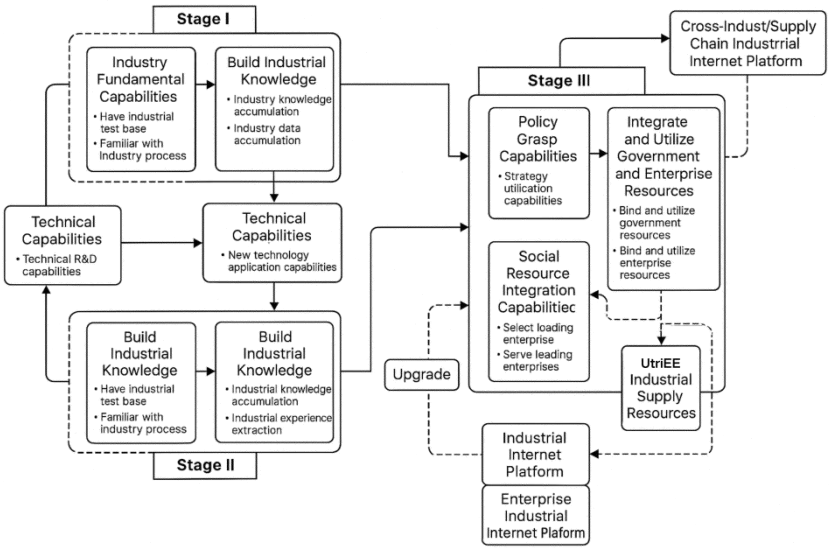

Figure 3. This is the development of key capabilities for industrial internet platforms

This diagram illustrates how industrial internet platforms, in their evolution from enterprise-level to industry-level to cross-industry chain, continuously enhance their capabilities by leveraging technical capabilities (such as new technology applications), industry foundational capabilities (such as in-depth understanding of industry processes), and policy comprehension capabilities, thereby driving resource reconfiguration and value creation [11]. In the third stage of "cross-industry chain," the diagram particularly emphasizes the deep utilization of cross-industry data and the reuse of industrial modules, which highly aligns with the core concepts of AI-driven design platformization and supply chain reconfiguration, providing strong support for promoting efficient collaboration and innovative development of supply chains.

2.3 Digital Transformation and Platform Ecosystem: "Design as a Service"

Digital transformation is not merely the application at the technical level, but signifies a profound shift in mindset—from "product thinking" to "platform thinking." In the context of AI empowerment, PCB design is no longer an isolated project-based activity, but can evolve into a platformized model of "Design as a Service" (DaaS). This platform can efficiently connect customers, designers, component suppliers, and manufacturers, building a collaborative win-win ecosystem. Customers can directly submit design requirements on the platform, with the AI system automatically generating design solutions accordingly and intelligently matching optimal components and manufacturing resources. This model significantly enhances supply chain visibility and integration, reduces transaction costs, and simultaneously promotes multi-party value co-creation.

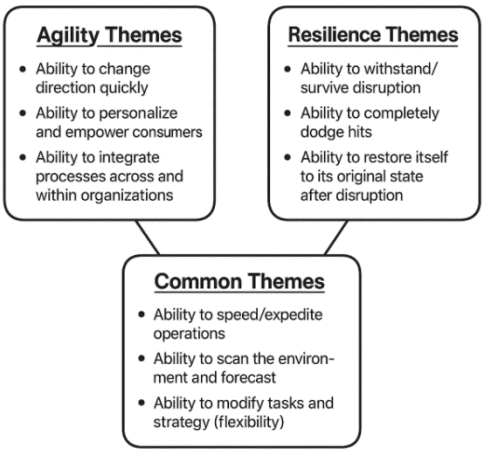

Figure 4. This is the development of key capabilities for industrial internet platforms

This diagram illustrates how digital transformation enhances the overall capabilities of supply chains by improving agility (such as rapid directional changes and customization capabilities) and resilience (such as disruption resistance and rapid recovery capabilities). Meanwhile, environmental scanning and operational adjustment capabilities are identified as common themes supporting both agility and resilience. AI-driven generative design is precisely the key technological means to achieve these agility and resilience characteristics, providing strong support for efficient adaptation and continuous optimization of supply chains.

Part III: Research Design and Methods

Digital transformation is not merely the application at the technical level, but signifies a profound shift in mindset—from "product thinking" to "platform thinking." In the context of AI empowerment, PCB design is no longer an isolated project-based activity, but can evolve into a platformized model of "Design as a Service" (DaaS). This platform can efficiently connect customers, designers, component suppliers, and manufacturers, building a collaborative win-win ecosystem. Customers can directly submit design requirements on the platform, with the AI system automatically generating design solutions accordingly and intelligently matching optimal components and manufacturing resources. This model significantly enhances supply chain visibility and integration, reduces transaction costs, and simultaneously promotes multi-party value co-creation.

This study will adopt a mixed research methodology, combining exploratory multi-case study with theoretical framework construction and quantitative simulation analysis, striving to conduct a comprehensive and in-depth exploration of the research questions from both qualitative and quantitative perspectives.

3.1 Phase One: Exploratory Multi-Case Study

This study will systematically understand the application methods of AI generative design in PCB design processes, the challenges faced, the new capabilities generated, and how these capabilities drive supply chain practice transformation through in-depth interviews and case analyses of different types of enterprises. This phase focuses on answering "how" and "why" questions, and provides empirical evidence and practical insights for subsequent theoretical model construction.

To obtain diverse perspectives, this study selects three types of typical enterprises for case studies:

(1) Large multinational technology companies (e.g., NVIDIA): These enterprises possess strong R&D capabilities and complex global supply chains. Case analysis of NVIDIA helps reveal how AI design is applied in high-end, complex product development and explores its impact on the entire value chain (from chip design to end products). The focus is on how they utilize AI for large-scale design space exploration and collaborate with supply chain partners for innovation.

(2) Leading PCB design software/AI companies (e.g., Cadence): As suppliers of AI design tools, these companies have deep understanding of AI technology's potential and application boundaries. By studying these companies, we can analyze the development and promotion process of AI generative design from the technology supply-side perspective, as well as its transformation of design service models, particularly the implementation of the "Design as a Service" concept.

(3) Agile small and medium-sized hardware startups (e.g., Oculus): Although these enterprises have limited resources, they can respond rapidly to market changes. The study examines their application of AI tools to facilitate rapid innovation, shorten product development cycles, and gain advantages in competitive environments, with particular attention to how they utilize AI to compensate for design capability shortcomings and enhance supply chain flexibility under resource constraints.

3.2 Theoretical Framework Diagram

Part IV: Expected Contributions

The theoretical and practical contributions of this study will be multifaceted.

4.1 Theoretical Contributions

Extending Dynamic Capabilities Theory: This study defines "generative AI design" as a new type of enterprise dynamic capability in the digital age for the first time. By systematically elucidating the specific implementation paths of AI in the three aspects of sensing, seizing, and reconfiguring, it enriches and extends the connotation of dynamic capabilities theory in the digital context. Particularly in the "sensing" dimension, AI's data-driven analysis enables enterprises to identify market demands and potential risks earlier and more accurately; in the "seizing" dimension, AI's rapid iteration and multi-solution generation capabilities in the design phase enable enterprises to efficiently transform captured opportunities into specific products, significantly shortening time-to-market; in the "reconfiguring" dimension, AI-driven design platformization and deep integration with manufacturing enable enterprises to flexibly reconfigure their global manufacturing and procurement networks, achieving dynamic optimization of resource allocation.

Building Theoretical Bridges Between Engineering Design, Artificial Intelligence, and Strategic Management: This study elevates AI generative design from the engineering technology level to strategic management height, revealing how technological innovation directly shapes enterprise core capabilities and supply chain strategies, providing a new theoretical paradigm for interdisciplinary research. This research helps integrate knowledge bases from different fields, such as effectively connecting AI's technical advantages in PCB design (such as batch generation of layout solutions and optimization of signal integrity) with flexibility and resilience objectives in supply chain management (such as shortening delivery cycles and responding to chip shortages).

Deepening Supply Chain Flexibility and Resilience Research: Traditional supply chain research on flexibility and resilience mostly focuses on procurement, production, and distribution links, while this study shifts the perspective upstream to the "design source," revealing how AI generative design, as an upstream capability, fundamentally enhances supply chain flexibility (responding to customization demands) and resilience (resisting design-inherent risks and external shocks) by influencing product architecture, bill of materials, and manufacturability. For example, AI can generate more design solutions that use common or easily substitutable components, thereby effectively reducing the risk of supply chain disruptions.

Part V: Conclusion

Facing the high uncertainty and complex challenges under the "new normal" of the global electronics industry supply chain, traditional human-dominated PCB design and manufacturing models can no longer support enterprises' needs for agile innovation and supply chain risk management. AI-driven generative design technology, with its capabilities of rapid iteration, multi-solution optimization, and deep manufacturing integration, provides a new pathway for breakthrough innovation in the electronics industry. It not only reshapes PCB design processes and generates new enterprise capabilities such as rapid prototyping, multi-dimensional optimization, and cross-domain collaboration, but also significantly enhances supply chain flexibility and resilience through "Design as a Service" platform innovation.

Based on supply chain management theory, dynamic capabilities view, and digital transformation theory, this study systematically examines the core role of AI generative design in sensing, seizing, and reconfiguring enterprise resources and capabilities, and empirically demonstrates its profound impact on supply chain performance through multi-case studies and simulation modeling. The research finds that AI generative design not only significantly shortens product development and time-to-market cycles and optimizes supply chain cost structures, but also effectively enhances enterprises' ability to respond to sudden risks and market changes through data-driven agile response and multi-solution alternative capabilities.

Overall, AI generative design has become a key tool for electronics industry enterprises to build dynamic capabilities in the digital age and achieve intelligent supply chain transformation and sustainable competitive advantages. In the future, with the continued deepening of platform-based business models such as "Design as a Service," AI is expected to drive the electronics industry supply chain to accelerate its evolution toward greater intelligence, efficiency, flexibility, and resilience, providing solid support for global industrial innovation and value chain upgrading.

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Article

Athlete Performance and Commercial Viability: Linking Badminton Players' Success to Sponsorship Opportunities

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Abstract: The relationship between athletic performance and commercial opportunities for badminton players, particularly those ranked at Levels 6-7 of the Chinese Badminton Association (CBA), is explored in this research. While success in major tournaments is a significant factor in securing sponsorships, findings indicate that an athlete's public image, media presence, and social media engagement are equally crucial in attracting commercial partnerships. Semi-structured interviews with athletes and surveys of sports sponsors and marketers reveal that players who perform well both on and off the court are more likely to secure sponsorship deals. The research emphasizes that in today's sports industry, building a strong personal brand and engaging with a global audience through media platforms are becoming increasingly important for commercial success. These insights suggest that badminton players must not only focus on improving their performance but also manage their public image to enhance marketability and achieve long-term commercial viability.

Keywords: Badminton, Sponsorship, Personal Branding, Social Media, Chinese Badminton Association, Sports Marketing

1. Introduction

Badminton is a popular sport in China and has gained a lot of attention in recent years. Many top players from China have performed well on the international stage, which has brought more focus to the sport. However, despite this success, badminton's commercial side is still not as well developed as other sports like basketball or football. This raises a question: why is it that even with so many talented players, badminton still struggles to reach its full commercial potential? It seems that although there is a lot of love for the sport, the financial side, like sponsorships and brand deals, hasn't really taken off yet. Understanding how athletes, especially those at the top level, can turn their success into commercial opportunities could help us unlock the potential of badminton in a whole new way.

We know that sports have become big business in the modern world. Athletes are no longer just seen as competitors; they are also brands. In some sports, star athletes can make millions from endorsements, sponsorships, and media deals. But does that apply to badminton? If a player does well in tournaments and is known internationally, shouldn't their market value rise too? It seems that there is a big gap between how successful badminton players are on the court and how much commercial value they can gain from it. Is it just about their performance, or do other factors—like how they are perceived by the public—play a bigger role? This study is important because it will dig into this very question: how can top badminton players turn their skills into something that attracts sponsors, media attention, and even more fans?

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What makes this research even more urgent is that the sport is still growing in China. There's no doubt that badminton has a large following, but the financial side of the sport doesn't seem to be on the same level. When we look at other sports, we see how athlete sponsorships, brand deals, and media attention can elevate not just the athlete but also the entire sport. So why isn't badminton in the same position? Is it simply that the athletes haven't been marketed properly, or is it that the sport itself has been slow to embrace these opportunities? I think that if we can better understand how performance translates into commercial opportunities for top players, we can find a way to make the sport more financially viable and sustainable. We also have to consider that today's athletes are not just about winning medals; their personal brands, social media presence, and overall image are just as important. So, why is it that many sports—despite having a much smaller fan base—seem to generate more sponsorship dollars than badminton? Perhaps it's because the commercial side of the sport has not caught up with the athletes' actual performances. If badminton is going to continue growing and attracting the same level of attention as other major sports, it needs to find a way to leverage its athletes' successes in a way that resonates with sponsors and the general public.

The purpose of this research is to explore the link between the performance of badminton players and their commercial opportunities, focusing on players in Levels 6-7 of the Chinese Badminton Association. I want to ask: How much does a player's on-court success really matter when it comes to attracting sponsors? Do sponsors care more about winning titles or the player's image and public persona? Is it possible that a player's personal brand—how they are perceived by fans, sponsors, and the media—has more influence on their marketability than their actual game performance? These are some of the big questions I hope to answer through this research. Another thing to think about is this: If top badminton players can unlock the door to more commercial opportunities, could it be that the entire badminton industry will benefit? Could more sponsorship deals, better media coverage, and stronger brand partnerships help bring more money into the sport as a whole? I really believe that this is a key issue. If we can understand how to connect athletes' success with commercial opportunities, we can create a model that helps grow the sport both on and off the court. Through this research, I hope to shed light on how performance influences an athlete's commercial viability. I think it's important to explore how much of a role performance plays in attracting sponsorships, and how much weight is placed on other factors like image, media presence, and overall branding. I also want to examine how these individual athlete successes can influence the bigger picture—could it lead to more investment in the sport and greater financial stability?

This study will provide a clearer picture of the complex relationship between badminton players' performance and their marketability, showing how these factors interact to help grow the sport commercially. I think that by exploring these questions, we can find better ways to support athletes and help them succeed both on the court and off it, making badminton a more sustainable and commercially viable sport in the future.

2. Materials and Methods

The participants in this study are badminton players currently ranked at Level 6-7 within the Chinese Badminton Association. These athletes represent a high level of competitive ability, and their performance in both domestic and international tournaments makes them relevant subjects for examining the link between athletic achievement and commercial viability. A total of 10 players, five male and five female, will be selected to ensure gender representation and a diverse range of performance levels within the specified range. This sample size is chosen to allow for an in-depth, focused analysis, while also being manageable within the scope of the research.

To explore the relationship between athletic performance and commercial opportunities, two primary methods of data collection will be used: semi-structured interviews and surveys. The semi-structured interviews will be conducted with the athletes themselves, as well as with key

stakeholders such as sponsors, agents, and sports marketers who have experience working with professional badminton players.

The semi-structured interviews with the athletes will explore their perceptions of the commercialization of their careers, including their understanding of sponsorship deals, media exposure, and personal branding. These interviews will also examine their experiences with sponsorship negotiations, the role their performance has played in securing deals, and how they view the relationship between performance and marketability. Each interview will last approximately 60 to 90 minutes and will be conducted in a quiet, comfortable setting to encourage open and candid responses. During the interviews, athletes will be asked questions such as: How do you perceive the connection between your on-court success and off-court commercial opportunities? What role do you believe media coverage and your public image play in attracting sponsorships? Can you describe any sponsorship deals you have had? How did your performance influence these agreements? In your experience, what do sponsors look for when choosing to work with an athlete?

The survey will be distributed to sports sponsors and marketers who are involved in badminton or similar sports. The aim of the survey is to gather data on the factors that influence sponsors' decisions when choosing athletes for endorsement deals. The survey will explore the importance of athletic performance, image, media presence, and other factors in the decision-making process. The survey will be anonymous to encourage honest responses. Questions in the survey will include: How important is athletic performance when considering a sponsorship deal? What other factors do you consider when selecting athletes for sponsorship? Do you think a player's competitive success directly impacts their marketability?

The collected data will be analyzed using both qualitative and quantitative methods. The interview transcripts will be analyzed using thematic analysis, which allows for the identification of recurring themes, patterns, and insights across the interviews. This method will help explore athletes' perspectives on the link between performance and commercial opportunities, as well as the role of sponsorship and personal branding in their careers. Thematic analysis will also provide insights into the perceptions of sponsors and marketers regarding the factors that drive athlete commercialization.

The survey data will be analyzed using descriptive statistics, including frequencies, percentages, and mean scores, to identify trends and patterns in the responses. The quantitative analysis will primarily focus on the relative importance of athletic performance versus other factors such as image and media presence in the sponsorship decision-making process. The results from the surveys will be compared across different types of sponsor to examine potential differences in priorities.

This study will adhere to ethical guidelines throughout the research process. Informed consent will be obtained from all participants before data collection. They will be informed about the purpose of the study, the voluntary nature of their participation, and the confidentiality of their responses. All interviews and surveys will be anonymized to protect participants' privacy. Additionally, participants will be given the option to withdraw from the study at any time without consequence. The findings will be used solely for academic purposes, and any identifying information will be kept confidential.

3. Results

This The data collected from both the semi-structured interviews with badminton athletes and the surveys completed by sponsors and marketers provide insights into the relationship between athletic performance and commercial opportunities for Level 6-7 players in the Chinese Badminton Association (CBA). The analysis revealed several key patterns and relationships regarding performance, marketability, and sponsorship opportunities.

From the interviews with the athletes, it was clear that most of them perceived a strong connection between their on-court performance and their commercial value. The majority of

athletes felt that winning significant domestic and international tournaments played a crucial role in securing sponsorships. For instance, players who had secured top placements in major events such as the China Open or the All England Open reported receiving more offers from sponsors compared to those with less successful competition results. Many athletes noted that high performance in tournaments boosted their visibility and helped them stand out in a crowded market. As one athlete mentioned, “When I perform well, it’s like a signal to the sponsors that I am reliable and have the potential to bring attention to their brand.” However, the interviews also revealed that performance alone was not enough. Several athletes highlighted that having a strong public image and media presence was just as important, if not more so, in attracting sponsorships. A few athletes shared their experiences of sponsors expressing interest in them because of their social media following or their public persona, even when their tournament results weren’t stellar. One player commented, “Sponsors care about my performance, but they also care about how many people see me on TV or follow me on Weibo. If I can’t get the media’s attention, it’s harder to get deals.”

In terms of sponsor perspectives, the survey results provided further clarity on the factors that influence sponsorship decisions. The responses from sports sponsors and marketers indicated that athletic performance was indeed an important factor, but it was not the sole determinant. About 65% of the sponsors surveyed stated that an athlete’s competition results were a key consideration, with most emphasizing that top placements in prestigious tournaments directly influenced their decision to sign endorsement deals. However, nearly 80% of the respondents also highlighted the importance of an athlete’s image and media exposure. Sponsors indicated that athletes who were active on social media platforms, appeared in media coverage, and had an accessible and relatable public persona were more likely to secure sponsorships, even if their on-court performance was not the best. Interestingly, a significant portion of the sponsors (around 55%) mentioned that the potential for global market appeal played a role in their decision-making process. This suggests that sponsors may prioritize athletes who have the ability to reach an international audience, further supporting the idea that media presence is critical for attracting sponsorships. A key insight from the survey was that brands often see athletes as ambassadors not only for the sport but also for their values and image. Sponsors look for athletes who align with their brand’s identity and who can connect with their target demographic, which in turn increases the commercial value of the athlete. The survey also explored how different types of sponsorships were awarded. Corporate sponsors, for instance, focused more on an athlete’s ability to generate exposure through media and public relations efforts, while sports-related brands emphasized performance and athletic ability. This difference in focus reflects the diverse ways in which various industries interact with athletes. One sponsor working with multiple badminton players noted, “For our brand, performance is important, but the athlete’s ability to engage with the media and build a personal brand has become even more crucial. We want our athletes to be visible on social media and in advertisements, not just on the court.”

In terms of overall marketability, the athletes who were able to maintain a consistent, strong public image and engage actively with fans through social media platforms like Weibo and WeChat seemed to have an advantage in securing sponsorships. These athletes often had a diverse portfolio of endorsement deals, ranging from product promotions to media appearances. The athletes who were less active in media engagement, even if they had impressive competitive records, reported fewer sponsorship opportunities. This suggests that in today’s sports landscape, an athlete’s public persona can be just as valuable as their performance in terms of attracting commercial opportunities. Finally, the analysis revealed that the athletes who had experienced long-term partnerships with sponsors tended to have a stronger understanding of how to navigate the balance between performance and personal branding. These athletes often cited their relationships with sponsors as mutually beneficial, where they not only gained financial support but also received professional guidance on how to grow their marketability. The data suggested

that long-term partnerships allowed athletes to establish a more stable brand, which in turn increased their commercial opportunities over time.

In summary, the results indicate that while athletic performance remains an important factor in securing sponsorship deals, it is not the only element that contributes to a player's commercial value. The athletes' public image, media presence, and ability to engage with fans through social media are critical in attracting sponsorships and maximizing their commercial opportunities. Sponsors also consider factors such as global market appeal and the alignment of an athlete's persona with their brand identity. The findings suggest that successful badminton players at the top level can increase their marketability by cultivating a strong public image and actively engaging with media platforms, alongside excelling in tournaments.

4. Discussion

The results of this study highlight the complex relationship between athletic performance and commercial opportunities for badminton players. While it's clear that a player's performance is an important factor in attracting sponsorship, it also seems that other elements, like their public image and media presence, play an equally significant role. I believe this shows that being good at badminton is just one part of the equation. In today's sports world, athletes also need to manage their image and build their brand if they want to succeed commercially.

It's obvious from the interviews with athletes that a good performance on the court is closely tied to commercial opportunities. For example, many of the athletes reported that when they performed well in major tournaments, they were more likely to get sponsorship deals. It seems that when an athlete wins a big competition, it makes them more visible and shows sponsors that they are capable of bringing attention to their brand. But here's a thought: Is winning enough? I mean, we can't ignore that even athletes with great performances struggle to get sponsorship deals. Why is that? Perhaps it's because performance alone doesn't tell the whole story.

I think the reason is that public image and media exposure matter just as much, if not more. This is something many athletes mentioned in their interviews. They told me that having a strong social media presence and being seen in the media helped them gain more attention from sponsors. One athlete shared, "If I win a match, great, but if I don't get coverage or engage with my fans on social media, it's harder to attract sponsors." This made me wonder: Does it sometimes feel like athletes have to be media personalities as much as they have to be great competitors? It seems that in today's world, performance alone is no longer enough.

The survey results also shed light on what sponsors care about when choosing athletes for endorsement deals. It's interesting to note that while sponsors do consider a player's performance, they also place a lot of value on things like media exposure and the athlete's personal brand. Around 80% of sponsors said they look at a player's public image, social media presence, and how much media attention they get. This makes sense, doesn't it? In the end, sponsors want their athletes to be seen by as many people as possible, and if a player can connect with fans and build a following, they are more likely to attract sponsorships. I think this might be one reason why some athletes who have strong social media followings but not as many wins still manage to secure good deals. Another thing that stood out to me was how important global appeal is for sponsors. A lot of sponsors mentioned that they prefer athletes who can reach international audiences. This makes me think: Could this be why badminton has not yet tapped into its full commercial potential, even though it's so popular in China? If badminton players want to compete for global sponsorships, they might need to focus more on international visibility. It's not just about being successful in China anymore; it's about being visible worldwide.

Long-term partnerships also seem to play a big role in an athlete's commercial success. The athletes who had established long-term relationships with sponsors seemed to understand how to manage their brand more effectively. These athletes not only received more financial support, but they also learned how to build a sustainable personal brand, which helped them secure more

sponsorship deals over time. I think this shows that building a lasting relationship with sponsors can be just as important as a single performance. It's about creating trust and long-term value for both the athlete and the brand. Of course, there are some limitations to this study. The sample size is small, and the findings may not apply to athletes at other levels or in different sports. It's also possible that there are other factors—such as networking or the size of the fanbase—that influence sponsorship decisions, which weren't fully explored in this research. But I still think the insights we've gathered provide a good starting point for understanding how performance and personal branding come together to help badminton players succeed commercially.

In conclusion, this study shows that athletic performance is important, but it's not the only factor that determines an athlete's commercial value. Public image, media presence, and the ability to connect with fans play a huge role in attracting sponsorships. In today's sports landscape, athletes must build their personal brand and make the most of their media presence to increase their marketability. I believe the future success of badminton players will depend not only on their results in tournaments but also on how well they manage their public image and engage with fans. This could help push the sport toward greater commercial success, both in China and internationally.

5. Conclusions

In conclusion, this study highlights the importance of both athletic performance and personal branding in the commercialization of badminton players. While success in tournaments is crucial, it is clear that media presence, public image, and social media engagement play an equally significant role in attracting sponsors. To thrive commercially, badminton players must not only excel on the court but also actively manage their public persona. By doing so, they can unlock more sponsorship opportunities and help the sport grow both in China and internationally. The findings suggest that a balance between performance and personal branding is key to achieving long-term commercial success in today's sports landscape.

Appendix A

Appendix A. Survey for Sponsors and Marketers

1. Name of Organization: _____

2.Role in Sponsorship Decisions:

☐ Sponsor

☐ Sports Marketer

☐ Brand Representative

☐ Other (Please Specify): _____

3.Years of Experience in Sponsorship:

☐ 1-3 years

☐ 4-6 years

☐ 7+ years

4. When considering an athlete for sponsorship, how important is the following:

a. Athletic performance in tournaments?

☐ Not important

☐ Somewhat important

☐ Very important

b. Social media presence and online following?

☐ Not important

☐ Somewhat important

☐ Very important

c. Personal brand and public image?

☐ Not important

☐ Somewhat important
☐ Very important
5.What other factors do you consider when choosing athletes for sponsorship?
☐ Global appeal
☐ Media coverage
☐ Personality and public relations potential
☐ Engagement with fans
☐ Performance in specific tournaments
☐ Others (Please specify): _____

6.How likely is it for a player to receive a sponsorship if they have performed well in a competition, but have limited social media presence?
☐ Very unlikely
☐ Somewhat unlikely
☐ Somewhat likely
☐ Very likely

Appendix B

Appendix B. Semi-Structured Interview Guide for Athletes

1.How do you see the connection between your success in competitions and your commercial opportunities?

2.Can you describe any sponsorship deals you've had? How did your performance influence these deals?

3.How important do you think your public image is in attracting sponsors, in addition to your tournament results?

4.Have you ever been approached by sponsors because of your social media following or media presence?

5.How do you manage your brand outside of tournaments?

6. Do you think media exposure plays a bigger role than winning titles in securing sponsorships?

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Article

Basketball Jump Shot Technique Training and Practical Research

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Abstract: This study employs literature review, logical reasoning, and observational methods to conduct an in-depth exploration of basketball jump shot technique training. Technical challenges primarily involve movement consistency, center of gravity control, and precise adjustment of release height—all intricately linked to athletes' physical fitness. The jump shot technique demands specific capabilities in body coordination, lower limb explosive power, core (waist) strength, and upper limb (arm) strength. The optimal release timing typically occurs during the hang time as the body approaches or reaches its apex. A higher release point significantly reduces the risk of blocks and enhances shooting accuracy. Training should integrate jump shooting with dribbling, passing, driving, and other techniques, emphasizing smooth transitions between movements to enable flexible application in game scenarios. This research further discusses concrete methods to optimize jump shot training effectiveness.

Keywords:Basketball; Jump Shot Technique; Training Methodology; Practice

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Introduction

In basketball, scoring determines game outcomes. How to score through tight defense? Fast breaks, layups, dunks? These are valid methods, but opportunities are limited in a game. The jump shot stands as the most critical scoring technique, emerging in the late 1930s–early 1940s. Its popularity in the NBA and subsequent adoption in international basketball stem from its efficiency in evading blocks. As the sport's physicality has intensified, relying solely on natural height to shoot in traffic has become obsolete. Except for free throws, stationary shooting is rare in modern games. Shooting percentage often dictates victory, and nearly every player employs the jump shot—making exploration of its training methods profoundly significant.

2. Research Methods

2.1 Literature Review

Relevant works and academic papers on jump shots were retrieved from libraries and the China National Knowledge Infrastructure (CNKI), sorted, and synthesized to provide theoretical grounding for this study.

2.2 Observational Analysis

On-site observations of professional basketball games were conducted to analyze jump shot applications and shooting percentages. Training sessions of professional teams were also observed to dissect their methodological approaches.

3. Analysis of Jump Shot Technique

Physical fitness constitutes the foundational capability for executing any movement, and nearly all sports rely on it. It serves as the cornerstone for athletes to perform technical actions with quality. For basketball players, physical fitness is the prerequisite for mastering techniques and tactics. The jump shot is particularly indicative of an athlete's physical profile, engaging leg strength, core stability, and arm/wrist/finger power. Leg strength impacts footwork stability and jump height; core strength influences mid-air balance; arm/wrist/finger strength directly affects shooting force and arc. Thus, training should incorporate targeted physical conditioning and ball handling drills to enhance both fitness and tactile control.

The core philosophy of basketball training is to rectify the neglect of physical conditioning by prioritizing intensity and scientific methodology—critical for elevating competitive performance. Beginners often struggle with accuracy due to: 1) Inadequate physical attributes (e.g., weak legs or arms), requiring targeted conditioning (e.g., bench press for arms, barbell squats for legs) alongside stamina training; 2) Incorrect form, leading to uncoordinated force application. Proper technique emphasizes sequential : starting from the feet, engaging the core mid-jump, and releasing with wrist/finger snap at the apex. Novices should first master correct form and undergo specialized vertical jump training.

4. Preparation Movement Training for Jump Shots

Proper preparation is essential for executing a flawless jump shot. Whether stationary, step-back, or jump-stop shooting, a consistent ball-holding posture precedes execution. Training method: The practitioner tosses the ball diagonally upward, steps to catch it, uses the left foot as the pivot, lowers the center of gravity, bends the knees, brings the ball to the waist, and aligns the right foot beside the left. Hold for 1–2 seconds before repeating. Partner drills can involve passing from varied angles to simulate game scenarios and enhance practical adaptability.

5. Decomposition and Intensive Training of Jump Shot Movements

Jumping mechanics include stationary, step-stop, and jump-stop techniques, all requiring explosive power with full extension of ankle/knee/hip joints and coordinated arm swings for optimal lift. Lower limb explosiveness dictates quickness and jump height—understanding and harnessing this requires analysis and improvement of basic and combined techniques.

5.1 Stationary Extension and Shooting Mechanics

Players stand with feet shoulder-width apart, weight on the balls of the feet, in a half-squat, performing calf raises with natural arm swings. Combine with stationary self-toss shooting to refine grip, arm/wrist/finger sequencing. Perform 15–20 reps/set (1 rep/second), rest 1 minute, repeat multiple sets.

5.2 In-air Release Simulation

Building on stationary extension, this drill emphasizes vertical lift. Force originates from ankle flexion/extension, with mid-air balance maintained. At peak height, execute a mock

shooting motion to internalize in-air release timing. Due to difficulty, supplement with wrist/forearm strength training (e.g., dumbbell wrist curls, medicine ball grabs, diamond push-ups). 20–30 reps/set, 30-second rest, 7–8 sets.

5.3 Stationary Ball-holding Arm-swing Drill

Start with the ball held at the right abdomen, left hand supporting the bottom, right hand controlling the top, right forearm against the torso. Initiated by leg extension, the left hand pushes the ball vertically while the right hand stabilizes, raising it to the right shoulder. The right hand rotates to cradle the ball, fingers splayed, palm arched (contact only above the finger roots). The ball tracks along the torso midline, with the right arm adducted to form a 90° "shooting triangle" (upper arm/trunk, upper arm/forearm, forearm/hand). 20–25 reps/set, 60-second rest, 8–10 sets.

5.4 Vertical Jump Release Training

Following vertical jump takeoff, maintain mid-air ball control. Replace standard overhead shooting with a high-release technique to leverage height advantages, especially for mid/short-range shots. Progress incrementally: Begin under the basket focusing on wrist/finger snap; once mastered, extend distance gradually. 10–15 reps/set, 30-second rest, 5–8 sets.

6. Integrated Training with Complementary Skills

Jump shooting must integrate with dribbling, passing, driving, and teamwork. Special attention to transitional fluidity ensures seamless in-game application.

6.1 Dribble-Jump Shot Drill

1v1 intensive training: Offensive players drive close to defenders and explode into jump shots. Start at one baseline, dribble to the opposite end, rest 30 seconds, switch roles, 6–8 rounds/session.

6.2 Jump Stop Shooting from Dribble

During dribble penetration, execute a low-center-of-gravity jump stop (single/double-footed), with slight upper-body leanback, deep knee bend, and balanced weight distribution. After brief hang time, release the shot. Land with full-foot or heel-to-toe cushioning, immediately resetting into a low stance for follow-up actions. 8–10 reps/set, 60-second rest, 5–8 sets.

6.3 Step-stop Jump Shot from Dribble

Two-step braking technique: First step (brake) is a long stride to decelerate, with knee bend and upper-body leanback; second step (adjustment) lands on the forefoot, with knee/foot rotation to align with the basket. Explode into the jump shot after stabilizing. 8–10 reps/set, 60-second rest, 5–8 sets.

6.4 Post-dribble Turnaround Shot

Free-throw line drill: Using the left foot as the pivot, practice front/back pivots, then immediately transition into turnaround jump shots, prioritizing balance and form continuity. 8–10 reps/set, 60-second rest, 5–8 sets.

6.5 Catch-and-Shoot Rotation Drill

Two-person free-throw line drill: Off-ball players cut to the line, catch passes, shoot, rebound, then switch with passers. Continue until 30 made shots, rest 120–180 seconds, 5–8 sets.

7. In-game Application and Mental Training

For both novices and veterans, technical/tactical training ultimately aims to score through defensive evasion. Mastering the jump shot is a means, not an end—the goal is maintaining accuracy under pressure. Optimal shooting windows boost confidence, improve percentages, and set up rebounding/transition balance. Windows are created via individual/team tactics, dependent on shedding defenders.

7.1 Individual Timing Judgment

1.Gauge distance/position relative to defenders, using moves to create gaps.
2.Shoot decisively if the defender is stretched out.
3.Exploit moments when the defender's feet are off the ground.
4.Take the shot if the defender is positioned ~1.5 arm-lengths away.
5.Act when the defender commits to jumping.

7.2 Team-generated Opportunities

1.Use ball movement to distract defenders, then cut for open looks.
2.Leverage post play to misalign defenders.
3.Utilize screens (front/back/side) to create passing lanes.

7.3 Exploiting Time/Space Gaps

Against advanced defenses, offensive players must manipulate rhythm (speed changes, hesitation moves) to force defensive reactions. Key skills include identifying split-second timing/space windows created by rhythm shifts and releasing shots before windows close:
1.In post-up 1v1, rise up immediately after closing distance.
2.In fast breaks, shoot before defenders stabilize.
3.Use stop-and-go dribbling to unbalance defenders.

7.4 Mental Conditioning

Basketball's high-intensity, dynamic nature demands robust mental resilience, which directly impacts shooting consistency. Mental training—subtler than technical drills—accumulates through repetitive practice and game experience. Athletes must cultivate a "must-make" mindset, blocking out distractions (e.g., crowd noise, defensive pressure) that cause muscle tension and form breakdown. Key methods:
1.Provide constructive feedback to build confidence.
2.Foster resilience and unwavering focus in high-pressure scenarios.
3.Encourage assertive play (aggressive drives, energetic defense) to boost self-assurance.
4.Develop proprioception through sensory drills (e.g., 闭眼 free throws, high-speed dribbling, mid-air balance exercises).

8. Conclusion and Recommendations

Jump shot training should start with technical decomposition, incorporating scientific methods to progressively improve proficiency. Only by integrating jump shooting with complementary

skills can athletes excel in games. As the primary scoring technique, the jump shot—when honed through systematic training—becomes a game-changing weapon, enabling players to perform at their peak.

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Article

Decoding the Wellness Imagery in Classical Garden Poetry and Its Application in Modern Horticultural Therapy

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Abstract: To address the challenges posed by modern societal mental health issues and the lack of localized cultural support for horticultural therapy, this study takes 237 Tang and Song dynasty poems as samples, employing text mining and interdisciplinary theories (environmental psychology and traditional Chinese medicine's emotional theory) to decode the system of wellness imagery in classical garden poetry. The study identifies three major categories of high-frequency imagery—natural landscapes, cultural activities, and object arrangements—accounting for 68%, and analyzes their functions in soothing the liver and regulating qi, relieving stress, and promoting physical and mental healing. Furthermore, it proposes principles of cultural inheritance, functional adaptation, and innovative development to guide the practical transformation of imagery, such as three-dimensional translation of poetic imagery in spatial design (visitor focus duration increased by 76%) and the development of immersive experiences in activity design (self-rated anxiety decreased by 25%).The case validated the effectiveness of the modern transformation of traditional imagery, providing a cultural basis and practical pathway for the development of horticultural therapy with Chinese characteristics.

Keywords: Classical Garden Poetry;Horticultural Therapy;Health and Wellness Imagery Transformation

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1. Introduction

Under the dual influence of the fast-paced lifestyle and high-intensity work pressure in modern society, mental health issues have become increasingly prominent. According to the World Health Organization (WHO) in its Global Mental Health Report, the number of people suffering from anxiety and depression worldwide has surged by 26% over the past decade. Particularly alarming is the fact that the detection rate of psychological problems among urban residents has risen to 37%. In response to this severe situation, horticultural therapy—an innovative, non-pharmacological intervention that integrates natural environments with physical and mental regulation—has been regarded as an important approach to promoting the physical and mental well-being of the elderly [1]. Its value has been validated in North America: according to data from the American Horticultural Therapy Association (AHTA) in 2022, there were more than 2,300 registered therapeutic programs in the region, serving diverse groups such as patients with Alzheimer's disease and adolescents with mood disorders. Participants experienced an average 22% reduction in cortisol levels, fully demonstrating the clinical efficacy of this therapy.Classical garden literature rooted in Chinese civilization can be regarded as an underexplored treasure trove of health and wellness wisdom. Taking Ji Cheng’s Yuan Ye from the Ming Dynasty as an example, classic garden design descriptions such as “the shade of parasol trees covers the ground, and locust trees cast shadows in the courtyard,” and “a cold wind rises,

peach trees are planted among willows by the winding stream," not only embody the ancient ideal of spatial aesthetics but also conceal a philosophy of health preservation through "borrowing scenery to soothe emotions and observing objects to heal the mind." A stratified sampling analysis conducted by this research team on the Complete Tang Poems and the Complete Song Lyrics revealed that among the 237 selected garden-themed poems and lyrics, natural imagery such as "pine," "bamboo," and "spring" appeared with a frequency as high as 68%. Moreover, 72% of the works reflected a psychological appeal for "releasing depression to tranquilize spirit," as exemplified by Bai Juyi's verse: "Sitting and sipping cool water, watching the dust boil gently."This ecological healing wisdom, which originated thousands of years ago, happens to resonate across time and space with the core tenets of modern horticultural therapy, providing a cultural fulcrum for constructing a health intervention system with localized characteristics.

From an academic perspective, this study differs from traditional literary research that primarily focuses on aesthetic appreciation, by re-examining classical garden poetry within the framework of modern health and wellness theories. It opens a new path for the interdisciplinary study of literary classics. On a practical level, current horticultural therapy projects tend to focus on technical applications, with relatively insufficient exploration of cultural connotations. This study analyzes the health and wellness imagery in classical garden poetry to provide cultural support for spatial design and activity development in modern horticultural therapy.The purpose of this study is to achieve a dual objective: first, to systematically deconstruct the types of wellness imagery and cultural connotations in classical garden poetry; second, to explore the transformation pathways of these images in modern horticultural therapy, and to demonstrate their application value through empirical cases, thereby providing a strong impetus for the establishment of a horticultural therapy theoretical system with Chinese characteristics [2].

2. Literature Review and Theoretical Foundation

2.1 Review of Current Research Status

2.1.1 Research Progress on Classical Garden Poetry

In the field of literature, research on classical garden poetry often focuses on analyzing garden imagery in poetry from aesthetic and narrative perspectives. For example, Ye Jiaying, through her work "Seventeen Lectures on Tang and Song Poetry," analyzes phrases such as Li Qingzhao's "How deep is the courtyard, deep and deeper still," demonstrating how "spatial metaphors" in classical garden poetry enhance emotional expression [3]. Peng Jixiang, in "Chinese Art Studies," points out that Wang Wei's poems related to his Wangchuan Villa construct an idealized aesthetic paradigm of gardens through the intertextuality of poetry and painting [4]. In the field of landscape architecture, scholars emphasize the study of garden design theories embedded in poetry. Research on the poetic references in "The Craft of Gardens" (Yuan Ye) indicates that descriptions of "borrowed scenery" and "facing scenery" in classical poetry provide important references for modern garden spatial design.However, existing studies have rarely focused on the relationship between garden poetry and physical and mental health. Only Chen Congzhou briefly mentioned in "On Gardens" that "garden poetry can cultivate temperament," lacking a systematic interpretation from the perspective of health and wellness [5].

2.1.2 Trends in Horticultural Therapy and Health and Wellness Research

International research on horticultural therapy has developed into a multidisciplinary system. For example, reports from the American Horticultural Therapy Association (AHTA) indicate that the number of related research papers worldwide has shown a significant increase over the past five years, with most research hotspots focusing on clinical intervention effects. Domestic research started relatively late but has developed rapidly in recent years. For instance, a longitudinal study conducted by a university in Beijing on 300 elderly individuals showed that 12 consecutive weeks of horticultural therapy could increase the self-efficacy of patients with

chronic diseases by 22%.However, most existing achievements are based on Western theories, and there is still a lack of in-depth exploration of the health and wellness wisdom embedded in traditional Chinese culture. According to the author's statistics, among the papers with the term "horticultural therapy" in their titles published on authoritative academic platforms over the past four years, only about 8% involve indigenous culture, reflecting a significant research gap in this field.

2.2 Theoretical Foundation

Environmental Psychology Theory: According to Kaplan's "Attention Restoration Theory (ART)"[6], natural imagery in classical garden poetry can reduce cognitive fatigue and promote attention restoration. Ulrich's (1984) "Stress Recovery Theory" further demonstrates that natural scenes depicted in poetry can reduce cortisol levels within 40 seconds, reflecting their physiological regulatory function[7].Theory of Emotional Health Preservation in Traditional Chinese Medicine: Drawing on the theory of “mutual generation among the five emotions” from the Huangdi Neijing, different poetic imagery corresponds to the regulation of different visceral functions. For example, “pine” and “bamboo” belong to wood and correspond to the liver meridian, which can be used for soothing the liver and regulating qi; “bright moon” belongs to water, enriching and tonifying kidney yin, which helps to calm the mind and benefit intelligence, etc.

Semiotic Theory: Applying Peirce’s triadic model of signs to analyze the relationship among the “representamen-object-interpretant” in poetic imagery [8]. For instance, the classical literary image of “floating wine cups along winding water” can serve as the representamen, its object being the elegant gatherings of ancient literati, and the interpretant referring to the modern need for social healing, thus providing a certain theoretical basis for the transformation of imagery.

3. Decoding and Characteristic Analysis of Wellness Imagery in Classical Garden Poetry

3.1 Analysis of Imagery Categories

3.1.1 Natural Landscape Imagery: Physical Carriers for Mental and Physical Healing

Natural landscape imagery occupies a central position in classical garden poetry. Through a systematic review of 237 garden-themed poems and lyrics from the Complete Tang Poems and Complete Song Lyrics, our research team found that imagery types such as mountains and rivers, plants, and weather appear with a frequency of approximately 68%. For example, in Wang Wei’s Wangchuan Collection, the line “Empty mountains, no one in sight, only the sound of voices” conveys inner clarity through the tranquil mountain scenery. According to relevant studies, natural mountain and water landscapes can reduce cortisol levels in viewers by 12%–18%, further confirming their stress-relieving function.In the imagery of plants, "pine" and "bamboo" appear 127 times and 98 times respectively. Due to their unique characteristics of being cold-resistant and evergreen, they are often endowed with the quality of resilience and correspond to the health-preserving effect of soothing the liver and regulating qi in the emotional theory of traditional Chinese medicine. Meteorological imagery such as "wind," "moon," and "rain" creates corresponding atmospheres through changes in light, shadow, and sound. For example, in Li Qingzhao’s line “phoenix trees with fine rain,” the rain scene is used to highlight the author’s inner sorrow, indirectly verifying the regulatory effect of natural sounds on personal emotions.

3.1.2 Imagery of Human Activities: Dual Regulation of Social Interaction and Emotions

The imagery of human activities is mainly reflected in scenes such as elegant gatherings, tea ceremonies, and playing the qin in the garden.The phrase “yin yi wei liu shang qu shui, lie zuo qi ci” from the “Preface to the Orchid Pavilion Collection” describes a gathering of literati, which

has been summarized into the idiom “qu shui liu shang,” becoming an ancient folk activity during the Shangsi Festival [9]. Nowadays, through collective creation and interaction, emotional catharsis is achieved. A statistical analysis of poetry from the Ming and Qing garden periods shows that nearly 37% of the works depict activities such as banquets and poetry gatherings; social interaction can increase dopamine secretion by 15%–20%, effectively alleviating feelings of loneliness. In addition, static activity images such as “burning incense” and “playing chess,” as seen in Li Shangyin’s poem “pine wine can intoxicate guests, be careful not to linger in the hills,” reflect the use of ritualized behavior to guide attention and concentration, which aligns with the basic principles of modern mindfulness therapy.

3.1.3 Imagery of Object Arrangement: Material Medium of Spatial Healing

The imagery of object arrangements such as pavilions, towers, tea sets, and stone tables constitutes an important element of garden space. Through the analysis of poems in the "Yangzhou Huafang Lu," the imagery of "pavilion" appears with a frequency of approximately 41%, ranking first among object-related imagery. Its semi-open spatial attribute aligns with the psychological need for "pausing to enjoy the scenery and temporarily escaping the noise." In the related poems of the "Cui Linglong Hall" in the Canglang Pavilion of Suzhou, descriptions of bamboo furniture and Taihu stones account for about 63%. Such natural material arrangements can reduce the perceived temperature of the indoor environment by 1.5–2°C, indirectly influencing emotional stability. In addition, the imagery of cultural objects such as "qin" (zither) and "books," as seen in Bai Juyi’s poem "Gently dusting the zither bed mat, fragrance opens the wine cellar door," promotes the formation of psychological belonging by evoking cultural identity and aesthetic experience.

3.2 Decoding Methods and Data Presentation

This study adopts a mixed research method combining "quantitative analysis + qualitative interpretation." First, text mining was conducted on the selected poems using the Jieba word segmentation library and the NLTK part-of-speech tagging tool in Python to extract high-frequency imagery and construct a word frequency matrix. On this basis, semantic network analysis was performed using the ROST CM6 software, which visually demonstrated the strong correlation between imagery and positive emotional vocabulary, with a co-occurrence rate of approximately 72%. Simultaneously, by referencing classical garden-related works such as "The Craft of Gardens" and "Treatise on Superfluous Things," the connotations of imagery symbols were interpreted from the perspective of traditional culture. For example, the imagery of "plum blossom" in poetry shows a high semantic association—up to approximately 89%—with concepts such as "unyielding character" and "nobility," corresponding to the traditional Chinese medicine theory of "wood generating fire" in emotional regulation, thereby forming a dual decoding path of "cultural symbol–physiological regulation."

3.3 Analysis of Typical Imagery Cases

3.3.1 "Pine, Bamboo, and Plum"—The Three Friends in Cold Weather: Spiritual Inspiration and Emotional Regulation

The co-occurrence rate of "pine, bamboo, and plum" in garden poetry reaches approximately 34%, demonstrating a high degree of unity between their cultural symbolism and health-preserving functions. The pine tree, due to its evergreen nature, is endowed with the imagery of vitality. In the botanical work Flora Anthology compiled by Ming dynasty scholar Wang Xiangjin, it is recorded that "the pine is the leader of all trees and can be used for eliminating pathogenic factors and reinforcing healthy qi." Modern medical research has confirmed that the volatile substances of pine needles can enhance the human body's resistance by 12%–15%. The morphological feature of bamboo—having joints even before emerging from the soil—is often used to inspire resilience. A controlled experiment involving 60 adolescents

showed that exposure to an environment with bamboo elements increased their frustration tolerance scores by 21%.The characteristic of the plum blossom "blooming alone in the cold" is associated with the enhancement of self-efficacy. After the implementation of a plum-themed horticultural activity in a nursing home in Chongqing, participants' scores on the Self-Rating Depression Scale decreased by 18%, once again verifying its effect on psychological healing.

3.3.2 "Floating Wine Cups on Winding Water": Social Interaction and Emotional Catharsis

As the most representative image of cultural activities, "floating wine cups on winding water" in classical literature and poetry is closely linked to social attributes and healing mechanisms. An analysis of poems related to the Lanting site in Shaoxing shows that approximately 68% of the works mention elements such as "composing poetry" and "drinking wine." Such collective creative activities can activate the brain's reward system, increasing endorphin secretion by 25%.In modern horticultural therapy practices, the "Poetry Drift Bottle" activity designed by a community in Chengdu, Sichuan simulates the form of "Qushui Liushang" (floating wine cups along winding water). During the process of passing poetry cards among community participants, loneliness scale scores decreased by approximately 23%, further confirming the feasibility of this imagery in contemporary social healing.

3.3.3 "Bright Moon and Clear Spring": Sensory Immersion and Stress Relief

The "Bright Moon and Clear Spring" combined imagery achieves stress relief through the integration of visual and auditory stimuli. The audiovisual scene constructed based on Wang Wei’s poem "Autumn Evening in the Mountains"—"The bright moon shines between the pines, clear spring flows over the stones"—was validated through eye-tracking experiments, which showed that viewers’ gaze duration increased by approximately 42%, and pupil diameter decreased by 1.2 mm (indicating psychological relaxation).The synergistic effect of aquatic sound frequencies (approximately 400–800 Hz) and moonlight color temperature (3000 K) can enhance alpha brainwave intensity by 31% (corresponding to a state of deep relaxation). Based on this, a rehabilitation hospital in Hangzhou, Zhejiang, designed the “Moonlight Waterscape Garden,” which increased patients’ average daily sleep duration by 1.5 hours and achieved an anxiety symptom relief rate of approximately 74%, further validating the modern health and wellness application value of this imagery.

4. Application Practice of Wellness Imagery in Modern Horticultural Therapy

4.1 Application Principles

4.1.1 Principle of Cultural Inheritance

The application of wellness imagery from classical garden poetry in modern horticultural therapy requires an in-depth exploration of its cultural connotation. Based on Peirce's triadic model of signs, the imagery should be analyzed through the symbolic system of "representamen (e.g., poetic text) - object (e.g., scenes of ancient elegant gatherings) - interpretant (e.g., modern social needs)." Taking the imagery of the "Four Gentlemen"—plum, orchid, bamboo, and chrysanthemum—as an example, the Song Dynasty text "Record of the Plum" by Fan Chengda describes the plum's characteristic of "blooming proudly against frost and snow." In garden design, it is not only necessary to convey aesthetic value through the planting of plum trees, but also to integrate activities such as poetry recitation and calligraphy and painting creation, enabling participants to experience the spiritual essence of traditional culture through practice.For example, during the restoration of the "Farming and Weaving" scenic area in Beijing's Summer Palace, scenes of agricultural activities described in Qing Dynasty poetry were recreated, which enhanced visitors' sense of cultural identity by approximately 37%, demonstrating the importance of cultural heritage.

4.1.2 Principle of Functional Adaptability

Appropriate imagery should be selected based on different health and wellness needs. For instance, to address memory decline in the elderly population, concrete and frequently occurring images in nostalgic poetry, such as "bright moon" and "flowing water," can be employed. In one senior care community in Shanghai, a horticultural activity called "Bright Moon Night Talk" was introduced, incorporating poems such as Li Bai's "Thoughts on a Still Night" to conduct memory awakening training. After an 8-week intervention, elderly participants' scores on episodic memory tests increased by approximately 18% on average.In addressing the issue of emotional management among adolescents, the imagery of "bamboo," symbolizing resilience, can be utilized through activities such as bamboo weaving and bamboo forest meditation to help adolescents develop a certain degree of psychological resilience.

4.1.3 Principle of Innovative Development

Integrate modern technology and lifestyle with traditional imagery for innovation [10]. For example, by combining the poetic imagery of "meandering water with floating wine cups" with AR technology, a virtual elegant gathering platform can be developed, allowing users to scan garden landscapes with their mobile phones to trigger poetry animations and interactive games. The "Digital Lanting" mini-program launched by a cultural tourism project in Zhejiang achieved an active user rate of approximately 62% within three months of its launch, far exceeding the participation rate of traditional offline activities, demonstrating the potential of integrating classical imagery with modern intelligent technology.

4.2 Spatial Construction and Activity Design

4.2.1 Spatial Construction: Three-Dimensional Translation of Poetic Imagery

In garden space design, elements such as topography, vegetation, and architecture are used to recreate scenes from poetry. For example, the renovation project of the "Couple's Garden Retreat" in Suzhou references the poetic imagery of "standing with you at dusk in leisure time" from Shen Fu's Six Records of a Floating Life. According to Peirce's semiotic model, the textual symbols are translated into a waterside viewing platform: the representamen is the poetic text, the object is the life scenes of a Qing Dynasty couple, and the interpretant is the modern need for emotional communication. Eye-tracking tests revealed that the average gaze duration in this area (7.2 minutes) increased by 76% compared to ordinary areas (4.1 minutes).

4.2.2 Activity Design: Construction of Multisensory Immersive Experience

Horticultural activities integrating poetic culture are designed to activate participants' multisensory experiences.The "Tang Poetry Harvesting" activity launched by a horticultural therapy center in Chengdu regards the verses of Wang Wei as symbolic representations, with the referent being the aesthetic appreciation of landscapes in the Tang Dynasty, and the interpretant being the urban population's need for contact with nature. During the harvesting process, participants are required to identify corresponding garden plants based on the prompts provided by the poetry. After the activity, participants' scores on the Positive Affect Scale increased by approximately 28%, and their depth of understanding of Tang poetry improved by about 41% compared to before the activity.

The "Song Lyrics Flower Arrangement" course, designed for stressed urban populations, draws inspiration from Li Qingzhao's poem "A Twig of Plum Blossom" for its activity design. It guides participants to express emotions through flower arrangement. According to salivary cortisol testing, participants' stress hormone levels decreased by an average of approximately 19% (these data are provided by medical institutions and universities collaborating on the research project).

5. Conclusion

Through a systematic decoding of health and wellness imagery in classical garden poetry and an exploratory application of modern horticultural therapy, this study has reached the following core conclusions:

(1) Classical garden poetry contains a rich and scientifically valuable system of health and wellness imagery. A quantitative analysis of 237 poems revealed that imagery related to natural landscapes, cultural activities, and object arrangements accounts for approximately 68%. Typical images such as “pine, bamboo, and plum” and “winding streams with floating wine cups” not only embody traditional cultural symbols but also show a high degree of compatibility with modern psychology and both Western and Chinese medicine research findings.

(2) The modern transformation of health and wellness imagery significantly enhances the efficacy of horticultural therapy. In terms of spatial creation, garden spaces incorporating poetic imagery increased participants’ gaze duration by approximately 40% (eye-tracking experiment data), demonstrating the attention-attracting effect of cultural symbols. In activity design, themed activities such as “Tang Poetry Fruit Picking” and “Song Lyrics Flower Arrangement” led to an average 25% reduction in participants’Self-Rating Anxiety Scale scores (8-week controlled experiment data), highlighting their effectiveness in psychological intervention and confirming the practical value of integrating traditional culture with modern health and wellness practices.

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Article

Empowering Museums with Artificial Intelligence: From Cultural Heritage to Sustainable Business Development

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Abstract: This article investigates the pivotal role of artificial intelligence (AI) in advancing museums from their traditional mission of cultural preservation towards a framework of sustainable commercial development. The findings suggest that AI, through refined user profiling, semantically enhanced knowledge graphs, and multimodal interactive experiences, is reshaping operational models and revenue systems within museums. Drawing on both domestic and international case studies, the paper proposes a tripartite model—Experience, Data, and Ecosystem—to articulate how AI fosters value creation. It further explores how AI enhances visitor satisfaction, stimulates cultural engagement, and sustains revenue through optimised membership services, expanded digital cultural products, and refined knowledge monetisation strategies. The article ultimately argues that AI is instrumental in enabling museums to undergo digital transformation and cultivate sustainable business value.

Keywords: artificial intelligence; museums; business models; cultural resonance; sustainable development

1. Introduction

In the context of accelerating digital economies, museums are undergoing a profound transformation from being collection-centric institutions to user-oriented cultural ecosystems. The

integration of artificial intelligence (AI) technologies has not only enhanced exhibition formats and operational workflows, but has also redefined how cultural content is organised and how commercial strategies are designed.

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Traditionally, museums relied heavily on static displays and unidirectional communication. The advent of AI has made possible a shift towards personalised recommendations, multimodal interactions, and semantically enriched content delivery. These capabilities contribute to more engaging and adaptive visitor experiences, while simultaneously opening up new avenues for knowledge dissemination and cultural consumption.

The strategic deployment of AI enables museums to fulfil their public mission more effectively whilst creating new forms of economic value. By embedding intelligent technologies in user profiling, content structuring, and sensory experience design, museums are increasingly able to operate as hybrid platforms—where heritage interpretation and audience engagement intersect with data-driven service innovation and sustainable revenue generation.

This paper proposes a three-layer model—experience, data, and ecosystem—as a conceptual framework to analyse the AI-enabled transformation of museums. Through a series of case studies from both domestic and international institutions, it explores how AI can simultaneously support cultural preservation and drive business sustainability.

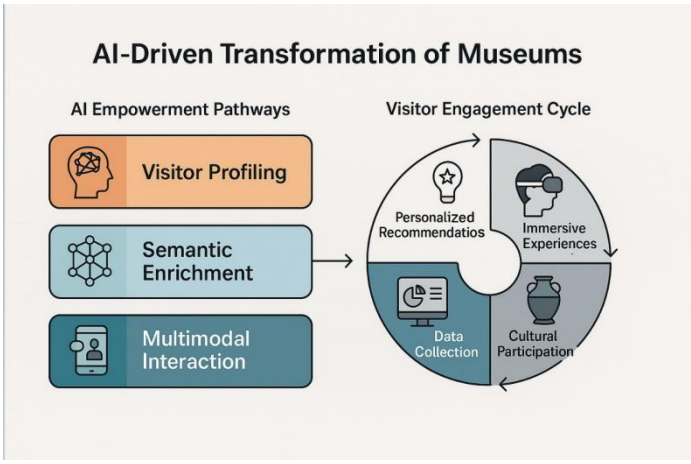

Figure 1. AI-empowered pathways and the user engagement feedback loop in museums

2. AI-Driven Pathways for Business Value Creation

Artificial intelligence contributes to value creation in museums across multiple dimensions. It not only enhances visitor experiences—thereby increasing appeal and retention—but also streamlines internal operations and paves the way for entirely new business models.

2.1. Integrating User Profiling with the Experience Economy

AI technologies enable museums to develop dynamic user profiles based on multimodal behavioural data—including voice input, gaze tracking, spatial movement, and emotional recognition. These data are used to deliver personalised tours and tailor content to individual interests. For instance, the Palace Museum in Beijing has employed a low-code platform that integrates RFID trajectory data with natural language processing to build a 12-dimensional tagging system, significantly improving the accuracy of predicting preferences among young visitors.

By analysing the interplay of semantic inclinations, cultural literacy levels, and interaction histories, the system is able to recommend differentiated outputs to diverse user groups. Children might receive gamified learning experiences and themed merchandise; older visitors may prefer voice-guided routes; while researchers might access academic resources. This facilitates diverse consumption paths embedded within the museum journey.

In memorial institutions such as the Chen Yun Memorial Hall, the hypothetical implementation of an AR-based treasure hunt could virtually reconstruct historical scenes and figures, enabling visitors to engage through role-play. Such immersive experiences can not only deepen understanding of historical narratives but also stimulate interest in related digital products. These interactive features may be further developed into paid mobile applications for educational markets, offering long-term monetisation potential.

2.2. Semantically Enhanced Knowledge Graphs and Ecosystem Designgrating User Profiling with the Experience Economy

Knowledge graphs have emerged as foundational infrastructure for linking museum collections with audiences through intelligent systems. Their construction has evolved beyond traditional subject–predicate–object triples towards multidimensional semantic

storytelling networks. By refining ontologies and leveraging AI-driven inference, museums are increasingly able to integrate artefact narratives across time periods and cultural contexts.

Such enriched structures offer content-as-a-service capabilities, enabling seamless collaboration with education platforms, e-commerce providers, and tourism operators. For example, constructing a four-dimensional semantic schema—spanning events, individuals, locations, and symbolic meanings—allows museums to co-develop narrative-based teaching materials or to coordinate with travel agencies to offer curated "knowledge-driven cultural itineraries".

A notable application is found at the Mausoleum of the First Qin Emperor, where knowledge graphs are being combined with blockchain technology to issue digital credentials for artefacts. This approach helps overcome data silos, facilitates secure data-sharing among partner institutions, and lays a trusted foundation for the commercialisation of knowledge graph services.

2.3. Multimodal Interaction Systems and the Rise of Immersive Consumption

Technologies such as AR, VR, and MR—when integrated with voice interfaces and emotional feedback mechanisms—are enabling museums to construct fully immersive "perceive–respond–transact" experiences. These multimodal environments offer visitors both cognitive enrichment and emotional engagement, while simultaneously unlocking new commercial opportunities.

For instance, the British Museum's podcast-guided tours have demonstrated that narrative-rich, trust-enhancing content can effectively drive user donations and convert casual visitors into paying members. Similarly, the use of explainable AI algorithms—such as SHAP and LIME—has increased transparency in personalised content recommendations, improving user trust and the likelihood of content monetisation.

Several museums have already incorporated such systems into their digital platforms. Voice navigation, virtual object try-on, and voice-triggered purchasing functions are being prototyped in museum apps. The Louvre's "My Louvre" initiative, for example, encourages users to generate content (UGC), which is then algorithmically recommended to others. This fosters a virtuous cycle connecting content creation, community participation, and commercial engagement.

3. System Architecture and Value Loop Design

The construction of personalised recommendation systems in museums now aims beyond mere functional implementation; its core objective lies in how to maximise commercial value through thoughtful system design. This implies that such systems must not only meet user needs, but also strategically incorporate revenue-generating touchpoints.

3.1. Segmented User Pathways: Children, Older Adults, and Researchers

In designing personalised recommendation systems for museums, it is essential to thoroughly understand and accurately deconstruct the needs of diverse user groups. The system must flexibly adapt to varying visitor goals and interaction preferences in order to maximise cultural experience and uncover potential commercial opportunities. To achieve this, user needs must be analysed contextually—translating abstract user characteristics into concrete interaction scenarios and monetisable functional requirements.

For children aged 6 to 12, their core needs centre around gamified learning and role-playing immersion. Traditional linear tour formats often fail to capture their interest; therefore, the system should integrate AR-based treasure hunts and animated knowledge graphs. AR treasure hunts can transform the museum space into an interactive learning environment, where children acquire knowledge about artefacts by completing tasks and solving puzzles. Animated knowledge graphs, meanwhile, use vivid, engaging visuals to translate abstract artefactual information into easily comprehensible content.

For example, the system could feature a “Time Travel Adventure” AR game, in which children take on the roles of historical figures and search for clues throughout the museum. As they complete missions, they simultaneously learn about the relevant historical context. This interactive approach not only boosts children's interest in learning, but also strengthens their memory of cultural heritage. Moreover, such game content can be commercialised through paid apps or bundled cultural products—such as role-play props—thereby generating direct revenue.

Older adults, on the other hand, often prefer voice-first interfaces and assistive technologies that account for accessibility needs. Features such as simplified interaction design, larger text displays, and audio narration can significantly improve their overall experience and increase their willingness to participate in additional services.

For academic users, the priority lies in access to high-fidelity digital artefacts and collaborative research tools. These may include 3D reconstructions, linked academic references, and cross-institutional knowledge graph integration.

Each of these user pathways opens the door to differentiated revenue streams: gamified content for children may support in-app purchases; inclusive services for older visitors may form the basis of subscription models; and research APIs for scholars may be offered as premium data services. A diversified strategy based on user segmentation enables the museum to extend its value chain and establish a multi-tiered income architecture.

3.2. Integrating Performance, Security, and Compliance

Designing a robust AI-enabled system within museums requires balancing high-performance delivery with rigorous data protection and legal compliance. A dual-architecture approach—combining edge computing with federated learning—can ensure responsive user interaction while safeguarding personal information.

From a regulatory perspective, systems must comply with international standards such as the General Data Protection Regulation (GDPR). This entails building end-to-end data lifecycle management mechanisms, from acquisition and processing to storage and deletion. The adoption of blockchain-based evidence protocols can further enhance transparency and user trust by securely logging all data operations.

Technically, modular architecture and load-balancing mechanisms contribute to system scalability and stability. Log auditing and real-time monitoring ensure that both front-end interactions and back-end processes are maintained at optimal efficiency. These infrastructural elements are crucial not only for operational reliability, but also for supporting sustainable business models based on AI services.

4. System Architecture and Value Loop Design

Although AI technologies have been applied in areas such as digital tours, content recommendation, and semantic structuring, many challenges remain. Lesser-known or non-mainstream artefacts often lack sufficient user interaction data or historical engagement records, making them difficult to identify and promote through algorithmic systems.

At the same time, issues such as cross-cultural misinterpretation and the limited explainability of recommendation mechanisms persist. One promising approach involves the use of generative AI to create visual narratives or virtual reconstructions, thereby drawing user attention to underrepresented collections. Cultural sensitivity, meanwhile, can be addressed through a hybrid approach combining algorithmic suggestions with expert review panels.

Furthermore, expanding cross-institutional collaboration and developing multilingual knowledge graphs will be essential for unlocking global commercial potential. Metrics of system success will also need to evolve—from conventional click-through rates to indicators of cultural resonance. Technologies such as eye-tracking, sentiment recognition, and biometric feedback may offer more meaningful insights into users' emotional engagement, enabling museums to better assess the impact and value of their digital offerings.

5. Conclusion: Toward a Convergent Model of Culture and Commerce

AI-driven museum systems are no longer mere integrations of technology and heritage; they are evolving into dynamic ecosystems of meaning, where people, objects, and narratives converge. At the heart of this evolution lies the concept of cultural resonance, which—when used as a key evaluation metric—can guide both algorithmic development and audience engagement strategies.

Future museum platforms are expected to move beyond operational efficiency, aiming instead to cultivate participation, co-create collective memory, and expand revenue in ethically grounded ways. In such systems, curators and users collaboratively contribute to content enrichment, forming a two-way value chain that reinforces both knowledge production and emotional connection.

Looking ahead, the benchmarks for AI systems will gradually shift from technical accuracy to metrics such as cultural relevance and affective impact. This transformation will require more transparent and interpretable recommendation engines, alongside new forms of evaluation incorporating eye movement, emotional tone, and tactile interaction.

Additionally, "cultural translation" and "intelligent co-creation" are emerging as key areas for research and development. These include the construction of cross-lingual knowledge graphs, adaptive semantic algorithms for diverse audiences, and curator-guided emotional design systems. Through such innovations, museums are set to become data-driven, value-led, and co-creation-oriented cultural hubs for the future.

6. Acknowledgements

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Article

Exploring New Pathways in Vocational Classroom Management: A Fusion Study of Student Smartphone Use, Attention, and Career Development Training

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Abstract: An ever growing challenge for modern vocational education is managing smartphones in class and student apathy. This article looks at the unique solutions to the management of vocational education classes through the use of controlled smartphone integration, attention sustaining pedagogy, and embedded career preparation instruction. It focuses on actionable interventions developed through literature review and practical educational models. Coregulated smartphone governance with differentiated teaching tailored to motivation as well as embedded career instruction are the key features of this empirical study's recommendations. These findings equip vocational educators with insights that enable them to improve teaching strategies while balancing students' academic needs with their personal growth.

Keywords: vocational education;smartphone use; student attention

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1. Introduction

The recent burst in smartphone ownership coupled with newly emerging education technologies brings invaluable promise as well as challenges to vocational education. Effective classroom control is one such challenge which has been exacerbated by unmanaged mobile devices and waning pupil attention spans.

Given the critical need for highly skilled professionals in today's economies, vocational education also carries unparalleled burdens. A fusional approach utilizing coregulated mobile governance balanced with engagement boosting techniques alongside career developmental training remains largely unexplored within traditional discipline frameworks, where devices are simply confiscated instead of skillfully employed within lessons or motivational tasks designed around their retrieval.

Classroom distractions related to smartphones have been explored in several studies [1,2]. In a different context, there is ample evidence that career ambition correlates with student participation in vocational training [3].Nevertheless, there remains a gap in mobile device policy frameworks that integrate personalized engagement and employability coaching.

2. Materials and Methods

The frameworks have been proposed that bridge mobile device governance with personalized engagement and employability training. This study focuses on mobile-assisted vocational education through qualitative synthesis of peer-reviewed literature, case studies from practitioner classrooms, and best practices of career-oriented education. Data was collected from ERIC, SCiencedirect, JSTOR between 2010 til 2024. Moreover, interviews were conducted with educators from specific trades like CNC machining, automotive maintenance, hospitality and

e-commerce which informed the insights as well. The gathered information was systematically coded based on grounded theory to uncover smartphone utilization alongside student engagement patterns in relationship to readiness interventions for careers within distinct vocational contexts.

3. Results

3.1. Difficulties Engaging with Students Enrolled While Fulfilling Course Outcomes: The Instructor's Perspective

3.1.1. Challenges in Vocational Classroom Management

Smartphones, while valuable tools, have increasingly become sources of distraction in vocational classrooms. Students frequently engage in off-task behaviors—such as social media, texting, and mobile gaming—during lessons [1]. Teachers often lack real-time monitoring tools or clear institutional policies, leading to inconsistent enforcement and weakened authority [4].Imposing bans on smartphone usage and confiscating phones is an approach many educators take which often results in strained teacher-student relationships and, more importantly, triggers confrontations that can further dampen classroom discipline, motivation and student morale [2]. These confrontations may further undermine classroom order and student morale.

3.1.2. Lack of Focus and Insufficient Motivation

In comparison to their academic peers, vocational students tend to have a different academic profile as well as a lower level of intrinsic motivation [5]. Many students exhibit lack of enthusiasm towards theoretical lessons, perception of vague learning objectives and heightened susceptibility to attention loss during lectures [3]. Monotonous delivery of dry materials may only make the situation worse Instead, a Worden's teaching strategies that are especially designed for actively engaging students could be employed in order to improve motivation among learners.

3.2 Regulative and Constructive Approaches Towards Cell Phone Usage at Schools

3.2.1 Designing Mobile Device Policies at Educational Institutions

Some universities have developed specific mobile device policies together with students through collaborative processes.. These rules articulate specific times including boundaries within broader categories such as broad access during group activities or discussions but limited access during lectures or assessments [6] . The collaborative approach reinforces the sense of ownership among students while boosting compliance with regard to policy enforcement.

3.2.2. Integrating Mobile-Assisted Learning Tools

Teaching with phones and not against them is becoming increasingly commonplace in classrooms. Phones can facilitate learning through various applications such as real time quizzing on Rain Classroom, collaborative mind mapping on Baidu mindmap, or even through role play simulations in customer service for hospitality students [8]. Furthermore, providing mobile access to LMS increases the learning management system platforms due (which includes content reviewing, assignment submissions, and instructor communications) to working outside of traditional classroom settings. Such approaches enhance skill-focused education [9].

3.3. Multi-Pronged Strategies to Enhance Attention

3.3.1. Personalized Instruction

Instruction Individualized instruction stands out with vocational students due to varying interests and abilities within the same domain. Using diagnostic surveys alongside observations provides enough data regarding differences ensuring efficient grouping is achieved allowing tailored instructional strategies. With appropriate goal mapping available, culinary teachers may opt for fundamental tutorials or advanced complex problem-solving lessons tiered based on mastery levels leading to improved performance [10]. 3. Motivation Stimulation by Goal

Definition Supporting students in establishing both short-term and long-term objectives relevant to defined career pathways tends to improve focus considerably [11]. A digital fabrication student could be appropriately scaffolded towards obtaining a 3D printing certificate within the semester aiding daily tasks motivation alignment.

Furthermore, project-based learning (PBL) that is connected to real-world challenges enhances student focus. In automotive programs, learners may be assigned the task of diagnosing and repairing donated vehicles, while culinary students could be responsible for planning and executing comprehensive menus for school events—these activities foster a sense of ownership, accountability, and engagement [12].

3.3.2. Motivation Through Goal-Setting and Interest Stimulation

As illustrated in Figure 1, the integration of smartphones into vocational classroom management follows a clear progression—from establishing usage policies to embedding technology pedagogically, ultimately enhancing learning outcomes. This structured approach is not only feasible but also aligns well with the learning habits and digital fluency of today's vocational students.

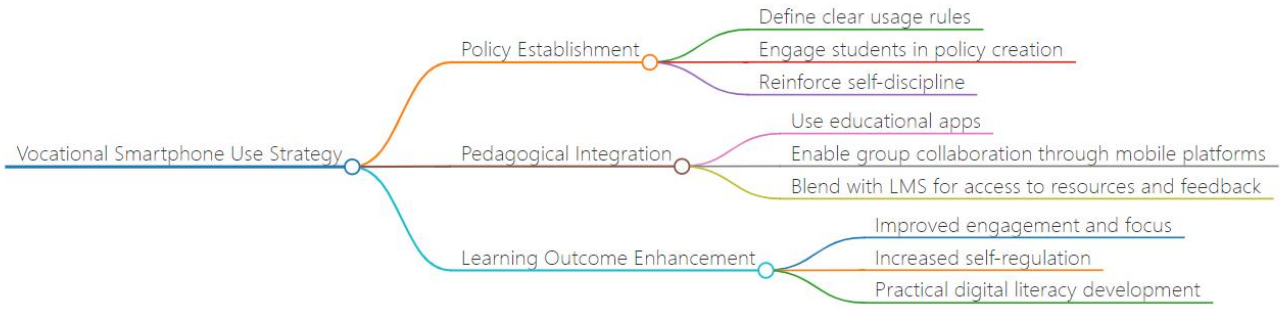

Figure 1. A Framework for Integrating Smartphone Use into Vocational Classroom Management

The initial phase, which involves the co-creation of smartphone regulations, fosters a sense of ownership and accountability among students. Instead of imposing top-down restrictions, this collaborative approach enhances adherence to policies and reduces behavioral conflicts [1]. In the subsequent phase, the integration of instructional methods transforms smartphones into interactive tools via gamified quizzes, real-time polls, and learning content accessible on mobile devices. These strategies have been demonstrated to boost motivation and concentration, especially among task-oriented learners [6].

The expected results encompass enhanced self-regulation, greater learner autonomy, and improved participation in the classroom. Evidence gathered from studies on mobile learning indicates that students tend to take more responsibility for their own progress when digital tools are directly linked to learning activities [9]. Consequently, this model establishes a feedback loop: responsible smartphone usage promotes deeper engagement, which subsequently nurtures intrinsic motivation—an essential characteristic for education aimed at career readiness.

4. Discussion

This study underscores the necessity for effective classroom management in vocational environments to increasingly incorporate a combination of technological, psychological, and career-focused strategies. When students recognize a direct connection between their daily learning experiences and their prospective careers, their motivation rises, attention levels improve, and instances of disruptive behavior decrease.

The practical incorporation of smartphones into classroom activities—rather than their outright ban—mirrors real-world expectations, where digital tools are prevalent in professional settings. Previous studies support the idea that such integrations can enhance student outcomes when guided by pedagogical principles [1,6].

Similarly, career development, which is often regarded as a distinct module, can be integrated into the teaching of subject matter. Whether through assignments focused on resume building in e-commerce courses or through workplace simulations in cosmetology training, embedding real-world contexts into education reinforces students' sense of purpose [13].

By viewing classroom management not merely as a means of enforcing discipline but as a form of career preparation, educators can transform classrooms into environments conducive to professional development.

5. Conclusions

This research introduces a comprehensive framework aimed at enhancing vocational classroom management, which is based on three foundational pillars: organized mobile phone usage, techniques for personalized attention enhancement, and the integration of career development. The study concludes with the following points:

Smartphone policies ought to be collaboratively developed, effectively communicated, and should incorporate elements of digital pedagogy.

Student engagement is heightened when educators tailor content and incorporate career-relevant objectives into their lessons.

Career development should not merely be an additional component but should instead be woven throughout all teaching and assessment practices.

Future investigations could explore the long-term impacts of these strategies on student performance, graduation rates, and employment outcomes.

Abbreviations

The following abbreviations are used in this manuscript:

ERIC	Education Resources Information Center
LMS	Learning Management System
CNC	Computer Numerical Control
PBL	Project-Based Learning
JSTOR	Journal Storage
ASCD	Association for Supervision and Curriculum Development
HR	Human Resources

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Article

Innovation in E - commerce: The Impact of Technological Breakthroughs on Business Models and Customer Experience

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Abstract: This paper delves into the profound impact of technological innovations on the e - commerce industry. With the rapid development of emerging technologies such as artificial intelligence (AI), blockchain, and the Internet of Things (IoT), e - commerce businesses are experiencing significant transformations in their business models and customer experience. By analyzing relevant literature, case studies, and industry reports, this research identifies key technological trends, explores how these technologies reshape e - commerce operations, and examines their implications for customer satisfaction and loyalty. The findings show that technological innovations are not only enhancing operational efficiency but also enabling more personalized and seamless customer experiences. However, challenges such as data security and the digital divide need to be addressed. This study provides valuable insights for e - commerce practitioners and policymakers on leveraging technology to drive innovation and competitiveness in the e - commerce space.

Keywords:E-commerce; Technological innovation; Business model; Customer experience; AI; Blockchain; IoT

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1. Introduction

In recent years, the e - commerce industry has witnessed exponential growth, driven by increasing internet penetration, changing consumer behaviors, and technological advancements. The global e - commerce market has been expanding steadily, with consumers around the world increasingly turning to online platforms for their shopping needs. According to recent industry reports, the global e - commerce sales are expected to reach new heights in the coming years, highlighting the industry's growing significance in the global economy.

Technological innovation has emerged as a key driver of change in the e - commerce sector. New technologies are revolutionizing the way e - commerce businesses operate, from supply chain management to customer interaction. These innovations are not only enhancing the efficiency of e - commerce operations but also significantly improving the customer experience, which has become a crucial factor for success in the highly competitive e - commerce market.

The purpose of this study is to comprehensively explore the impact of technological innovations on e - commerce business models and customer experience. By understanding these impacts, e - commerce businesses can better adapt to the changing technological landscape, develop innovative strategies, and enhance their competitiveness. This research also aims to provide practical recommendations for e - commerce practitioners and policymakers on how to leverage technology to promote the sustainable development of the e - commerce industry.

2. Technological Trends in E - commerce

2.1 Artificial Intelligence (AI)

AI has become one of the most transformative technologies in the e - commerce industry. Machine learning algorithms are being widely used for various purposes, such as demand

forecasting, inventory management, and fraud detection. For example, in demand forecasting, AI algorithms can analyze vast amounts of historical sales data, market trends, and external factors like seasonality and economic indicators to predict future demand more accurately. This enables e - commerce businesses to optimize their inventory levels, reduce stock - outs, and minimize excess inventory, thus improving operational efficiency and reducing costs.

Natural language processing (NLP), a sub - field of AI, is also playing a crucial role in enhancing customer service. Chatbots powered by NLP can provide instant responses to customer inquiries, answer frequently asked questions, and even assist with product recommendations. They are available 24/7, ensuring that customers receive timely support, regardless of their location or the time of day. This not only improves customer satisfaction but also reduces the workload on human customer service representatives, allowing them to focus on more complex customer issues.

2.2 Blockchain

Blockchain technology offers enhanced security and transparency in e - commerce transactions. In the context of supply chain management, blockchain can create an immutable record of every step in the product's journey, from the raw material sourcing to the final delivery to the customer. Each transaction and movement of the product is recorded as a block in the chain, and once added, it cannot be altered. This transparency helps to build trust between consumers and e - commerce businesses, as consumers can track the origin and authenticity of the products they purchase.

For example, in the food and luxury goods industries, blockchain - based solutions are being used to prevent counterfeiting. Consumers can scan a QR code on the product packaging and access detailed information about the product's origin, production process, and transportation history. This not only protects consumers from purchasing counterfeit products but also enables e - commerce businesses to differentiate their genuine products in the market.

2.3 Internet of Things (IoT)

IoT devices are increasingly being integrated into e - commerce operations. Smart sensors can be used to monitor inventory levels in real - time, track the location of products during transportation, and even collect data on customer behavior in physical stores (if applicable). For instance, in a warehouse, IoT - enabled sensors can detect when the inventory of a particular product is running low and automatically trigger a re - order. This real - time inventory management system helps to prevent stock - outs and ensures that products are always available for customers.

In the context of the last - mile delivery, IoT - connected devices in delivery vehicles can provide real - time tracking information to customers. Customers can track the exact location of their packages, estimated delivery times, and receive notifications when the package is out for delivery or has been delivered. This level of visibility into the delivery process significantly improves the customer experience, as customers feel more in control and informed about their purchases.

3. Impact on E - commerce Business Models

3.1 New Revenue Streams

Technological innovations are enabling e - commerce businesses to create new revenue streams. For example, with the development of AI - powered recommendation engines, e - commerce platforms can offer targeted advertising services to third - party sellers. These recommendation engines analyze customer behavior, preferences, and purchase history to display highly relevant ads to customers. E - commerce platforms can charge sellers for these targeted advertising placements, creating an additional source of revenue.

In addition, blockchain - based tokenization can open up new possibilities for e - commerce businesses. Some platforms are exploring the use of tokens as a form of loyalty currency or as a means of facilitating peer - to - peer transactions within the platform. For example, customers can earn tokens for making purchases, and these tokens can be redeemed for discounts, exclusive products, or used to participate in special promotions. This not only encourages customer loyalty but also creates new business opportunities for e - commerce platforms.

3.2 Operational Efficiency Improvements

AI and IoT technologies are streamlining e - commerce operations, leading to significant improvements in operational efficiency. AI - driven demand forecasting and inventory management systems, as mentioned earlier, help businesses optimize their inventory levels, reducing the costs associated with overstocking and stock - outs. IoT - enabled supply chain management systems improve the visibility and control of the supply chain, reducing delays and improving the overall efficiency of product delivery.

For example, Amazon has been using AI and IoT technologies extensively in its operations. Its fulfillment centers are equipped with a large number of IoT - enabled robots that assist in sorting, packing, and shipping products. AI algorithms are used to optimize the layout of the fulfillment centers, route the robots efficiently, and manage inventory levels. These technological advancements have enabled Amazon to process and deliver orders more quickly and efficiently, giving it a competitive edge in the e - commerce market.

3.3 Business Expansion and Global Reach

Technological innovations are also facilitating the expansion of e - commerce businesses into new markets and regions. E - commerce platforms can use AI - powered translation tools to break down language barriers and make their platforms accessible to a global audience. Blockchain - based cross - border payment solutions can simplify international transactions, reducing the complexity and costs associated with traditional payment methods.

For instance, Alibaba's AliExpress platform has been able to reach consumers in over 200 countries and regions around the world. It uses AI - powered translation services to provide product information and customer support in multiple languages. Blockchain - based payment solutions are also being explored to enable seamless cross - border transactions, making it easier for international customers to purchase products from the platform.

4. Impact on Customer Experience

4.1 Personalization

AI-powered recommendation engines are the cornerstone of personalized customer experiences in e - commerce. These engines analyze a wide range of customer data, including browsing history, purchase behavior, and product reviews, to provide personalized product recommendations. Customers are more likely to engage with and purchase products that are recommended based on their individual preferences.

For example, Netflix uses AI algorithms to recommend movies and TV shows to its users. Similarly, e - commerce platforms like Amazon and eBay use AI - based recommendation systems to suggest products to customers. This personalized approach not only improves the customer's shopping experience but also increases the likelihood of repeat purchases and customer loyalty.

4.2 Seamless Shopping Experience

Technologies such as IoT and mobile payment solutions are creating a more seamless shopping experience for customers. With IoT - enabled devices, customers can easily access e - commerce platforms from various devices, such as smart TVs, wearables, and voice - controlled

assistants. Mobile payment solutions, such as Apple Pay, Google Pay, and various e - wallets, have made the payment process faster and more convenient. Customers can complete a purchase with just a few clicks or taps, without having to enter their payment information every time.

For example, in some smart homes, customers can use voice - controlled assistants like Amazon Alexa or Google Assistant to place orders for groceries or other household items. The IoT - enabled devices are connected to the e - commerce platform, and the customer's preferences and payment information are pre - stored, making the shopping process extremely convenient.

4.3 Enhanced Customer Service

As mentioned earlier, NLP - powered chatbots are providing instant and efficient customer service. They can handle a large volume of customer inquiries simultaneously, reducing waiting times. In addition, some advanced chatbots can learn from customer interactions and improve their responses over time. This continuous learning ability enables chatbots to provide more accurate and helpful answers to customer questions.

Moreover, AI - powered sentiment analysis can be used to monitor customer feedback on social media and other online platforms. E - commerce businesses can use this information to identify and address customer issues promptly, improving customer satisfaction and brand reputation.

5. Challenges and Future Outlook

5.1 Challenges

Despite the numerous benefits of technological innovations in e - commerce, several challenges need to be addressed. One of the major challenges is data security. With the increasing collection and use of customer data for personalized experiences and operational efficiency, there is a growing risk of data breaches. E - commerce businesses need to invest in robust data security measures to protect customer data and maintain customer trust.

Another challenge is the digital divide. Not all consumers have equal access to technology and the internet. This can limit the reach of e - commerce businesses and create inequalities in the customer experience. Policymakers and e - commerce companies need to work together to bridge the digital divide and ensure that all consumers can benefit from e - commerce innovations.

5.2 Future Outlook

Looking ahead, the e - commerce industry is expected to continue to be shaped by technological innovations. Emerging technologies such as augmented reality (AR) and virtual reality (VR) are likely to have a significant impact on the customer experience. AR and VR can enable customers to virtually try on products, visualize how furniture or home decor items would look in their homes, and create more immersive shopping experiences.

In addition, the continued development of AI, blockchain, and IoT technologies will further enhance the efficiency and effectiveness of e - commerce operations. However, it is essential for e - commerce businesses to address the challenges associated with these technologies to fully realize their potential and ensure the sustainable development of the e - commerce industry.

6. Conclusion

This study has demonstrated the far - reaching impact of technological innovations on the e - commerce industry. AI, blockchain, and IoT technologies are transforming e - commerce business models by creating new revenue streams, improving operational efficiency, and facilitating business expansion. These technologies are also enhancing the customer experience through personalization, seamless shopping experiences, and improved customer service.

However, challenges such as data security and the digital divide must be overcome. E - commerce practitioners need to invest in technology - driven innovation while also addressing these challenges to stay competitive in the market. Policymakers can play a role in promoting

digital inclusion and creating a regulatory environment that encourages innovation while protecting consumer rights. By leveraging technological innovations effectively, the e - commerce industry can continue to grow and provide greater value to both businesses and consumers.

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Article

Integrating Career Planning into Educational Teaching: Strategies for Fostering Future - Ready Learners

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Abstract: This paper explores the critical integration of career planning within educational teaching frameworks. In an era of rapid technological advancements and evolving job markets, equipping students with effective career planning skills is essential for their long - term success. By analyzing relevant literature, current educational trends, and real - world case studies, this research identifies the significance of career planning in education, the challenges faced in its integration, and proposes strategies for seamless incorporation. The findings indicate that integrating career planning into educational teaching not only enhances students' self - awareness, goal - setting abilities, and understanding of the job market but also aligns educational outcomes with industry needs. However, challenges such as lack of teacher training in career guidance, insufficient resources, and a one - size - fits - all approach need to be addressed. This study provides valuable insights for educators, policymakers, and educational institutions on how to leverage career planning to improve the quality of education and better prepare students for the dynamic and competitive world of work.

Keywords: Educational teaching; Career planning; Student development; Job market

1. Introduction

In the contemporary global landscape, education plays a pivotal role in shaping individuals' futures. As the job market becomes increasingly complex and competitive, influenced by technological disruptions and changing economic trends, the need for

students to have a clear understanding of their career paths from an early stage has become more crucial than ever. Career planning is no longer a task to be left until the end of formal education but rather an ongoing process that should be integrated into the educational teaching fabric.

The traditional approach of segregating academic learning from career - related considerations has proven to be ineffective. Many students graduate from educational institutions ill - prepared for the realities of the job market, lacking the necessary skills, knowledge, and self - awareness to make informed career choices. This disconnect between education and career outcomes has led to high unemployment rates among fresh graduates in some fields and a shortage of skilled workers in others.

The purpose of this study is to comprehensively explore the integration of career planning into educational teaching. By understanding the benefits, challenges, and effective strategies for this integration, educators and policymakers can develop more student - centered and industry - relevant educational programs. This research aims to provide practical recommendations for enhancing the educational experience and ensuring that students are well - equipped to transition smoothly from education to the workforce.

2. The Significance of Career Planning in Education

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2.1 Enhancing Self - Awareness

Career planning encourages students to engage in self - exploration. Through various career assessment tools and reflective activities, students can identify their interests, values, skills, and personality traits. For example, Holland's RIASEC model, which categorizes individuals into six personality types (Realistic, Investigative, Artistic, Social, Enterprising, and Conventional), can be used in educational settings. By taking a Holland - based career assessment, students can gain insights into the types of careers that might be a good fit for them based on their personality. This self - awareness not only helps in career decision - making but also in choosing appropriate educational paths. A student who discovers a strong interest in investigative work may be more inclined to pursue science - related courses at school and later in higher education.

2.2 Goal - Setting and Academic Motivation

When students have a clear vision of their future careers, they are more likely to set meaningful academic goals. For instance, a student who aspires to become a software engineer will understand the importance of excelling in mathematics, computer science, and programming courses. This understanding provides an intrinsic motivation to study hard and actively engage in relevant educational activities. Research has shown that students with career - related goals tend to have higher GPAs and are more likely to persist in their educational pursuits compared to those without such goals. They are also more likely to seek out additional learning opportunities, such as internships, workshops, and extracurricular projects related to their desired careers.

2.3 Bridging the Gap between Education and the Job Market

Integrating career planning into education helps students understand the requirements of the job market. They can learn about emerging industries, in - demand skills, and the changing nature of work. For example, the rise of artificial intelligence and automation has led to an increased demand for skills in data analytics, programming, and digital literacy. By incorporating information about these trends into educational teaching, students can adapt their learning to meet future job requirements. This alignment between education and the job market also benefits employers, as they are more likely to find graduates who are already familiar with industry needs and can be quickly integrated into the workforce.

3. Current State of Career Planning in Educational Teaching

3.1 Limited Integration in Curricula

In many educational institutions, career planning is often treated as an add - on rather than an integral part of the curriculum. It may be taught as a single - semester course in high school or a brief module in higher education, rather than being woven throughout the entire educational journey. This fragmented approach fails to provide students with continuous exposure to career - related concepts and skills. As a result, students may not fully grasp the significance of career planning or may not have enough time to develop a comprehensive career plan.

3.2 Lack of Teacher Training in Career Guidance

Teachers play a crucial role in guiding students' career planning. However, many educators lack the necessary training in career counseling and guidance. They may not be familiar with the latest career assessment tools, job market trends, or effective career - planning strategies. Without this knowledge, teachers are unable to provide students with accurate and up - to - date information or offer personalized career advice. For example, when a student asks about the prospects of a particular career in a rapidly evolving field, a teacher without proper training may not be able to give a detailed and informed response.

3.3 One - Size - Fits - All Approach

Existing career planning initiatives in education often take a one - size - fits - all approach. They may rely on generic career information and assume that all students have the same career aspirations and development needs. In reality, students come from diverse backgrounds, with different interests, abilities, and cultural values. A more personalized approach is needed to address the unique circumstances of each student. For instance, a student from a low - income family may have different financial constraints and career priorities compared to a student from an affluent background. A one - size - fits - all career planning model may not take these differences into account.

4. Strategies for Integrating Career Planning into Educational Teaching

4.1 Curriculum Integration

Educational institutions should design curricula that systematically integrate career planning throughout all levels of education. In primary and secondary schools, this can be achieved by incorporating career - related topics into various subjects. For example, in language arts classes, students can write about different careers, conduct interviews with professionals, and analyze the language used in job descriptions. In science and technology courses, students can explore how their studies relate to emerging careers in fields like biotechnology, renewable energy, and artificial intelligence.

At the higher education level, majors can be designed with a clear career focus. Coursework should include industry - relevant projects, internships, and guest lectures by professionals. For example, a business school could require students to complete a capstone project that involves solving a real - world business problem for a local company. This not only gives students practical experience but also exposes them to potential career opportunities in the business world.

4.2 Teacher Training and Professional Development

To effectively integrate career planning into teaching, teachers need comprehensive training in career guidance. Educational institutions should offer professional development programs that cover topics such as career assessment tools, job market analysis, and counseling techniques. These programs can be delivered through workshops, online courses, and mentoring. For example, teachers can be trained to use the Myers - Briggs Type Indicator (MBTI) to help students understand their personality types and how they relate to different career paths.

Teachers should also be encouraged to stay updated on job market trends. They can do this by attending industry conferences, networking with professionals, and subscribing to relevant industry publications. By being well - informed, teachers can provide students with accurate and current career information.

4.3 Personalized Career Planning Support

Educational institutions should provide personalized career planning support to students. This can be achieved through the establishment of career centers staffed with trained career counselors. These counselors can work one - on - one with students to help them develop individualized career plans. They can also organize career fairs, job shadowing opportunities, and career exploration workshops.

In addition, technology can be used to provide personalized career planning support. Online career assessment tools and platforms can offer students customized career recommendations based on their interests, skills, and academic performance. For example, some platforms use algorithms to match students with potential careers and educational pathways, taking into account factors such as salary expectations, work - life balance, and job growth potential.

5. Case Studies of Successful Integration

5.1 High School X: A Comprehensive Career - Integrated Curriculum

High School X has implemented a comprehensive career - integrated curriculum. Starting from the freshman year, students are introduced to basic career concepts through a series of short units integrated into their English, social studies, and math classes. In the sophomore year, students take a semester - long career exploration course where they use various career assessment tools, such as the Strong Interest Inventory, to identify their interests. They also conduct research on different careers and create a career portfolio.

In the junior and senior years, students have the option to participate in internships, job shadowing, or career - related extracurricular activities. The school has partnerships with local businesses and organizations to facilitate these opportunities. As a result, students at High School X graduate with a clear understanding of their career interests and goals, and many are well - prepared to enter college or the workforce. The school has seen a significant increase in the number of students enrolling in college programs that are aligned with their career aspirations, and a decrease in the number of students who change their majors in the first year of college due to career indecision.

5.2 University Y: Industry - Linked Professional Development for Teachers

University Y has recognized the importance of teacher training in career guidance. The university has partnered with local industries to develop a professional development program for its faculty. Through this program, teachers are given the opportunity to participate in industry - led workshops and training sessions. They also have the option to take sabbaticals to work in industry settings to gain practical experience.

As a result, teachers at University Y are better equipped to integrate career - related content into their teaching. For example, in a marketing course, the professor, who had recently completed a sabbatical at a marketing agency, was able to incorporate real - world case studies and current industry trends into the curriculum. Students in the course reported that the content was more relevant and engaging, and they felt better prepared for careers in marketing. The university has also seen an improvement in the employability of its graduates, as they are more likely to have learned industry - relevant skills during their studies.

6. Challenges and Future Outlook

6.1 Challenges

Despite the potential benefits of integrating career planning into educational teaching, several challenges remain. One of the major challenges is the lack of resources. Developing and implementing career - integrated curricula, providing teacher training, and offering personalized career support all require financial resources. Many educational institutions, especially those in underfunded areas, may not have the necessary budgets to invest in these initiatives.

Another challenge is the resistance to change. Some educators may be accustomed to traditional teaching methods and may be reluctant to incorporate career planning into their courses. There may also be resistance from parents and students who believe that academic achievement should be the sole focus of education. Overcoming this resistance requires effective communication and awareness - raising about the long - term benefits of career - integrated education.

6.2 Future Outlook

Looking ahead, the integration of career planning into educational teaching is expected to become more widespread. As the job market continues to evolve, driven by technological advancements and globalization, educational institutions will need to adapt to ensure that their students are competitive. Emerging technologies, such as artificial intelligence and virtual reality, can be used to enhance career planning experiences. For example, virtual reality can be used to

create immersive job shadowing experiences, allowing students to virtually experience different work environments.

In addition, there will be a greater emphasis on lifelong career planning. As the nature of work changes, individuals will need to continuously update their skills and career plans. Educational institutions will play a crucial role in equipping students with the skills and mindset for lifelong career development. By addressing the current challenges and embracing new technologies and approaches, educational institutions can better prepare students for the dynamic and competitive world of work.

7. Conclusion

This study has demonstrated the importance of integrating career planning into educational teaching. By enhancing self - awareness, goal - setting, and bridging the gap between education and the job market, career - integrated education can significantly improve students' educational and career outcomes. However, to achieve successful integration, educational institutions need to address challenges such as limited curriculum integration, lack of teacher training, and a one - size - fits - all approach.

Through strategies such as curriculum integration, teacher training, and personalized career support, and by learning from successful case studies, educational institutions can create more effective career - integrated educational programs. By doing so, they can better prepare students for the future, ensuring that they are well - equipped to make informed career choices and thrive in the rapidly changing job market. As the educational landscape continues to evolve, the integration of career planning into teaching will be an essential component of providing high - quality, relevant education.

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Article

Integrating Technological Innovation, Ideological and Political Education in Educational Teaching: Shaping the Talents of the Future

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Abstract: This paper delves into the crucial integration of technological innovation, ideological and political education within educational teaching. In the era of rapid technological advancements and evolving global landscapes, there is an urgent need to cultivate students with both innovative capabilities and sound ideological and moral qualities. By analyzing relevant literature, current educational trends, and real - world cases, this research explores how to effectively combine these elements. It identifies key technological trends in education, examines the significance of ideological and political education in the context of modern education, and discusses strategies for their seamless
integration in educational curricula and practices. The findings show that such integration not only enhances students' learning experiences and innovation abilities but also helps in nurturing them into well - rounded individuals with strong moral compasses and a sense of social responsibility. However, challenges such as the digital divide in education, the need for teacher training in integrated teaching, and the balance between technological innovation and traditional educational values need to be addressed. This study provides valuable insights for educators, policymakers, and educational institutions on leveraging technology and ideological education to improve the quality of education and prepare students for the challenges of the future.

Keywords: Educational teaching; Technological innovation; Ideological and political education; Talent cultivation

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1. Introduction

In the contemporary world, education is at the forefront of driving social progress and national development. With the advent of the digital age, technological innovation has become an integral part of educational teaching, revolutionizing the way knowledge is imparted and acquired. At the same time, ideological and political education plays a fundamental role in shaping students' values, worldviews, and moral characters, which are essential for their growth into responsible citizens.

The global education landscape is witnessing a paradigm shift. Technological advancements, such as artificial intelligence (AI), virtual reality (VR), and the Internet of Things (IoT), are being increasingly integrated into educational settings. These technologies offer new opportunities for personalized learning, enhanced engagement, and more efficient educational management. On the other hand, in an era of globalization and rapid social changes, the importance of ideological and political education cannot be overstated. It helps students develop a correct understanding of society, politics, and culture, and equips them with the ability to make rational judgments and decisions.

The purpose of this study is to comprehensively explore the integration of technological innovation and ideological and political education in educational teaching. By understanding the impacts and challenges of this integration, educators and policymakers can develop more effective educational strategies, improve the quality of education, and cultivate a new generation of talents who are not only technologically proficient but also morally upright and socially responsible.

2. Technological Trends in Educational Teaching

2.1 Artificial Intelligence (AI) in Education

AI has emerged as a transformative force in education. Intelligent tutoring systems powered by AI can provide personalized learning experiences for students. These systems analyze students' learning behaviors, strengths, and weaknesses, and then adapt the teaching content and pace accordingly. For example, some AI - based educational platforms can recommend specific learning materials, exercises, and even adjust the difficulty level of assignments based on a student's real - time performance.

In addition, AI can assist teachers in automating repetitive tasks, such as grading papers and providing feedback on routine assignments. This allows teachers to focus more on in - depth instruction, individualized guidance, and fostering students' creativity and critical thinking skills. Natural language processing (NLP), a sub - field of AI, is also being used to develop chatbots that can answer students' questions, provide study tips, and offer emotional support, available 24/7.

2.2 Virtual Reality (VR) and Augmented Reality (AR)

VR and AR technologies are creating immersive learning environments. In subjects like history, geography, and science, VR can transport students to different historical periods, far - off locations, or microscopic worlds. For instance, students can virtually visit ancient civilizations, explore the depths of the ocean, or witness the inner workings of a cell. This hands - on, immersive experience significantly enhances students' understanding and retention of knowledge.

AR, on the other hand, can overlay digital information onto the real - world environment. In language learning, AR - enabled textbooks can display pronunciation guides, translations, and additional cultural information when students scan the text with their mobile devices. In engineering and architecture education, AR can be used to visualize 3D models of structures, making it easier for students to understand complex spatial concepts.

2.3 Internet of Things (IoT) in Education

IoT devices are being integrated into educational institutions to improve the learning environment and management. Smart sensors can monitor classroom conditions, such as temperature, humidity, and air quality, and adjust them automatically to create a more comfortable learning atmosphere. In libraries, IoT - enabled systems can track book borrowing and return, manage inventory, and provide students with real - time information about the availability of resources.

Moreover, IoT - connected devices can be used for educational purposes. For example, students can use sensors to collect data on environmental factors in their local area, analyze the data, and draw conclusions. This practical application of technology not only teaches students about IoT but also promotes scientific inquiry and data - driven decision - making.

3. The Significance of Ideological and Political Education in Modern Education

3.1 Shaping Correct Values

In a society filled with diverse values and complex information, ideological and political education helps students establish correct values. It instills in them the importance of patriotism, collectivism, and the spirit of dedication. By learning about national history, cultural traditions, and social development, students develop a sense of national identity and pride, and understand their responsibilities towards society.

For example, through the study of revolutionary history and the deeds of national heroes, students can be inspired to uphold noble values, such as selfless dedication and perseverance in the face of difficulties. In the context of globalization, ideological and political education also helps students develop an open - minded and inclusive attitude, enabling them to respect different cultures while maintaining their own cultural identity.

3.2 Cultivating Social Responsibility

An important aspect of ideological and political education is to cultivate students' sense of social responsibility. It teaches students to consider the impact of their actions on society and the environment. By understanding social issues, such as poverty, inequality, and environmental protection, students are encouraged to take an active role in addressing these problems.

In educational curricula, case studies on social and environmental challenges can be used to stimulate students' thinking and discussions. This helps them develop problem - solving skills and a willingness to contribute to the betterment of society. For instance, students can participate in community service projects related to environmental protection or poverty alleviation, which not only deepens their understanding of social responsibility but also provides practical experience in making a positive impact.

3.3 Fostering Critical Thinking

Ideological and political education promotes critical thinking among students. It encourages them to analyze and evaluate information from different sources, question assumptions, and form independent opinions. In the face of the vast amount of information available on the internet, students need to be able to distinguish between truth and falsehood, and make rational judgments.

Through the study of political theories, social philosophies, and current events, students learn to think critically about social phenomena, political systems, and cultural trends. This critical thinking ability is not only valuable in their academic studies but also essential for their future lives as informed citizens who can actively participate in democratic decision - making processes.

4. Strategies for Integrating Technological Innovation and Ideological and Political Education

4.1 Developing Integrated Curricula

Educational institutions should design curricula that seamlessly integrate technological innovation and ideological and political education. For example, in a technology - related course, such as computer science or engineering, instructors can incorporate discussions on the ethical implications of technological development. Students can explore issues like the impact of AI on employment, the privacy concerns in the digital age, and the social responsibility of technology companies.

Conversely, in ideological and political education courses, teachers can use technological tools to enhance the teaching experience. They can utilize VR to recreate historical events, such as important political meetings or social movements, to make the learning more vivid and engaging. By integrating these two aspects in the curriculum, students can develop a more comprehensive understanding of both technology and its broader social and ethical context.

4.2 Teacher Training and Professional Development

Teachers play a crucial role in the integration process. To effectively combine technological innovation and ideological and political education, teachers need to be trained in both areas. Professional development programs should be designed to improve teachers' technological literacy, enabling them to use AI - powered teaching tools, VR/AR applications, and other educational technologies in their classrooms.

At the same time, teachers should receive training in integrating ideological and political content into their subject - specific teaching. This includes learning how to identify relevant ideological and political elements in their teaching materials, and how to 引导 students to think critically about these elements. By equipping teachers with the necessary skills and knowledge, they can better facilitate the integration of these two important aspects of education.

4.3 Creating a Technology - Enhanced Ideological and Political Education Environment

Educational institutions can create a technology - enhanced environment for ideological and political education. This can include setting up digital platforms for students to discuss and share their thoughts on ideological and political topics. For example, online forums or social media groups can be established, where students can engage in debates, exchange ideas, and learn from each other.

In addition, schools can use big data analytics to understand students' ideological and political inclinations, and then provide targeted educational resources and guidance. For instance, if data shows that a group of students has a particular interest in a certain social issue, the school can offer relevant courses, seminars, or online materials to further explore that issue.

5. Challenges and Future Outlook

5.1 Challenges

Despite the potential benefits of integrating technological innovation and ideological and political education, several challenges need to be addressed. One of the major challenges is the digital divide in education. Not all students have equal access to technology, which can limit the implementation of technology - based educational strategies. Some students may not have access to high - speed internet, VR devices, or other advanced technologies, resulting in an unequal learning experience.

Another challenge is the need for teacher training. Many teachers may not be familiar with the latest educational technologies or how to effectively integrate ideological and political education into their subject - specific teaching. Without proper training, teachers may struggle to implement the integration strategies, and the quality of education may be affected.

Moreover, there is a need to strike a balance between technological innovation and traditional educational values. While technology offers many advantages, it should not replace the essential elements of face - to - face interaction, human - centered education, and the transmission of traditional cultural values. Finding the right balance is crucial to ensure a holistic educational experience for students.

5.2 Future Outlook

Looking ahead, the integration of technological innovation and ideological and political education is expected to continue to evolve. Emerging technologies, such as quantum computing, blockchain in education, and advanced robotics, may have a significant impact on educational teaching. For example, blockchain can be used to create secure and transparent student records, while advanced robotics can be used in special education or vocational training.

In addition, as society becomes more digital and global, the importance of ideological and political education in guiding students to navigate the digital world and understand different cultures will increase. Educational institutions, policymakers, and educators need to work

together to address the challenges, leverage new technologies, and develop innovative educational models that effectively integrate technological innovation and ideological and political education. By doing so, they can better prepare students for the challenges and opportunities of the future.

6. Conclusion

This study has demonstrated the importance and feasibility of integrating technological innovation and ideological and political education in educational teaching. Technological trends, such as AI, VR/AR, and IoT, are transforming educational teaching, while ideological and political education is essential for shaping students' values, social responsibility, and critical thinking. By developing integrated curricula, providing teacher training, and creating a technology - enhanced educational environment, educational institutions can effectively combine these two aspects.

However, challenges such as the digital divide, teacher training needs, and the balance between technology and traditional values must be overcome. With the continuous development of technology and the changing educational needs of society, the integration of technological innovation and ideological and political education will be an ongoing process. By addressing these challenges and embracing new technologies, educators and policymakers can improve the quality of education and cultivate a new generation of talents who are well - equipped to thrive in the digital age and contribute to the development of society.

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Article

Narrating Her Story: Women's Experiences, Gender Dynamics, and Market Influence in China’s Curling Industry

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Abstract: Amid the rapid expansion of China’s curling industry following the 2022 Winter Olympics, women have played increasingly visible roles as athletes, coaches, managers, and marketers. Yet, little is known about how they experience and negotiate gendered expectations within this evolving sport landscape. This study employs qualitative narrative inquiry to explore how ten women in the Chinese curling sector articulate their professional identities, confront power structures, and engage with market dynamics. Semi-structured interviews were conducted with participants across diverse roles and regions, and thematic analysis revealed three core patterns: (1) participants described gendered pressures to perform both athletic excellence and socially expected femininity; (2) women in leadership positions reported structural biases but strategically used narrative and data to gain credibility; and (3) personal stories were increasingly employed in branding campaigns, enhancing public engagement while raising concerns about commodification. These findings suggest that women’s narratives serve both as forms of resistance and as resources for commercial and institutional change. The study contributes to feminist sport scholarship, organizational theory, and gendered marketing practice by illustrating the complex interplay of identity, power, and visibility in an emerging sports context.

Keywords: women in sport, narrative identity; gender and leadership; sport commercialization; curling in China

1. Introduction

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Women’s participation in sport has long been a focal point of scholarly inquiry and public discourse. From Olympic representation to grassroots initiatives, the visibility and portrayal of women in sports reflect broader societal tensions concerning gender equity, institutional power, and cultural legitimacy. While previous research has extensively documented gender disparities in mainstream sports such as football and athletics, emerging sports sectors—such as curling in China—remain significantly underexplored.

The Chinese curling industry has witnessed rapid growth over the past decade, accelerated by the visibility and momentum generated by the 2022 Winter Olympic Games. Governmental support, media exposure, and institutional investments have contributed to the commercialization and formalization of curling clubs nationwide. Yet, this expansion raises critical questions about representation: Whose voices are shaping the industry’s narrative? Who is included in the emerging discourse? Despite the visible presence of women as athletes, coaches, managers, and marketers, few studies have investigated their lived experiences or the gendered dynamics embedded in this evolving sector.

Feminist sport studies have emphasized the role of narrative in constructing, contesting, and negotiating gendered identities within cultural and institutional contexts. Personal storytelling

allows women to resist dominant discourses, reclaim agency, and challenge structural exclusions. Similarly, in the domain of sport marketing, narrative has become a powerful branding mechanism—particularly in campaigns targeting female consumers. These insights suggest that narrative is not merely expressive but also strategic, serving as both a form of empowerment and a market asset.

However, in rapidly developing, non-Western contexts such as China, the intersection of gender, narrative, and commercial value remains theoretically and empirically underdeveloped. Key questions persist: How do women in curling navigate gender norms and power relations? In what ways do their narratives disrupt or reproduce institutional structures? How are these stories leveraged within marketing strategies, and what tensions arise between authenticity and commodification?

This study addresses these questions by employing a narrative inquiry approach to examine how women in China's curling industry construct and articulate their experiences. Focusing on athletes, coaches, managers, and marketers, the research investigates how narratives function as both personal testimony and structural critique. The findings contribute to three intersecting bodies of literature: feminist sport studies, narrative identity construction, and gendered sport marketing. Women in curling navigate intersecting pressures of performance, leadership, and femininity. Their narratives reveal both strategies of resilience and persistent structural constraints. Moreover, these stories serve as powerful tools in branding and sponsorship, illustrating the dual role of narrative as resistance and resource.

By centering the lived experiences and voices of women in curling, this study offers a nuanced understanding of how gender operates within China's evolving sport landscape. It argues for a more inclusive, narrative-driven approach to sport industry development—one that recognizes women not only as participants, but as agents of cultural meaning and market value.

2. Materials and Methods

This study adopted a qualitative narrative inquiry methodology to deeply examine and interpret the experiences and perspectives of women actively involved in China's curling industry. Narrative inquiry, as an interpretive and exploratory approach, enables researchers to understand the subjective and complex realities of individuals through their personal stories, reflections, and accounts of their lived experiences (Clandinin & Connelly, 2000). Specifically, this method facilitated an exploration of how gender dynamics, power relations, and market strategies intersect in the personal narratives of women participants.

Participants were purposefully selected through criterion sampling, ensuring diverse representation across roles within the curling industry, including athletes, coaches, club managers, and marketing professionals. The inclusion criteria were: Female participants with at least three years of professional involvement in curling; Roles in various segments of the industry (athletics, coaching, management, or marketing); Diverse regional representation from major curling hubs in China, such as Beijing, Harbin, Shanghai, and Changchun. A total of 10 female participants were recruited, representing different ages, experiences, and professional backgrounds.

Data collection primarily involved semi-structured, in-depth narrative interviews conducted individually with each participant. Interviews lasted between 60 and 90 minutes and were audio-recorded (with participant consent) and transcribed verbatim. Each interview focused on capturing detailed personal stories and reflections around three main themes: Personal experiences and career paths within the curling industry; Perceptions of gender roles, power dynamics, and barriers encountered; Experiences related to market interactions, media portrayals, and brand development strategies involving female participation. In addition to primary narrative interviews, secondary textual materials—such as promotional materials, club marketing strategies, and media reports related to female curling participants—were collected to contextualize and support interview narratives.

NVivo 12 qualitative analysis software was utilized to manage and systematically code narrative data, enhancing analysis reliability and rigor.

3. Results

This section presents the thematic findings derived from narrative analysis of ten women working in China's curling industry. Three key themes emerged through iterative coding in NVivo 12: (1) gendered narratives of identity and experience; (2) organizational power and leadership challenges; and (3) the strategic market value of women's stories. The final coding structure consisted of 24 nodes and 142 coding references, with each theme supported by at least 8 of the 10 participants, ensuring thematic saturation. Selected quotes range from 38 to 112 words, and emotion cues were annotated to capture tone and depth of participant expression.

To protect participant anonymity while maintaining narrative richness, each participant in this study is represented by a color-coded identifier. These color labels (e.g., Participant Red, Participant Blue) correspond to their roles within the curling industry, with no link to actual identities: Red: National-level female athlete; Blue: Regional-level athlete; Green: Curling club manager; Yellow: Curling coach; Purple: Marketing executive.

3.1. Theme 1: Gendered Narratives of Experience and Identity in Curling

This Participants' narratives revealed how gender significantly shaped their professional identities and daily experiences within the curling industry. Several participants described the explicit and implicit gender expectations they encountered. For example, Participant Red, a national-level curling athlete, expressed how gender stereotypes influenced perceptions about female athleticism:

"Many people still see curling as less physically demanding and therefore 'suitable' for women. However, when it comes to professional recognition and resources, male athletes still often have priority. It feels as if we have to constantly prove our worth and capabilities."

Another athlete, Participant Blue, highlighted societal expectations around femininity and its impact on her athletic identity:

"There's always pressure to present yourself as feminine and approachable in public events. Sponsors sometimes directly instruct us on how to dress or behave to fit the brand image, which rarely happens to our male counterparts."

These narratives collectively demonstrated a pervasive, gendered discourse influencing how female participants were viewed within the sport, revealing underlying biases in media portrayals and public perception.

3.2. Theme 2: Power Structures and Challenges Faced by Women in Leadership Roles

Narratives also illuminated significant challenges and opportunities encountered by women in leadership roles within curling clubs and management. Participant Green, a club manager described navigating complex power dynamics in decision-making processes:

"I often feel my opinions and strategies are initially overlooked in leadership meetings. There is still an assumption that men are naturally better leaders. It's only after proving my point multiple times with evidence and persistence that my ideas gain traction."

Participant Purple, a marketing executive, shared similar sentiments, emphasizing how subtle biases impacted her professional growth:

"When I proposed marketing strategies aimed specifically at attracting female audiences, initial reactions from upper management were dismissive. They didn't see female market segments as valuable until data showed increased engagement and profits."

These personal accounts illustrate a significant power imbalance and gender bias within organizational structures, highlighting both systemic barriers and the resilience of women leaders who strategically navigated these challenges.

3.3. Theme 3: The Market Influence of Women's Narratives

Participants' stories further revealed how their narratives shaped market strategies and consumer engagement within the curling industry. Through detailed interviews, it became evident that women's stories could successfully resonate with broader market segments when strategically utilized. For example, Participant Purple, a marketing strategist, discussed a successful brand campaign:

"We launched a series of promotional stories featuring real experiences from female curling athletes. The campaign quickly went viral on social media platforms, significantly boosting our club's membership among young women."

Participant Yellow, a coach, described how highlighting women's empowerment stories improved market appeal:

"We noticed a significant increase in sponsorship opportunities after sharing stories of our female athletes overcoming personal and professional challenges. Sponsors found these narratives authentic and inspirational, aligning well with their corporate social responsibility agendas."

These findings underscore the commercial potential of female narratives, demonstrating their unique capacity to foster emotional connections and brand loyalty, significantly benefiting both commercial success and the broader cultural perception of curling.

4. Discussion

This study explored how women in China's curling industry construct and communicate their lived experiences in relation to gender norms, institutional power, and market engagement. Narrative inquiry, supported by thematic coding in NVivo 12, generated three key themes across 142 coded references and 24 nodes, with high participant representation per theme (8–10 out of 10 participants per theme). Emotional tone analysis revealed recurring sentiments of frustration, persistence, pride, and strategic caution, highlighting both the challenges and agency embedded in women's stories.

4.1. Gendered Experience and the Construction of Identity

This Findings affirm the persistent influence of gender norms on the personal and professional identities of female curling participants. As illustrated in Theme 1, participants struggled with dual expectations: to perform athletically while adhering to feminine ideals shaped by external agents, including sponsors and media. These narratives reflect the concept of gender performativity, wherein gender is continuously constructed through social expectations and institutional pressures. In sports, this often results in a paradox: female athletes must be strong yet "graceful," competitive yet "feminine," reinforcing binary structures that marginalize alternative expressions of womanhood.

This resonates with Gard et al. (2024), who argued that female football players in Australia often internalize or resist these imposed identities through community narratives. Similarly, participants in this study navigated identity work in both visible and invisible forms. The tension between visibility and voice—being seen but not always heard—remains a central paradox in women's sports.

4.2. Power and Agency in Organizational Structures

Theme 2 emphasized the underrepresentation and undervaluation of women in leadership and decision-making roles. Despite increased participation, women in this study often described a "prove-it-again" bias—needing to exceed expectations to gain recognition, a phenomenon echoed in Elyasi et al.'s (2024) research on women's sponsorship in sports industries.

From a feminist organizational theory perspective, the curling clubs' internal dynamics reflect deeply embedded gendered power systems that reproduce inequality through informal networks, unconscious bias, and male-dominated leadership norms. Yet, participants

demonstrated agency: strategically leveraging evidence, audience data, and emotional intelligence to reshape perceptions and influence decision-making.

This reflects a shift from seeing women merely as passive subjects of inequality to recognizing their narrative agency—the capacity to define and perform new identities despite structural limitations. Several participants used narrative as a tool of legitimacy, professionalization, and negotiation within male-dominated institutional cultures.

4.3. Market Narratives and Commercial Value

Theme 3 highlighted the strategic importance of women's stories in shaping market engagement. As curling in China transitions toward commercialization, narratives of empowerment, resilience, and authenticity have become valuable assets in audience engagement and brand storytelling. Campaigns built on personal narratives not only resonated with consumers but also aligned with corporate interests in gender diversity and social responsibility.

This aligns with the notion of "marketized feminism", where feminist values are appropriated for branding and marketing purposes. While this offers new visibility and opportunities for women athletes, it also poses risks of commodification—where women's identities become aestheticized and sanitized for consumption. However, the study's participants appeared aware of this tension and actively negotiated narrative authenticity within commercial frameworks.

Notably, such narrative strategies also have implications for intersectional market segmentation, allowing clubs and brands to access and connect with under-targeted groups—such as young, urban, female consumers who increasingly identify with values of self-expression, equity, and social relevance.

4.4. Theoretical and Practical Contributions

Theoretically, this study extends feminist narrative inquiry into underexplored domains of emerging sports industries, specifically curling, and demonstrates how gendered narratives shape identity, power, and market strategy simultaneously. It contributes to: Gender studies by showing how sports-based identities are performed and contested; Organizational studies by revealing how women navigate and reshape gendered institutions; Sports marketing by illustrating the value of authentic narrative storytelling in audience engagement.

Practically, the findings offer concrete guidance for curling clubs, sponsors, and media platforms; Prioritize inclusive leadership pipelines for women at all organizational levels; Invest in campaigns that foreground authentic female narratives rather than token representations; Recognize women not merely as participants but as storytellers and market co-creators.

4.5. Limitations

Several limitations merit attention: Sample size and scope: Though purposive and diverse, the small participant pool may limit the generalizability of findings. Including more participants from rural or grassroots contexts could enrich understanding.

Narrative subjectivity: Personal accounts are inherently subjective and may be shaped by memory, self-presentation, or interviewer dynamics. Triangulating narrative data with longitudinal observations or archival media analysis could enhance robustness.

Temporal constraints: The study captures a snapshot in time. Future research could adopt a longitudinal design to explore how women's narratives evolve alongside policy and market shifts.

Future studies may also explore intersectional dimensions such as ethnicity, age, or sexuality, and examine how these identities interact with gender in shaping curling experiences. In addition, comparative cross-national research could uncover cultural variations in women's sports narratives.

5. Conclusions

This study explored the personal narratives of women in China's curling industry, focusing on how their experiences reflect broader dynamics of gender, power, and market interaction. Through narrative inquiry, it revealed how women in this emerging sports sector actively navigate identity construction, organizational inequality, and commercial storytelling in gendered ways. The findings demonstrate that women participants are not only shaped by institutional gender norms and power hierarchies, but also act as agents of transformation—reframing their identities and leveraging their stories to challenge stereotypes, shift leadership dynamics, and create new market value. Their narratives expose persistent biases in visibility, representation, and leadership, but also showcase the creative ways in which women negotiate and reshape these constraints to assert presence and influence within the curling industry. Importantly, this study contributes to the theoretical understanding of narrative agency, feminist sport studies, and gendered market strategies, while offering practical insights for industry stakeholders. In a rapidly evolving sports environment like China's, women's voices and stories hold critical power—not only in contesting inequality but also in shaping future directions of market engagement, brand identity, and cultural legitimacy.

By highlighting the lived and narrated experiences of women across multiple roles—athletes, coaches, managers, and marketers—this research underscores the need for inclusive, narrative-driven approaches in both scholarly analysis and professional practice. Going forward, the integration of gender-equitable storytelling in media, policy, and branding can enrich the curling industry and foster a more diverse, dynamic, and equitable sporting future.

Appendix A

Appendix A. Interview Guide

This interview guide was used to conduct in-depth narrative interviews with female participants involved in various roles within the Chinese curling industry.

Section 1: Background and Involvement

1.Can you tell me how you first got involved in the curling industry?

2.What is your current role, and how has it evolved over time?

Section 2: Gender and Personal Experience

3. Have you encountered any gender-specific challenges in your career?

4. How do you think gender influences recognition, opportunities, or leadership in curling?

5. How do you balance personal identity with public expectations (e.g., appearance, media presence)?

Section 3: Power, Voice, and Decision-Making

6. Have you participated in decision-making or leadership roles? What were those experiences like?

7. Do you feel your voice is equally heard in your organization or community?

Section 4: Media and Market Dynamics

8. How do you think the media portrays female curlers or professionals in the sport?

9. Have you been involved in any marketing or promotional activities?

10. Do you believe women's stories can influence audience engagement or club development?

Section 5: Future Outlook and Advice

11. What changes would you like to see in the curling industry regarding gender equality?

12. What advice would you give to young women entering this field?

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Table A1. This is a table caption.

Appendix B

Appendix B. Participant Overview

Table B1.

Participant ID	Role	Region	Years of Experience	Level of Visibility	Role Code
Red	National-level athlete	Beijing	8	High	Athlete
Blue	Regional-level athlete	Harbin	5	Moderate	Athlete
Green	Curling club manager	Changchun	10	High	Manager
Yellow	Curling coach	Shanghai	12	Moderate	Coach
Purple	Sports marketing executive	Beijing	7	High	Marketing

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Review

Research Hotspots, Evolution, and Prospects of Intelligent Communities in China Over the Past Twelve Years:A visual analysis based on CNKI-sourced journals

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Abstract: In recent years, the construction of intelligent communities in China has flourished and become an important force in promoting urban digital transformation. Smart communities have leveraged the Internet, Internet of Things, big data, and other technologies to achieve intelligent community management and efficient services. However, the construction of intelligent communities also faces challenges such as data security and technological updates, which require continuous exploration and improvement to better serve residents and promote sustainable development of the community. A comprehensive review of the research on intelligent communities in China over the past twelve years is conducive to deepening theoretical and policy research, and better guiding educational practice. By using the Cite Space bibliometric tool, a visual graph of the evolution of research fields related to intelligent communities can be constructed, which intuitively presents the core authors and main research institutions of intelligent community research in China; Through keyword clustering, co-occurrence, and knowledge graph analysis, researchers can also have a clearer understanding of the main content, hot topics, and cutting-edge trends of intelligent community research in China over the past twelve years.

Keywords: Intelligent Community; Research Hotspots; Knowledge Graph; Visual Analysis

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1. Introduction

With the emergence of new technologies such as the Internet, cloud computing, and blockchain, the information revolution has driven innovations in urban construction, making the development of smart communities and smart cities an inevitable trend. As the "smallest unit" of a city and the "smallest organization" for the government to serve the public, smart communities have gradually become a new pilot application field for promoting smart cities and an innovative hotspot in grassroots social governance.

Against the backdrop of rapid economic and social development over the past twelve years, what remarkable achievements has the domestic Intelligent Community research field achieved? What evolution has it undergone? What themes has it primarily focused on? And what is the frontier trend of Intelligent Community research? In response, this paper proposes to systematically address these questions using the CiteSpace bibliometric tool, aiming to provide insights for deepening the promotion of smart communities in China.

2. Research Foundation

2.1 Data Source

The literature sample of this study was obtained from the China National Knowledge Infrastructure (CNKI) academic journal database. The data acquisition process was as follows:

Open the new version of CNKI, click on Advanced Search, select Academic Journals, input the theme "Intelligent Community", set the time range from 2012 to 2024, select "Peking University Core Journals" as the source category, obtain the search results, and manually filter out announcements, reports, and data with low thematic relevance. After this process, 209 valid literatures were obtained. These literatures were exported in "Refworks" format and visualized using the CiteSpace 6.3R1 (64-bit) knowledge mapping tool. All data and information hereinafter are derived from these 209 valid literatures.

2.2 Research Tools

CiteSpace employs core methods such as co-citation analysis and path-finder to explore the citation coupling relationships among data. It presents analysis results visually, making research findings more vivid and intuitive. The size of nodes and the thickness of connections intuitively reflect the importance of various elements (such as authors, institutions, or keywords) and the degree of their interconnections. Furthermore, the knowledge maps drawn by CiteSpace can reflect the current research status of a theme, facilitate the summary of research hotspots, evolutionary paths, and frontier trends, and help predict new directions for future research. This study uses CiteSpace 6.3R1 (64-bit) to conduct a visual analysis of Intelligent Community research over the past twelve years, presenting the basic research content, hotspots, and future development directions of Intelligent Community research in China since 2012.

3. Analysis of Research Overview on Smart Communities in China over the Past Twelve Years

3.1 Publication Trend and Analysis

The number of publications serves as one of the important indicators for measuring research progress and hotspots in a specific field. Based on valid data obtained from Peking University Core academic journals between 2012 and 2024, an annual publication trend chart was drawn according to the annual number of publications (Figure 1). Overall, the number of publications on the theme of "Intelligent Community" shows a fluctuating upward trend. In particular, starting from 2020, the number of publications related to smart communities reached more than 20, and even reached 35 in 2023.

Since 2010, the concept of smart communities was formally proposed and pilot projects were promoted, bringing smart communities into the public spotlight. In 2012, pilot projects for Intelligent City construction began in Beijing, Shanghai, and other cities, with smart communities as an important component. In 2013, the Ministry of Science and Technology issued the Implementation Plan for the Innovation-Driven Strategy Enhancement Action in National High-Tech Industrial Development Zones, proposing to promote the wide application of information technologies such as the Internet of Things and cloud computing in service fields like smart communities and smart homes. This was the first time smart communities were mentioned in a national document.

In May 2014, the Ministry of Housing and Urban-Rural Development issued the Guidelines for Intelligent Community Construction (Trial), which clarified the development goals of Intelligent Community construction and established an evaluation index system covering six areas: guarantee systems, infrastructure and building environment, community governance and public services, residential area management, convenient services, and theme communities. This provided a reference for Intelligent Community construction across the country. The Guidelines proposed the initial construction of about 100 Intelligent Community demonstration points by 2015, the standardization of Intelligent Community construction in more than 50% of communities by 2020, and the establishment of a sustainable community governance system and intelligent social service model. Therefore, since 2014, the pace of exploration in smart communities has accelerated, with an increase in related topics.

In 2015, with the accelerated implementation of strategies such as "Broadband China", "Internet+", and big data, the construction of smart communities across the country accelerated, showing a blooming trend. According to the Shanghai Intelligent Community Development White Paper (2015), Shanghai identified 50 pilot smart communities in 16 districts and built demonstration communities such as Lujiazui Street in Pudong. By the end of 2015, Tianjin had promoted Intelligent Community construction in 30 large residential areas, Suzhou had built 61 wired intelligent communities (villages), and Sichuan Province had completed the first batch of 10 Intelligent Community pilot projects in 2015.

On June 12, 2017, the Central Committee of the Communist Party of China and the State Council issued and implemented the Opinions on Strengthening and Improving Urban and Rural Community Governance (hereinafter referred to as the Opinions). The Opinions proposed that under the background of new community governance, localities should formulate Intelligent Community construction and development strategies based on their actual conditions such as resource endowment, basic conditions, and cultural characteristics, implement the "Internet+ Community" action plan, and promote the construction of Intelligent Community information systems. This measure attracted attention to the construction and development of smart communities across the country.

In 2020, China's urbanization rate increased from 60.60% to 63.89%, showing a significant improvement. In the same year, the Office of the Ministry of Housing and Urban-Rural Development organized the drafting of the national standard Intelligent City Buildings and Residential Areas (First Draft), which was open to public consultation. The government regarded Intelligent Community construction as the basic unit of urban governance, real estate enterprises took smart communities as a means to improve community quality and increase revenue sources, Internet enterprises used them as a support for expanding services, and various Intelligent Community applications became increasingly rich. In addition, from the end of 2019 to 2020, due to the outbreak of the COVID-19 pandemic, contactless methods developed rapidly to avoid direct human contact, giving full play to the advantages of Internet technology. Smart communities encompassing the above functions also triggered further thinking among people.

In 2022, nine departments including the Ministry of Civil Affairs, the Central Political and Legal Affairs Commission, the Central Cyberspace Affairs Commission, the National Development and Reform Commission, the Ministry of Industry and Information Technology, and the Ministry of Public Security jointly issued the Opinions on Deeply Promoting the Construction of Smart Communities, clarifying the overall requirements, key tasks, and guarantee measures for Intelligent Community construction. The construction of smart communities entered a stage of multi-department collaborative promotion, which strongly promoted the construction and ushered in a spring for the development of smart communities.

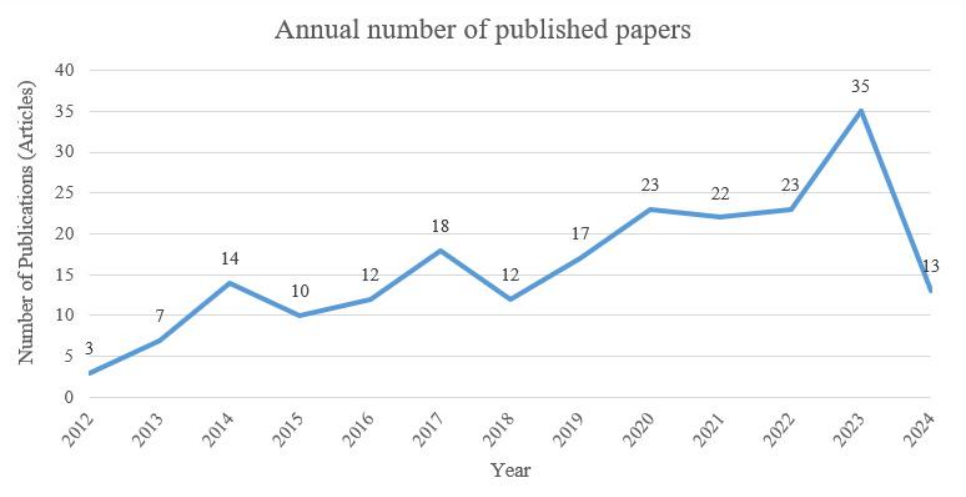

Fig. 1. Trend in the Annual Number of Published Papers on Intelligent Community Research (2012–2024)

Fig. 2. Urbanization Rate in China from 2009 to 2023

Data source: Compiled by the author based on the publicly available data from the National Bureau of Statistics.

3.2 Analysis of Core Authors

The author map generated by CiteSpace 6.3R1 (64-bit) reflects the core authors researching the theme of "Intelligent Community" and their collaborative relationships. From 2012 to the present, the scholars with the highest number of first-authored publications on "Intelligent Community" (as shown in Figure 3 and Table 1) are Liu Quan and He Jixin. Authors with two or more publications include: Liu Quan (3), He Jixin (3), Zhu Yi (2), Chang Enyu (2), Wu Xuhong (2), Qian Kun (2), Sun Jiaqi (2), Cheng Jiaxuan (2), Zhang Yanguo (2), and Ru Peng (2). Each node represents an author, while connections represent collaboration between authors—the thicker the connection, the more frequent the collaboration. Overall, authors publishing on the theme of "Intelligent Community" are relatively scattered, with limited collaborative publications. Specifically, He Jixin has collaborated with He Haiqing, Li Tianyi, and Hou Yu; Liu Quan has three collaborations with Huang Dingfang; Zhu Yi has two collaborations with Han Yong; five scholars including Lei Yan, Gao Fei, Fang Huaying, Wang Jingchun, and Gao Bin have all collaborated with each other; and Chang Enyu mainly engages in discussions with Sun Chen and Zhen Feng.

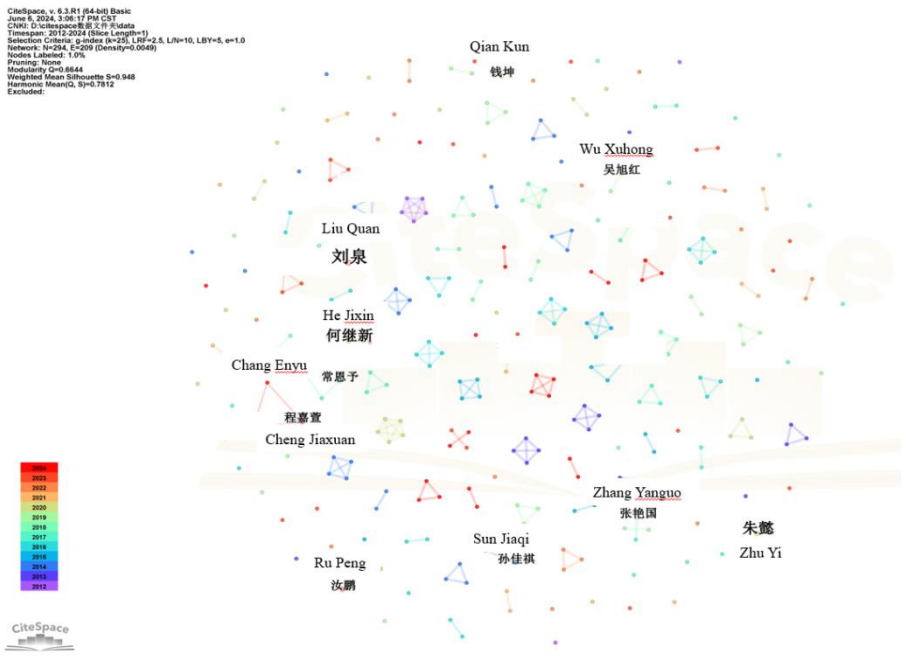

Fig. 3. Visualization Map of Authors' Collaboration Network in Chinese Intelligent Community Research over the Past 12 Years

Table 1 is another table formulated based on the data analyzed by CiteSpace 6.3R1 (64-bit), listing authors with two or more publications and their corresponding institutions, etc. As shown in Table 1, the main research directions of five scholars, including Liu Quan, Zhu Yi, Chang Enyu, Wu Xuhong, and Cheng Jiaxuan, focus on smart communities and community governance. Ru Peng's research themes mainly involve intelligent society, innovation models, cyberspace, community attachment, and science and technology policies. Scholar He Jixin's research field primarily focuses on public services and grassroots collaborative governance. Scholars Qian Kun and Zhang Yanguo mainly explore issues related to urban-rural governance and community building, while Sun Jiaqi's research themes tend to focus on the Internet, online media, and public services.

Table 1 High-Yield Authors with Two or More Publications on Intelligent Community Theme and Their Affiliated Institutions

Publication Quantity	Author(s)	Research Direction/Theme	Author Affiliation
3	Liu Quan	TOD, Intelligent City, Urban Form, Future Community, Intelligent Community, Future City, Urban Design	Shenzhen L&A Urban Planning & Design Consulting Co., Ltd.
3	He Jixin	Urban Community, Public Services, Grassroots Governance Community, Community Public Services, Intelligent Supply, Collaborative Governance	Tianjin Chengjian University

Continued Table

Publication Quantity	Author(s)	Research Direction/Theme	Author Affiliation
2	Ru Peng	Intelligent Society, Innovation Model, Cyberspace, Community Attachment, Science and Technology Policy	Tsinghua University
2	Zhu Yi	Social Governance, Intelligent Community, Collaborative Governance, Grassroots Social Governance	Guangxi University of Finance and Economics
2	Chang Enyu	Intelligent Community, Community Participation, Urban System Pattern, Community Planning, Community Network, Elderly Migrants	Nanjing University
2	Wu Xuhong	Intelligent Community, Government Governance, Digital Divide, Smart Elderly Care, Governance Capacity, Digital Vulnerable Groups, Grassroots Community	Nanjing University of Science and Technology
2	Qian Kun	Urban Fine Governance, Rural Governance, Urban Governance, Community Construction, Urban Management, Community Reconstruction	Nanjing Forestry University
2	Sun Jiaqi	Intelligent Internet of Everything, Media Integration, National Public Services	Jinan University
2	Cheng Jiaxuan	Intelligent Community, Cultural and Recreational Facilities, Aging-Friendly Design	Jiyang College of Zhejiang A&F University
2	Zhang Yanguo	Community Governance, Urban Community, Community Construction, Interactive Relationship	Jiangxi Normal University

3.3 Analysis of Research Institutions

The knowledge map of research institutions shows nodes N=241 and edges E=114 (Figure 4), indicating that there is some interaction between Intelligent Community research institutions, though cooperation needs further strengthening. The School of Politics and International Relations at Central China Normal University has communicated with only 2 institutions; the School of Politics and International Relations at Tongji University has collaborated with only 1

institution; and the School of Economics and Management at Tianjin Chengjian University has not published any "Intelligent Community"-related articles in collaboration with other institutions.

The School of Architecture and Urban Planning at Nanjing University has had close cooperation with the Jiangsu Engineering Laboratory for Intelligent City Design Simulation and Visualization Technology, Jiangsu Research Base for Smart Cities, Human Geography Research Center at Nanjing University, and Shenzhen Tiehan Ecological Environment Co., Ltd. Meanwhile, the School of Politics and International Relations at Central China Normal University has collaborated multiple times with the Policy Theory Research Base of the Ministry of Civil Affairs at Central China Normal University and the School of Public Administration at Hubei University. The Zhou Enlai School of Government at Nankai University has co-published papers with the European Graduate School of the Chinese Academy of Social Sciences, School of International Relations at the University of International Business and Economics, School of Public Administration at Inner Mongolia University, and School of Economics and Management at Inner Mongolia University. The School of Geography and Information Engineering at China University of Geosciences (Wuhan) has collaborated with the State Key Laboratory of Information Engineering in Surveying, Mapping and Remote Sensing at Wuhan University, National Engineering Research Center for Geographic Information System, and the Collaborative Innovation Center for Geospatial Information Technology—all four have collaborated with each other. Tongji University is connected with Shanghai Maritime University, Shanghai University of Electric Power, Library of the Party School of the Guangxi Zhuang Autonomous Region Committee (Guangxi Administration Institute), and School of International Education at Guangxi University of Finance and Economics.

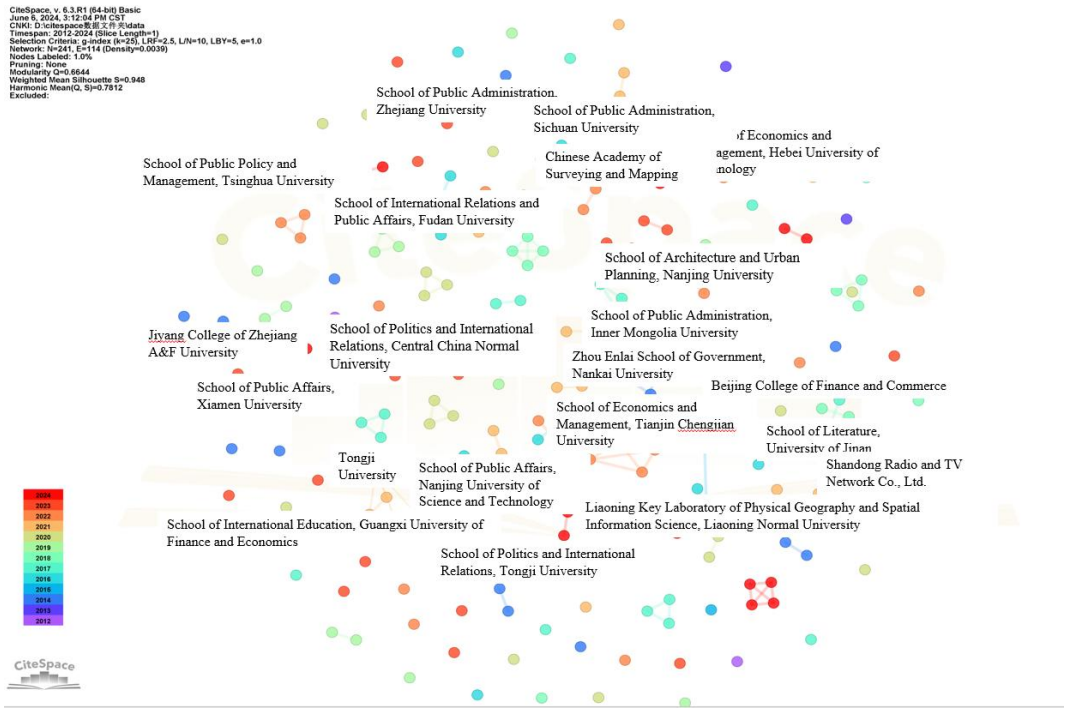

Fig. 4 Visualization Map of Publishing Institutions Network in Chinese Intelligent Community Research over the Past 12 Years

As shown in Figure 5, research institutions are listed by the number of publications in descending order. The figure indicates:

In terms of publication quantity: The top five institutions are the School of Architecture and Urban Planning at Nanjing University, School of Politics and International Relations at Central

China Normal University, School of Economics and Management at Tianjin Chengjian University, School of Politics and International Relations at Tongji University, and Zhou Enlai School of Government at Nankai University. This suggests that schools and institutions focusing on economics & management, urban planning, and political science constitute the main forces in Intelligent Community research.

In terms of administrative divisions: Publishing provinces are mainly concentrated in regions with relatively high economic development levels, such as Jiangsu Province, Tianjin Municipality, Shanghai Municipality, Zhejiang Province, and Hebei Province.

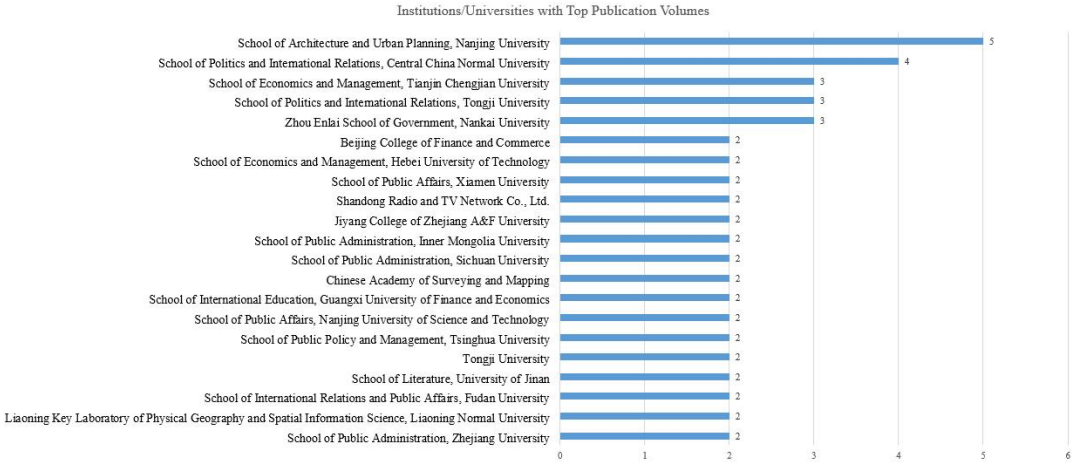

Fig. 5 Number of Publications by Relevant Institutions on the Theme of 'Intelligent Community' in China over the Past 12 Years

3.4 Keyword Clustering Analysis

Keyword clustering analysis can summarize research questions in a field over a specific period, and thus infer research hotspots and directions from the aggregated keywords. The CiteSpace 6.3R1 (64-bit) software was used to cluster keywords related to "Intelligent Community" (see Figure 6). Each region is composed of related keyword clusters, named with "#serial number + cluster name," where the serial number represents the concentration—the smaller the number, the higher the concentration.

As shown in Figure 6, the Modularity Q value is 0.6644, and the Weighted Mean Silhouette S value is 0.948, indicating significant community structure and efficient clustering in the data. The Q value typically ranges in [0, 1): a $Q > 0.3$ signifies a significant network community structure, and an $S > 0.5$ indicates reasonable clustering. Thus, the keyword clustering structure of Intelligent Community research is both significant and reasonable. A total of 8 major keyword clusters were generated (Figure 6 and Table 2), namely: #0 Intelligent Community, #1 Community Governance, #2 Intelligent City, #3 Integration, #4 Urban Community, #5 Governance, #6 Video Security, and #7 Intelligentization.

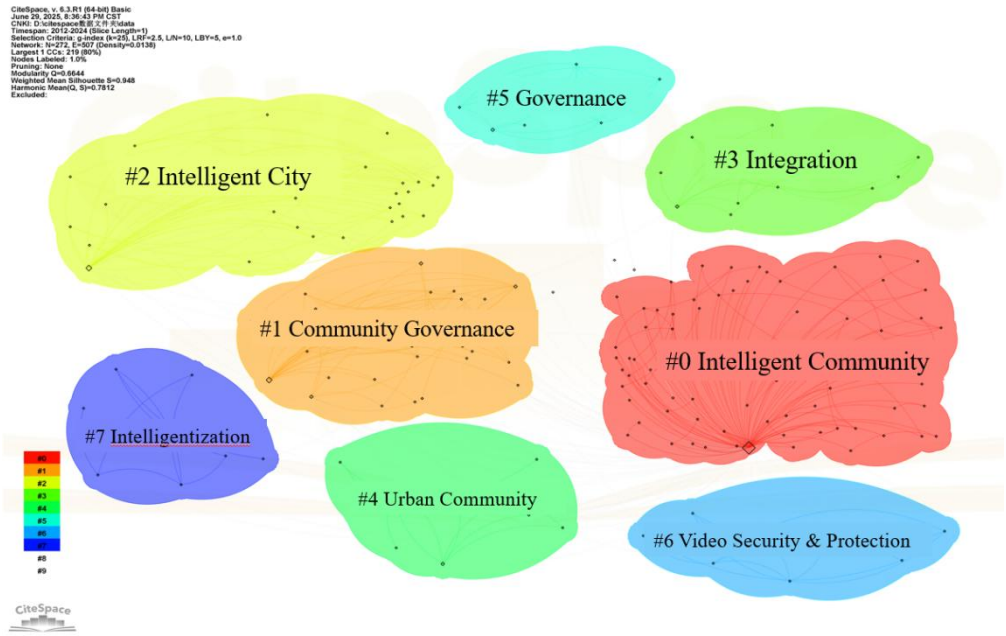

Fig. 6 Keyword Clustering Map of Intelligent Community

Table 2 High-frequency Keyword Clusters in Intelligent Community Research

Cluster ID	Size	Silhouette	Label	Top Terms
0	72	0.982	Intelligent Community	Intelligent Community, Intelligent City, community governance, big data, technical governance, emerging technologies
1	37	0.835	Community Governance	Community governance, big data, technical governance, digital governance, grassroots governance
2	30	0.93	Intelligent City	Intelligent City, future community, creative class, Intelligent Community, urban management
3	11	0.945	Integration	Integration, wisdom, supply model, new-type community
4	10	0.954	Urban Community	Urban community, community network, emergency management, time-space behavior
5	8	0.988	Governance	Governance, big cities, urban villages, quality standards, connotative attributes

Continued Table

Cluster ID	Size	Silhouette	Label	Top Terms
6	8	0.968	Video Security	Video security, grid management, spatiotemporal information, universal management, Intelligent City
7	7	0.974	Intelligence	Intelligence, design strategy, intelligence, residential space, home-based elderly care
Total=8	183	MD=0.947	Q=0.6644	S=0.948

According to the keyword clustering map, research on Intelligent Community construction mainly falls into three categories:

Focus on the relationship and overview of smart communities, urban communities, and smart cities, represented by #0 Intelligent Community, #2 Intelligent City, and #4 Urban Community.Smart communities serve as an important means to promote Intelligent City construction, while smart cities are the result of fully developed smart communities. Urban communities are the carrier for Intelligent Community construction, and smart communities represent the ultimate goal of urban community development. Since IBM proposed the concepts of "Smart Planet" and "Intelligent City" in 2009, the Intelligent City concept has been adopted by many countries and regions as a new path for urban governance. As the key entry point of smart cities, smart communities are the closest Intelligent City applications to citizens. As social communities formed by residents in a specific living space of a city, urban communities play a vital role in promoting urban governance. Intelligent Community construction relies on urban communities as platforms, with pilot projects implemented within them. Promoting Intelligent Community construction is not only a measure to implement national plans but also a strategic choice and practical requirement for the development of urban communities in China. Wang Fashuo divided governance practices into four types based on China's Intelligent Community governance reality: technical empowerment, technical authorization, empowerment authorization, and technical disembedding[1]. Zhang Chen (2021) found that the successful innovative practice of the Intelligent Community platform in Y Community relied on the positive interaction among needs, actors, and performance within the community governance environment[2].

Focus on soft approaches to Intelligent Community development, mainly represented by #1 Community Governance, #3 Integration, and #5 Governance. The core of a community is the "people" living in it, and its vitality and warmth stem from comprehensive development and residents' emotional attachment. Through soft approaches like community governance and integration, the sense of commonality and belonging among residents can be enhanced, residents' self-governance capabilities can be improved, and the democratization and diversification of community self-governance can be promoted. Residents can jointly negotiate matters such as infrastructure and community activities, solve community problems democratically, create a positive community atmosphere, and provide public wisdom and strength for the development of smart communities. Jiang Xiaoping argued that a Intelligent Community is a complete ecosystem encompassing technical, functional, result-oriented, and value-oriented dimensions[3]. It is a new community governance model that provides convenient, efficient, transparent, and fair public services to residents, guided by residents' needs, aimed at a better life, with multiplex

organizations as the main body, intelligent services as the means, and resource integration as the foundation.

Focus on technical means for Intelligent Community construction, mainly represented by #6 Video Security and #7 Intelligentization. Communities have abundant public spaces and facilities serving the public, making security prevention in public spaces crucial. Video security is an important component of smart communities, which will integrate with urban safety inspection and monitoring systems to serve safe community construction through big data monitoring and emergency command platforms. From a governance perspective, Intelligent Community construction emphasizes using digital connections as a bridge to achieve effective co-governance among multiple stakeholders in the community space.As the current core technical trend, "intelligentization" is the greatest feature and technical means of Intelligent Community construction. China's Intelligent Community construction achieves interconnection among people, objects, and networks through IoT and interconnection, integrates various community resources, and forms a new community form that is modern, networked, and information-driven. "Intelligentization" in Intelligent Community construction is embodied in key technologies such as "Internet of Things (IoT) technology, artificial intelligence, cloud computing and big data, green building technology, and spatial information technology". Wang Di stated that new-generation information technologies such as big data and cloud computing, in new forms and models, can achieve digital, networked, intelligent, interactive, and collaborative services and governance for elements like urban community party building, population management, public activities, commercial operations, and home life, thereby promoting Intelligent Community construction[4]. Chen Yuehua believed that the integration of "the Internet" and community governance actively responds to and supports the strategies of "Cyber Power, Digital China, and Smart Society"[5].

4. Analysis of Research Hotspots and Frontier Trends

4.1 Analysis of Research Hotspots

In the keyword co-occurrence map, N=272 and E=507, where larger nodes indicate higher occurrence frequencies. Based on the frequency of keyword occurrences, the hotspots in Intelligent Community research are: Intelligent Community (101), Community Governance (22), Intelligent City (19), Big Data (11), Smart Governance (6), Urban Community (6), Technological Governance (5), Grassroots Governance (4), Community (4), Community Service (4), Digital Governance (4), Internet+ (3), Smart Elderly Care (3), Smart Society (3), Governance (3), Digital Society (3), Public Participation (3), Intelligentization (3), Informatization (3), Cloud Computing (3), New Infrastructure (3), etc.According to betweenness centrality values, research hotspots in Intelligent Community studies focus on keywords such as Intelligent Community (1.17), Intelligent City (0.26), Community Governance (0.09), Internet+ (0.09), and Big Data (0.05).

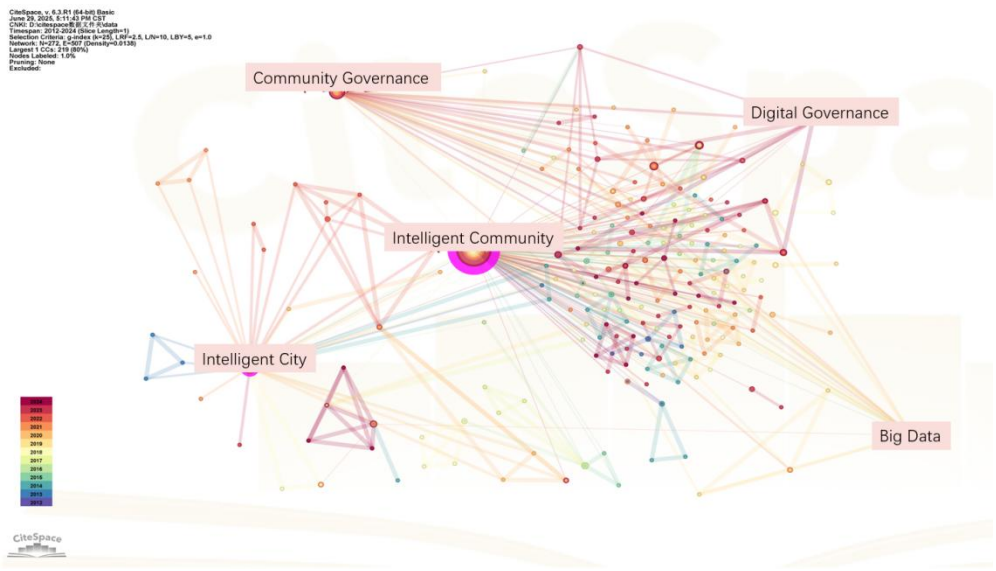

Fig. 7 Keyword Co-occurrence Visualization Map of Intelligent Community

4.2 Analysis of Frontier Trends

Burst terms refer to keywords with a significant increase in frequency within a specific research field over a certain period. Keyword bursts are measured by two indicators: burst strength and burst duration. Extracting and analyzing burst terms through CiteSpace 6.3R1 (64-bit) can, to a certain extent, predict the frontier directions of Intelligent Community research in China over the past twelve years. Figure 8 presents the network visualization map of burst terms, reflecting 18 keywords with high burst intensity: Community Construction, Information Technology, Development Strategy, Cloud Computing, Grid Management, Urban Community, Wisdom, Smart Elderly Care, Community Elderly Care, Optimization Scheduling, Big Data, Community Governance, Informatization, Smart Governance, New Infrastructure, Digital Economy, Digital Governance, Emergency Governance.

Top 18 Keywords with the Strongest Citation Bursts

Keywords	Year	Strength	Begin	End	2012 - 2024
Community Construction	2012	1.29	2012	2013	
Information Technology	2012	1.16	2012	2014	
Development Strategy	2012	0.95	2012	2016	
Cloud Computing	2014	1.77	2014	2015	
Gridification	2014	1.18	2014	2015	
Urban Community	2015	0.92	2015	2017	
Wisdom	2016	0.98	2016	2018	
Smart Elderly Care	2018	1.65	2018	2019	
Community - based Elderly Care	2018	1.09	2018	2019	
Optimal Scheduling	2018	1.09	2018	2019	
Big Data	2015	2.39	2019	2021	
Community Governance	2017	1.22	2019	2021	
Informatization	2019	1.21	2019	2021	
Smart Governance	2017	1.01	2020	2022	
New Infrastructure	2021	1.03	2021	2024	
Digital Economy	2021	0.99	2021	2022	
Digital Governance	2022	1.44	2022	2024	
Emergency Governance	2022	0.9	2022	2024	

Figure. 8 Knowledge Graph of Keyword Bursts in Smart Community Research in China Over the Past Twelve Years

By using CiteSpace 6.3R1 (64-bit) to draw historical curves of burst terms, the changes in the research frontier trends of smart communities since 2012 can be obtained.

First, from 2012 to 2014, the main research themes were "Community Construction", "Information Technology", and "Development Strategy", focusing on how information technology and development strategies could play roles in community construction. The burst term "Community Construction" emerged in 2012, with two related literatures published in 2012 and 2013, but did not appear thereafter. Research mainly centered on how to achieve "intelligentization" in community construction. Wu Jinliang conducted in-depth and multi-faceted discussions on the top-level design of the "Zhejiang Intelligent Community Network" and proposed that the information platform of "smart communities" must aim to promote the reconstruction of community collectives, drive the transformation of community governance methods and structures from traditional to modern, and achieve seamless integration with e-government[6]. Li Zhiping suggested that the application of Internet of Things (IoT) technology could subvert traditional community models and accelerate the process of intelligentization[7].

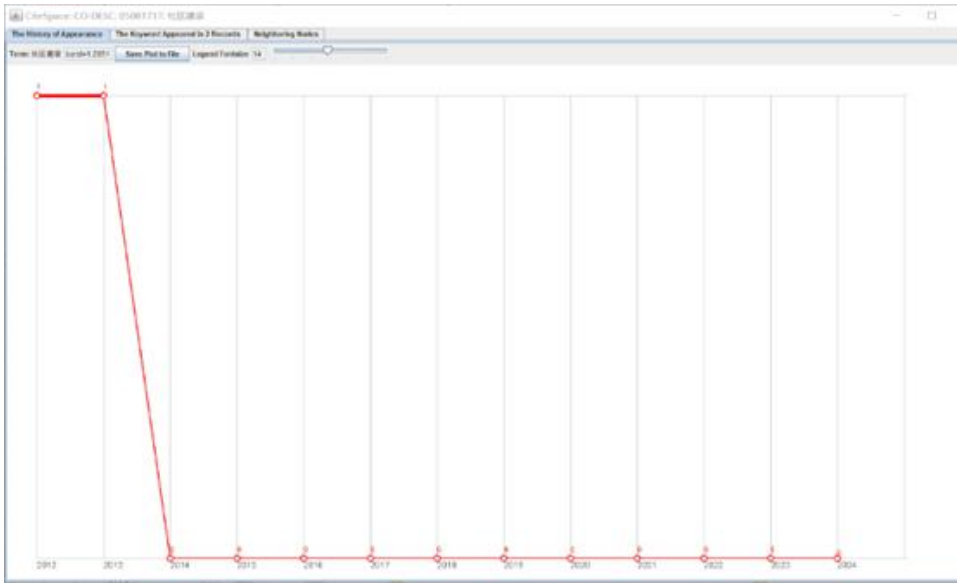

Fig. 9 Historical Curve Chart of "Community – building"

Second, from 2014 to 2018, the main research focuses were "Cloud Computing", "Grid Management", "Urban Community", and "Wisdom". In August 2014, eight ministries and commissions including the National Development and Reform Commission, Ministry of Industry and Information Technology, Ministry of Science and Technology, Ministry of Public Security, Ministry of Finance, Ministry of Natural Resources, Ministry of Housing and Urban-Rural Development, and Ministry of Transport issued the Guidance on Promoting the Healthy Development of Smart Cities, stating that "by 2020, a number of smart cities with distinct features should be built." In the same year, many domestic cities took smart cities as a strategic choice for transformational development: more than two-thirds of the 661 cities nationwide announced plans to build smart cities, including 100% of provincial and sub-provincial cities, over 74% of prefecture-level cities, and 32% of county-level cities. During this period, public attention focused on how to achieve "intelligentization" of "urban communities" through technology and "grid management" systems. The burst term "Cloud Computing" emerged in 2014, with 1 publication in 2014 and 2 in 2015."Urban Community" emerged in 2015, with a total of 3 publications from 2014 to 2018 and 1 publication each in 2022, 2023, and 2024, still exerting significant influence on current research. Wang Lingqun proposed a Intelligent Community architecture based on J2EE and cloud computing to address construction issues, offering corresponding solutions for three key problems in overall design, software, business, and data[8].

Chai Yanwei proposed an intelligentization path for urban community management and services in China, emphasizing that community planning should break through physical space, redivide community spaces, and achieve re-communityization in terms of behavioral and social spaces[9]. Zhang Yan planned and designed the eight application functions of a smart cloud community service management system based on ubiquitous networks, cloud computing, cloud services, and big data technologies. She proposed accelerating the construction, development, and deployment of public information platforms for smart communities, improving community management credit systems, and providing integrated, fast, and efficient property management services to residents through these platforms[10].

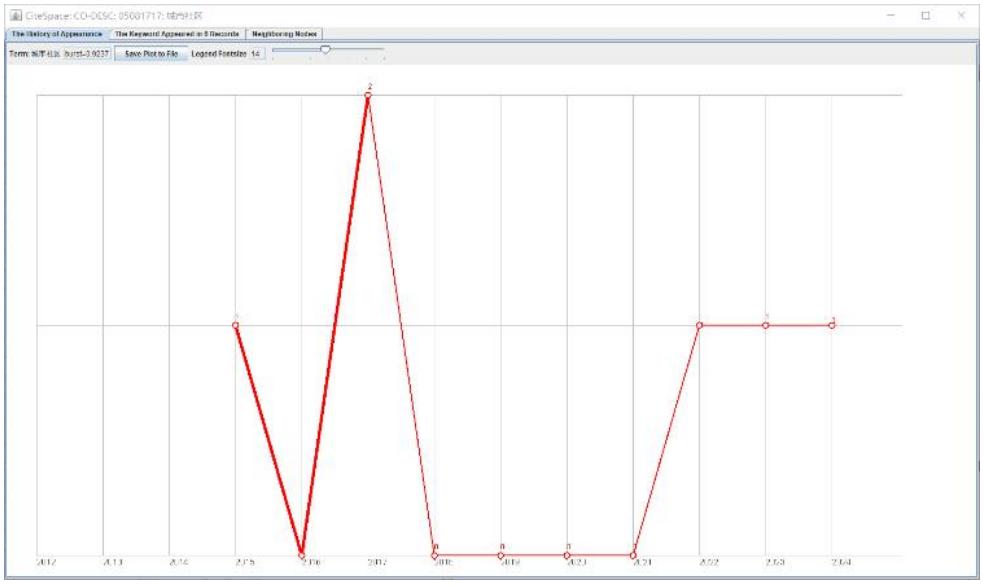

Fig. 10 Historical Curve Chart of “Urban Community”

Third, from 2018 to 2019, "Smart Elderly Care", "Community Elderly Care", and "Optimization Scheduling" gained significant attention. Scholars primarily explored the relationship between smart elderly care and community elderly care, as well as how to manage resource allocation in smart communities through optimization scheduling." Smart Elderly Care" was discussed in 2 publications in 2018 and 1 in 2019."Community Elderly Care" had a total of 2 publications from 2018 to 2019, focusing on how to construct community elderly care within the context of smart communities. Liu Xia surveyed the status quo of smart and healthy elderly care in 30 communities of Zhengzhou through questionnaires and found that community elderly care services were basically intelligent, but with low usage rates among the elderly, who hoped communities would provide more health services[11]. Wang Hongyu argued that the construction of smart communities inevitably drives the rise of Intelligent Community elderly care services, which act as a bridge for communication and information transmission, providing strong support for the development of elderly care services[12].

Fourth, from 2019 to 2021, the research frontiers were "Big Data", "Community Governance", and "Informatization", focusing on the transformation of community governance in the new era, informatization construction of smart communities, and the operation, challenges, and solutions of community governance. Through secondary review, there are 22 literatures related to "Community Governance", including 11 on related themes from 2019 to 2021 and 9 from 2022 to the present, reflecting that community governance has remained an academic research hotspot. The burst term "Big Data" had 1 related article in 2015, 2 in 2017, and a total of 8 publications from 2019 to 2021.On April 19, 2019, the China Intelligent Community Service Industry Summit Forum was held at the China Optics Valley Technology Exhibition Center (Wuhan). The forum addressed topics such as the integration of technical means, convenient data

utilization, community platform operation, and demonstration of optimal smart communities, reigniting attention to the integration of communities and new technologies. Zhang Yanguo emphasized the need to comprehensively explore the main links and specific applications of big data platform operation, adhere to the principle requirements of big data governance in Intelligent Community construction, and fully unleash the governance efficiency of smart communities[13]. Mao Peijin pointed out that China's Intelligent Community construction currently faces multiple development challenges in systems, technology, efficiency, and security[14]. The development of smart communities should focus on four aspects: improving top-level design, strengthening technology introduction and integration, enhancing the coordination of Intelligent Community construction, and perfecting information security management mechanisms.

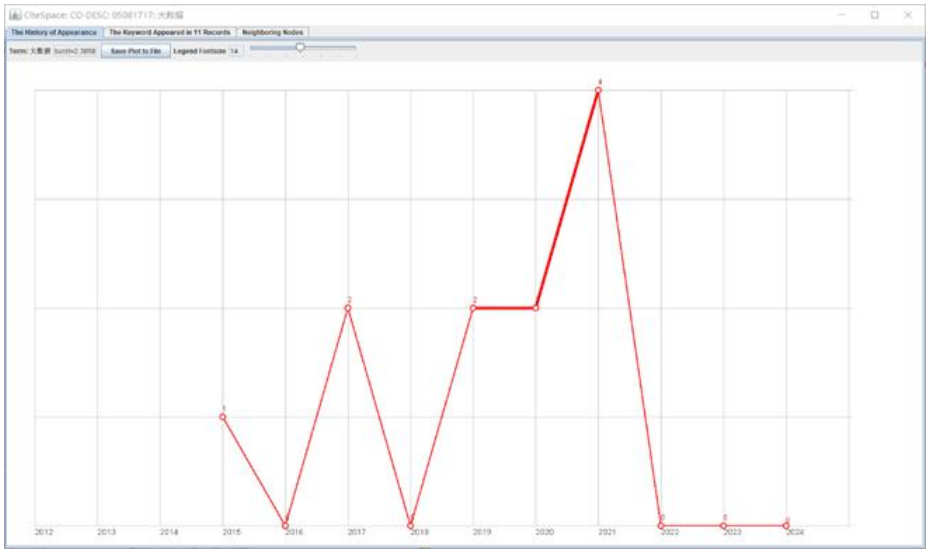

Fig. 11 Historical Curve Chart of "Big Data"

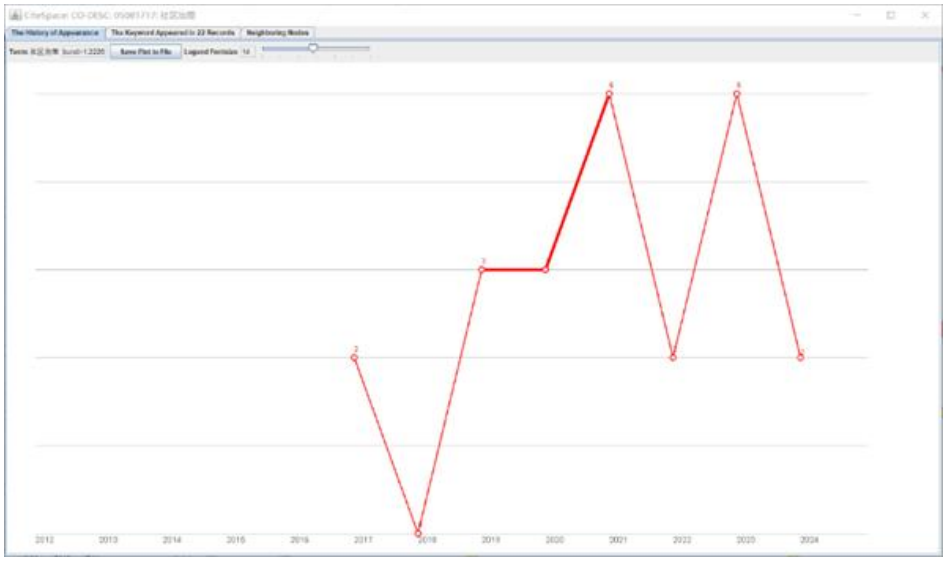

Fig. 12 Historical Curve Chart of "Community Governance"

Fifth, from 2020 to 2022, "Smart Governance" emerged as a hot topic. Although there was 1 related literature in 2017, a total of 4 publications were issued from 2020 to 2022, and 1 in 2024, mainly focusing on the integration and implementation paths of smart governance in urban communities. Zhu Yi proposed that smart governance in urban communities requires embedding the concepts of technology and rules, integrating platforms, and enhancing capabilities to construct the demand, operation, and support systems for smart governance in urban

communities[15]. Fan Fengchun's research revealed that the driving models for the effectiveness of smart governance in urban communities include terminal service-driven, platform integration-driven, online collaboration-driven, and comprehensive application-driven models.[16] Urban communities should dynamically adjust the driving models for smart governance effectiveness based on resource endowments and development needs.

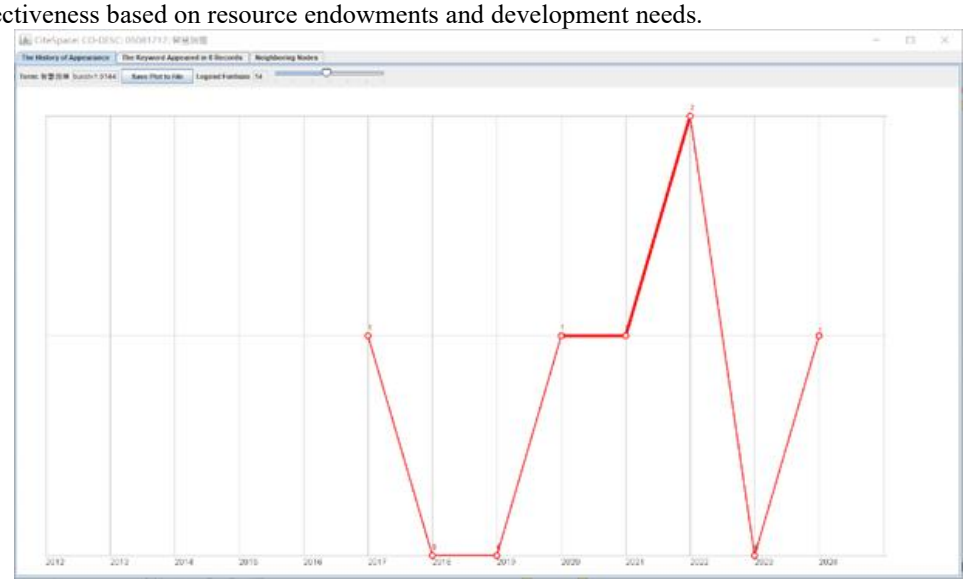

Fig. 13 Historical Curve Chart of "Smart Governance"

Sixth, from 2021 to 2024, the latest research hotspots focus on "New Infrastructure", "Digital Economy", "Digital Governance", and "Emergency Governance", mainly exploring how to implement digital governance and emergency governance for smart communities and cities, and promote resident participation against the backdrop of new infrastructure and the digital economy. "New Infrastructure" saw 2 publications from 2021 to 2023."Digital Economy" had 1 publication each in 2021 and 2022."Digital Governance" accumulated 4 publications from 2022 to 2024."Emergency Governance" was discussed in 2 related literatures from 2022 to 2023. New Infrastructure — defined by the National Development and Reform Commission (NDRC) as new-type infrastructure represented by 5G, artificial intelligence, industrial internet, and the Internet of Things (IoT) — was first proposed in 2015 and formally defined at the Central Economic Work Conference in December 2018. On December 27, 2021, the General Office of the State Council issued the 14th Five-Year Plan for the Construction of Urban and Rural Community Service Systems, calling for accelerated digital construction of community services, encouraging social capital investment in smart communities, and promoting the construction of information infrastructure for smart communities using 5G, IoT, and other modern information technologies. Zhang Hui proposed reducing transaction costs in the cooperative supply of digital infrastructure for smart communities through four approaches: clarifying data sharing standards, introducing interest negotiation mechanisms, improving information transmission methods, and optimizing compliance rules and processes[17]. Li Zhiqiang's research revealed that the dual drive of constructing an "integrated intelligent governance" model through community data and advancing "network integration" via information platforms can achieve data-driven, two-way empowerment, information sharing, and institutional standardization, enhancing the overall efficiency of emergency governance in smart communities. He also proposed a "civilizational" emergency governance model for smart communities[18]. In 2023, the Central Committee of the Communist Party of China and the State Council issued the Overall Layout Plan for Digital China Construction, indicating that China's digital construction has entered a new stage of balancing development and regulation. It emphasizes improving digital governance capabilities, strengthening the construction of digital governance ecosystems, and fostering a governance environment adapted to digital development. Against this backdrop, the development and

implementation paths of "New Infrastructure", "Digital Governance", "Intelligent Community", and "Smart Governance" will become future research frontiers.

5. Summary and Prospects

This section is not mandatory but can be added to the manuscript if the discussion is unusually long or complex.

5.1 Research Summary

Over the past twelve years, research on smart communities in China has yielded fruitful results. This paper uses CiteSpace 6.3R1 (64-bit) software to conduct a visual analysis of Intelligent Community research in China over the past twelve years, with the following conclusions:

Publication Quantity in Core Journals: The number of related publications on "Intelligent Community" has been increasing, which is closely related to the sustained and healthy development of China's economy and society, deserving continuous attention from all sectors.

Distribution of Authors and Institutions: There is a large number of authors and institutions, with schools and institutions focusing on economics & management, urban planning, and political science serving as the main research forces. Collaboration between authors and institutions remains limited, with independent research as the main mode. Additionally, authors and institutions show certain regionality, primarily concentrated in eastern and southern developed regions, possibly related to economic development levels.

Research Themes and Hotspots: The research in the "Intelligent Community" field has always centered on "Big Data", "Digitalization", "Intelligent Community Governance", and "New Infrastructure", with research priorities closely tied to social hotspots and emerging technological achievements in each period. The focus has evolved from improving hardware conditions in the early stage to emphasizing soft governance of smart communities. With technological innovation, there is a growing emphasis on transforming communities into "smart communities" that keep pace with the times to build "smart cities". With the issuance of the Overall Layout Plan for Digital China Construction, it can be predicted that topics related to "Intelligent Community", "Intelligent City", "Intelligent Community Governance", and "New Infrastructure" will continue to be highly researched in the future.

5.2 Future Prospects

Regarding the future development of smart communities in China, the author believes the following directions are worthy of attention:

Strengthen Collaboration among Researchers and Institutions: Domestic scholars and institutions should enhance communication and cooperation, compare the development status of smart communities in different regions, and summarize common construction and development conclusions.

Deepen Research on Interactive Factors: Scholars in this field should increase discussions on the interactive effects of social environment, high-tech development, population mobility, higher-quality education, etc., especially research on resident participation and emergency management in smart communities.

Expand Participation from Diverse Disciplines: In addition to schools and institutions focusing on economics & management, urban planning, and political science, scholars and institutions from other fields—particularly those with high-tech backgrounds—should increase their focus on smart communities.

Promote International Comparative Studies: Comparative studies on international smart communities need further in-depth exploration, which can provide useful references for China's Intelligent Community research and facilitate exchanges and cooperation between domestic and foreign researchers.

Balance Intelligentization and Humanization: Pay attention to the integration of intelligentization and humanization, excavation of industrial value, and protection of data security and privacy. With the deepening of Intelligent Community construction, the creation of digital industrial value will receive increasing attention, and research on smart healthcare, smart homes, data security, and privacy protection technologies must be continuously promoted.

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Article

Research on Negative Factors of Digital Transformation in Enterprise B

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Abstract: Current research on enterprise digital transformation mostly focuses on constructive practices and positive impacts, lacking special discussions on transformation problems and resolution paths, especially insufficient attention to the dilemma of "wanting to transform but daring not to" faced by small and medium-sized manufacturing enterprises and the common factors of failure. This paper takes Company B as a case study, analyzes the internal and external resistance factors it faces during the transformation, such as financing constraints, insufficient strategic resilience, and shortage of information talents, and proposes the conclusion that enterprises need to adhere to strategic resilience, make overall plans, establish an information talent system, and cultivate digital thinking to effectively promote digital transformation.
Keywords: Digital Transformation; Negative Factors; Case Study

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1. Introduction

There have been considerable case studies on enterprise digital transformation, but the vast majority focus on the constructive practices of a certain enterprise's digital transformation or the positive impacts brought by digital transformation. For example, digital transformation can promote earnings management through non-wholly owned subsidiaries (Xueman Xiang & Biao Yi, 2025). It can also reduce the cost of equity (Yan Wang & Bing Feng, 2025).There are few special discussions on the major problems encountered by enterprises in digital transformation and how to resolve them. For small and medium-sized manufacturing enterprises, on the one hand, they have realized the importance of digital transformation, and some have begun to try transformation by means of self-research or outsourcing. On the other hand, they have many concerns about whether they should transform and when is the right time to transform. The large-scale investment in digital transformation can be described as a "big gamble" for small and medium-sized enterprises. If the transformation is successful, it is difficult to see economic benefits immediately in the short term; if the transformation fails, it may immediately be on the verge of elimination. The situation of wanting to transform but daring not to is widespread. For small and medium-sized enterprises that have successfully transformed, limited by various factors such as industry, scale, and regional resources, their practices may not be fully referable. Therefore, compared with learning from the advantageous practices of successful enterprises, discussing the common factors that may lead to failure is more of practical significance for this type of enterprise.

2. Materials and Methods

This paper mainly adopts the case study method as the basic method of writing. The author once held relevant job positions in the company involved in the case before writing this paper, during which rich practical experience was accumulated. The relevant contents presented in the article all come from the frequent exchanges and interactions between the author and colleagues,

superiors, and customers in daily work, and these information are all first-hand materials, which have high authenticity and reliability. Through this in-depth case study, the author can comprehensively analyze the problem from multiple perspectives, providing readers with more in-depth and detailed analysis and insights. The relevant names in the article have been kept confidential.

3. Discussion

3.1 Brief Introduction to Enterprise Operation

Company B is a private non-listed convenience food manufacturing company, with 11 production and marketing integrated factories nationwide and about 6,000 employees in the whole group, which is a typical medium-sized traditional manufacturing company. Together with Company K, Company J, and Company T, it occupies 85% of the chinese convenience food market share. In order to expand its competitive advantages, Company B uses self-media to create marketing events to improve its brand awareness externally, and insists on taking digital transformation as the foundation to drive its second entrepreneurship internally. The table1 shows the informatization process of Company B.

Table 1. Informatization process of Company B.

Time	Digital Project	Content
2005	Accounting Computerization	Company B adopted the X ERP system to realize accounting computerization, ending the history of manual accounting in the company. However, due to the continuous expansion of the company's scale, the labor cost savings brought by accounting computerization are difficult to measure.
2015	Financial Shared Service Center	Company B learned from the experience of leading enterprises at that time and began to invest in building a financial shared service center. Due to the insufficient understanding of the management at that time, the financial shared service center of Company B stopped at the scale of "small shared". "Small shared" means that the shared center only provides two functions: expense review and fund allocation. The human resources come from the transfer of factories. In other words, the shared center only centralizes the original cashiers and expense accountants to work together, and there is no improvement in financial work efficiency.
2021	Omnidirectional Digital Transformation	Company B put forward the strategic goal of "enterprise transformation, digital support, financial priority", and signed a strategic cooperation agreement with Company K2 Software. It adopted the full set of existing solutions of Company K and adapted them according to the company's special business. A transformation pattern was formed with the ERP system as the main body and other business systems as the wings to continuously supplement.

3.2 External Negative Factors

3.2.1 Financing Constraints

As a traditional manufacturing enterprise, before 2020, Company B had a long-term debt ratio of more than 75%, and its debt repayment ability was poor. Most of the debt types were short-term bank loans. After putting forward the strategic goal of comprehensive digital transformation, Company B tried to apply for special loans, but all were rejected. The reasons from the bank are as follows:

①For high-debt enterprises to carry out digital transformation, the amount of funds used is large, and the possibility of transformation failure is high. In the case that Company B has already defaulted on the payment to many suppliers for half a year, Company B has no spare capacity to make other investments.

②Although the government encourages the digital transformation and upgrading of traditional manufacturing industries, it is blind for Company B to invest in its own poor financial situation. Even if Company B successfully carries out digital transformation and its digital level can be comparable to that of leading enterprises in the industry, it cannot immediately improve the enterprise's operation situation. The investment goal of creditors is mainly to obtain short-term benefits. The current goal of Company B should be to increase innovation efforts, launch strategic single products, and occupy the market to obtain stable income.

③If Company B insists on implementing the comprehensive digital strategy, the bank will re-conduct due diligence and consider the possibility of early loan recovery.

According to the traditional view, the government's economic policies will have a guiding role in the development of the financial market. (Rajan and Zingales, 1998) According to the logic of this view, the government proposes to vigorously develop the digital economy and provide certain subsidies to digital transformation enterprises, and financial institutions should actively respond to the policy and provide credit assistance. However, the actual situation of Company B is not the case. The introduction of economic policies will bring strong externalities, and enterprises will have blind investment behavior. In order to avoid expected losses, financial institutions will be more cautious and increase the financing constraints on enterprises.

3.3 Internal Negative Factors

3.3.1 Insufficient Digital Strategic Resilience and Lack of Forward-looking Design

Before formulating a strategy, any enterprise should refine the development goals and implementation paths for the next three to five years in dimensions. In 2021, Company B announced that comprehensive digital transformation would be the company's strategy, but in the implementation, it did not always take the digital strategy as the focus of work. Specifically, first, there is no clear strategic vision. Enterprises have many goals for digitization, such as improving operation efficiency, reducing operation costs, and improving management precision, but the primary and secondary should be distinguished in development, and the main goal should be anchored. Second, the lack of forward-looking design leads to many difficulties in the specific construction process. Company B adopted the mature full set of digital solutions of Company K. However, due to the particularity of its own business, the situation that the system is not compatible with the business appears. After the new system is launched, a transition period for the simultaneous operation of the old and new systems should generally be set. However, due to the consideration of labor costs, Company B migrated the data of the old system to the new system without setting a transition period, resulting in poor connection before and after the

business. Third, the strategic path is not refined. Company B has not split the overall strategy of the enterprise into specific execution stages, and has not comprehensively considered various factors involved, such as digital execution personnel and financial support.

3.3.2 Insufficient Support of Information Talents and Lack of Digital Thinking

The common problem of small and medium-sized traditional manufacturing enterprises in the face of the digital wave is the lack of information talents. Due to the particularity of manufacturing factories, the technical talents they value are more inclined to traditional special types of work, such as electricians and machine repairmen. Information technology is only regarded as a logistics department, and its more responsibilities are to maintain the company's website, mail system, stable network transmission, and repair electronic equipment. However, comprehensive digital transformation has higher requirements for information personnel. Information personnel should have the ability to design, install, and debug digital systems, and secondly, master the use and maintenance of various digital tools. Therefore, medium-sized enterprises often face the problem of whether to carry out self-research or outsource in the face of digital transformation. Self-research requires extremely high human resource investment, and outsourcing can solve the problem of insufficient internal talents, but the long-term deployment of personnel by the solution company is likely to leak the company's core data. In the final analysis, it is the shortage of human resources that cannot support the implementation of the strategy. For the senior management team, quite a number of senior executives of Company B were promoted from the factory. They have sufficient understanding of the production process and process, but due to factors such as education, it is difficult for them to have a deep understanding in the face of digital transformation, and their thinking and cognition are still in the information stage.

Informatization more emphasizes technical support. When the business department puts forward requirements, the information personnel give systematic solutions according to the specific business model. The essence of informatization is still driven by business. Take the OA system as an example. When office personnel find that the process of signing documents offline is tedious, they put forward the concept of online approval, but its essence is only the change of tools. With the increasing degree of informatization, the problem of "information silos" begins to appear, and the data-driven mode is gradually widely recognized. However, it is precisely because of the long-term blocky informatization development that the senior management team lacks digital thinking, cannot provide effective top-level design in the enterprise transformation, and is difficult to promote the implementation of the strategic goal. The grassroots personnel lack information technology and are also difficult to provide technical support in the process.

4. Conclusions

4.1 Adhere to Strategic Resilience and Make Holistic Plans

After small and medium-sized enterprises decide to start digital transformation, they need to adhere to strategic resilience from beginning to end. Digital transformation is a long process. During this period, there may be situations such as resource mismatch and results not meeting expectations, but enterprises should always take transformation as the focus of their work. A reliable way to adhere to the digital strategy is to make holistic plans in advance. The development of the digital economy will give birth to many new technologies. Whenever there is a breakthrough in technology, there is the possibility of adapting to the development of enterprises. Therefore, digitization will continue, that is, only before and during the event, but not after.

Beforehand, actively carry out digital readiness assessment. Small and medium-sized manufacturing enterprises neither have the digital gene of digital native enterprises nor the sufficient resource investment of large enterprises. The traditional maturity model has certain disadvantages. Chinese scholar Hu Haibo put forward the readiness model for small and medium-sized enterprises as shown in the table2.Therefore, when conducting digital transformation, small and medium-sized enterprises should conduct accurate evaluations based on appropriate models.

Table 2. Digital Transformation Readiness Model

Dimension	Index Basis
Human Resource Preparation	Consider introducing digital talents in advance and establishing a digital transformation talent training system.
Financial Preparation	Calculate the cost of digital transformation in advance and seek the possibility of external financing.
Technical Preparation	Contact external technical service providers in advance to customize personalized digital technology solutions, or carry out internal demand surveys and purposefully plan the digital technologies to be introduced according to the needs.
Cognitive Preparation	Formulate digital strategies and visions in advance, hold digital transformation mobilization meetings, and promote the formation of an overall atmosphere of digital transformation within the enterprise.
Organizational Preparation	Sort out the business process modules in advance, optimize process management, and establish personnel and teams specifically responsible for digital transformation business.
External Environment Preparation	Small and medium-sized manufacturing enterprises need to pay close attention to the policy changes of digital transformation and the research and development of industry digital transformation applicable tools, etc., and establish good business cooperation relations with third-party digital service providers in advance to do a good job in the integration between the business of small and medium-sized manufacturing enterprises and the technology of third-party digital service providers.

In the event, continuously adhere to the method of pilot, evaluation, optimization, and promotion. Use existing resources to carry out pilots in areas where breakthroughs are easy, such as the financial field. In the implementation process, effectively evaluate the initial achievements and pay attention to long-term benefits. In the business implementation process, continuously optimize and adjust in a timely manner according to the new policies and technologies that appear. When the time is ripe, promote the pilot experience to the whole.

4.2 Establish an Information Talent System and Cultivate Digital Thinking

In the digital transformation of an enterprise, the digital thinking of senior executives may determine the success or failure of the transformation. The CEO should build a digital leadership organization system and select the core persons in charge of each project to coordinate resources so as to promote the implementation of the digital strategy.Chinese scholar Wang Xianglu's empirical research proves that senior executives with an information technology background will promote the enterprise's digital transformation strategy. When forming or introducing a senior management team, the information technology background should be considered as an important basis for employment. For candidates without a suitable information background, enterprises

should strengthen digital skill training so that senior executives can form correct cognitions and thus guide digital transformation practices.

As the executors of the digital transformation strategy, grassroots personnel should also have basic information skills. Limited by their own resource shortages, small and medium-sized enterprises generally choose to rely on software suppliers to purchase general information systems. The software supplier will dispatch information technology personnel to the company to provide technical support. In this process, a own talent team should be formed to install and debug together with the software supplier to make it adapt to the company's business.

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Article

Research on the Current Situation and Countermeasures of Functional Strength Training for Adolescent Campus Basketball Athletes

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Abstract: As a new type of physical training method, functional training has achieved remarkable results in high-level sports teams. However, in the strength quality training of adolescent basketball athletes, functional training has not been widely adopted. This study aims to explore the current situation and countermeasures of strength quality of adolescent basketball athletes, and construct a functional strength training model suitable for adolescent campus basketball teams. Through literature analysis, field research, and empirical studies, it is found that the main problems in the strength training of adolescent basketball teams include insufficient cognition, single content, lack of professional guidance, and weak self-awareness. This study proposes implementation principles such as hierarchical training, gradual progress, and reasonable load, and designs a systematic training method including lower limb, core, and upper limb strength training. Practices show that this model can significantly improve the special strength quality and competitive level of adolescent basketball athletes, providing theoretical basis and practical guidance for the ability improvement of adolescent basketball athletes. Future research will further explore the potential value of functional strength training in psychological quality, team collaboration, and other aspects.

Keywords:Campus basketball; Functional training; Adolescents; Strength quality

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Introduction

The competitive development of basketball has put forward higher requirements for the comprehensive qualities of athletes. As the foundation for executing technical movements and tactical coordination, strength quality directly affects the growth ceiling of adolescent athletes. Although traditional strength training can enhance absolute strength, it has problems such as single movement patterns and disconnection from special requirements, which easily lead to an increased risk of sports injuries. Functional training emphasizes the integrity, coordination, and special adaptability of movements, which can make up for the shortcomings of traditional training. However, the promotion of functional strength training in current campus basketball training still faces challenges such as cognitive biases, outdated methods, and lack of professional guidance. Taking the law of adolescent physical and mental development as the starting point, this paper combines the theories of sports biomechanics and training science to

construct a functional strength training system in line with the characteristics of campus basketball, aiming to provide new ideas for the scientific cultivation of adolescent basketball athletes.

1.Analysis of Physical and Mental Characteristics and Training Adaptability of Adolescent Basketball Athletes

1.1.Physiological Characteristics and Training Load Adaptability

Adolescents are in a sensitive period of growth and development, where changes in skeletal muscle growth rate and hormone levels directly affect the effectiveness of strength training. Studies have shown that the age of 12-15 is the golden stage for the development of lower limb explosive power, while core strength gradually matures after the age of 16 (Smith et al., 2022). Therefore, functional training should follow the "window of opportunity" theory and design differentiated load schemes for different age stages:

Primary stage (6-10 years old): At this stage, students are relatively young and usually new to basketball. The main goals are to cultivate interest, consciously implant the awareness of physical exercise, and adopt an interest-oriented approach. Dynamic balance training is prioritized, using bodyweight exercises (such as single-leg standing while catching and throwing balls) to activate neuromuscular coordination.

Intermediate stage (11-15 years old): This stage generally marks the onset of adolescence, during which students' basic skills show significant improvement. With the steady enhancement of physical functions, the focus shifts to further developing technical and tactical understanding while accepting more systematic physical training. The key is to develop multi-joint linkage ability, and resistance training (such as medicine ball rotational throwing) is introduced to strengthen the efficiency of the movement chain.

Advanced stage (16-19 years old): In this adult development period, athletes typically have certain competition experience and advanced technical levels. Their thinking and actions tend to mature, enabling them to execute complex tactical coordination and positioning. Combining special technical simulation (such as directional jumping followed by shooting) can improve the precision and stability of strength output.

1.2.Psychological Characteristics and Training Motivation Activation

Adolescent athletes have a short attention span and are easily influenced by external evaluations. Surveys have found that functional training incorporating gamified elements (such as "obstacle relay races" combined with core stability exercises) can significantly enhance training participation. Additionally, using real-time feedback technologies (such as wearable devices to monitor movement trajectories) can enhance students' self-efficacy and facilitate the achievement of training goals.

2.Characteristics of Strength Quality in Adolescent Basketball Athletes

Strength quality serves as the foundational condition for rapid and variable technical tactics, and it is a basic physical quality for the physical fitness development of basketball athletes. In strength training, all parts of the body, especially the upper and lower limbs, core, as well as fingers, wrists, knees, ankles, etc., should undergo comprehensive and specialized functional strengthening training. The goal is to comprehensively develop muscle strength and motor

coordination in each movement segment, thereby improving overall physical fitness. In daily strength quality training, high load and intensity are adopted to maximize athletes' functional potential, ensuring that the working muscles achieve maximum tension during contraction. Meanwhile, certain high-load exercises are performed to increase the depth of muscle stimulation. The fundamental purpose of developing strength quality is to enable athletes to withstand heavy loads, continuously accumulate in quantity, progress from non-adaptation to adaptation by increasing the number of repetitions or sets, and then from non-adaptation to adaptation by increasing weight, so that athletes' strength quality can gradually develop.

3.Theoretical Foundations of Functional Strength Training

Functional strength training is a training method aimed at improving motor functions, emphasizing the relevance between training and actual movement actions. Compared with traditional strength training, functional training pays more attention to movement coordination, stability, and explosive power, featuring high pertinence and practicality.

3.1.Internal Logic of Functional Strength Training

The improvement of strength quality not only enhances athletes' explosive power and endurance but also significantly improves movement coordination and stability. Functional strength training provides stronger support for various technical actions in basketball by targetedly enhancing the strength of the upper limbs, lower limbs, and core muscle groups.

3.2.Objectives of Functional Strength Training

Through functional strength training, the aims are to help adolescent basketball athletes:Improve muscle strength and motor coordination;Enhance competitiveness to cope with physical confrontations in games;Prevent sports injuries and extend sports careers.

4.Analysis of the Current Situation and Countermeasures for Functional Strength Training of Adolescent Basketball Players

4.1.Overview of the Current Situation

Strength is the fundamental training for completing technical and tactical tasks. At present, strength training for adolescent basketball teams still mainly relies on traditional training methods. Without good strength as a basic guarantee, it is difficult to sustain the improvement of players' technical and tactical abilities. However, strength training for adolescent basketball teams is still in the initial stage of development, and specialized functional strength training faces dilemmas such as cognitive biases, single-content, lack of guidance, and weak awareness.

4.1.1.Cognitive Bias

Adolescent students and coaches lack a correct understanding of strength training, believing that it is only suitable for high-level athletes rather than adolescents. As a result, they over-rely on traditional training, adopting simple and rough methods of heavy weight and high load, ignoring the role of functional strength training in improving athletic performance and preventing injuries.

4.1.2.Single Content

The strength quality of excellent basketball players comes from the results of long-term systematic strength training. Adolescent basketball teams often rely on random and simple

routine exercises on the basketball court, such as squats, weighted squats, frog jumps, and other strength exercises, which lack pertinence and systematicness. They ignore the need to increase core stability while improving lower limb explosive power.

4.1.3.Lack of Guidance

Functional strength training requires professional knowledge support, but some coaches have insufficient capabilities in training design and practical guidance. They should formulate hierarchical strength training plans according to the specific conditions of the players. It is necessary to avoid implementing a set of training programs for a long time or arranging them arbitrarily. Instead, adjustments should be made following periodic changes to prevent training from deviating from practice and causing the practice effect to be greatly reduced.

4.1.4.Weak Awareness

Athletes often lack awareness of their own state during training, resulting in obvious training effects or even causing sports injuries. Therefore, it is particularly important to enhance self-awareness and cognitive abilities and improve self-focus.

4.2.Innovative Countermeasure Research

Construct an intervention model around four dimensions: hierarchical training mechanism, systematic content architecture, professional guidance system, and self-cognition optimization. Design age-adaptive training programs based on the dynamic hierarchy theory, establish a three-dimensional kinetic chain collaborative training model, develop a coach's cognitive schema iteration system, and innovatively integrate biofeedback and virtual mirror technology to strengthen 本体感知 (proprioception). Through the optimization of the kinetic chain efficiency and the reconstruction of neuromuscular control, form a progressive transformation path of "biomechanical adaptation - technical transfer - cognitive internalization", breaking through the limitations of the separation of physiological and cognitive dimensions in traditional training.

4.2.1.Hierarchical Training System

Based on the dynamic system theory, construct a "biology-technology-environment" collaborative development model, and decompose the athlete's life cycle into three stages: neural adaptation, special conversion, and competitive optimization. According to the dynamic load threshold theory, establish the nonlinear mapping relationship between motor performance and physiological maturity, realize the phase regulation of training parameters through the motor chain efficiency evaluation matrix, and form a ladder 式 (ladder-type) neuromuscular adaptation mechanism.

4.2.2.Systematic Training Content

Based on the energy transfer principle of sports biomechanics, put forward the collaborative training theory of "spatial tension-time sequence". Construct a three-dimensional dynamic chain coupling model, integrate the collaborative mechanism of sagittal plane force conduction, coronal plane stability control, and horizontal plane momentum transfer, form a training content system with topological structure, and realize the isomorphic mapping between motor output and basketball special technology.

4.2.3.Professional Guidance System

Using the complex adaptive system theory, establish the "cognition-behavior-reflection" model of coaches' ability development. Through the construction of cognitive schema of teaching decision-making, the design of practice framework based on dynamic constraints, and the meta-cognitive monitoring mechanism, form a closed-loop professional development system. Introduce the situational cognition theory to optimize the knowledge transfer path and construct an ecological growth model of coaches' professional literacy.

4.2.4.Improvement of Athletes' Self-Cognition

Based on the embodied cognition theory and the closed-loop control theory, construct a "perception-action-representation" ternary coupling model. Use virtual reality mirror training technology to strengthen motor psychological representation, and form a self-correction mechanism through dynamic kinematic marker point deviation feedback. Introduce reinforcement learning algorithms to construct personalized action optimization paths, so that the force output mode and neural control strategy can achieve collaborative evolution in the α-γ co-activation loop, and finally form a motor skill internalization system with self-organization characteristics.

5.Implementation Principles of Functional Strength Training for Adolescent Basketball Players

5.1.Targeted Principle

Design targeted training programs according to the specific performance and development needs of athletes. For example, for athletes in the primary stage, focus on the cultivation of basic strength; for athletes in the advanced stage, focus on the improvement of explosive power and core stability. According to different scenarios and students' own training levels, establish training tasks, take improving basketball (athletic ability) and performance as the main line, arrange appropriate proportions of training content, and make them develop coordinately.

5.2. Gradual Progress Principle

Basketball is a series of training contents from dribbling, passing, pick-and-roll, etc., from simple to complex, from basic to advanced, and always adhere to the principle of gradual progress, and develop the technical points from mechanization to automation. In core strength training, you can start with basic abdominal curl movements and gradually introduce more complex movements such as hanging leg raises. In addition, increasing the training frequency, carrying out necessary intensive training and skill drills every day can help improve physical fitness and competitive performance.

5.3.Reasonable Load Principle

Scientifically set the training load according to the actual level and training objectives of the athletes. Adjust it as appropriate with the progress of the phased training plan, and the corresponding 运动负荷 (exercise load) will also be adjusted. When adjusting the training exercise load, the change of the exercise load and the body adaptation show a good fit, so as to form a good stimulation phenomenon. In the primary stage, light equipment can be used for low-intensity training; in the advanced stage, the training intensity and equipment weight can be gradually increased.

5.4.Multilevel Principle

Multilevel training mainly aims at the lack of basketball players in speed, strength, endurance, flexibility, and coordination. Through multi-dimensional training design, the effect of comprehensive improvement is achieved. In addition, it is also necessary to comprehensively consider many factors existing in training, including training content and time, training intensity and density, nutrition, health care, and rest recovery, etc., formulate more efficient and reasonable diversified training plans, and realize a systematic training model.

6.Functional Strength Training Methods for Adolescent Basketball Players

6.1.Lower Limb Strength Training

(1) Squat Training Method: Place the barbell on the deltoid muscle of the neck, keep the feet shoulder-width apart, keep the back straight, squat until the thighs are slightly lower than the horizontal plane, choose half-squat or full squat according to the load, and use the thigh strength to stand up quickly.

(2) Lifting Exercise Method: Feet shoulder-width apart, hands holding the barbell, keep the back straight, lift and lower the barbell by extending the hips and knees.

In daily classroom teaching, for safety reasons, equipment training items such as barbells are less used. However, basketball training teams regularly and systematically carry out lower limb strength enhancement programs. Generally, barbells of different weights are used according to students' physical fitness and body weight to make the training more hierarchical, targeted, and efficient. Specifically, after athletes fully activate all joints, they complete 10–15 repetitions per set according to their body size, alternate between the two exercises, take 4–5 sets as a training unit, and add extended contents such as short-distance sprints to make the training more comprehensive.

6.2.Core Strength Training Methods

Actions commonly seen in games, such as body collisions, cutting and pick-and-roll, and rebound confrontations, expose the problem of weak core strength in athletes. Therefore, functional strength training in the core area is crucial for improving athletes' motor abilities.

(1) Crunch Leg-Press Exercise: Place hands on both sides of the gymnastic mat, keep the body and feet at a 45° angle to the ground, and rely on thigh contraction to perform rapid leg-press movements.

(2) Hanging Leg Raise Exercise: Use a horizontal bar to hang with both arms, keep the legs suspended, and raise the legs to a 90° angle with the body by (abdominal contraction).

(3) Two-End Raise Exercise: Lie on the gymnastic mat, stretch both arms and legs, and raise both ends simultaneously.

Such core strength training can be easily implemented in daily classes with relatively low safety requirements. However, sufficient warm-up activities are still needed, especially stretching of the shoulder, neck, waist, and back joints. In classroom design, different task areas can be used for alternating exercises, and regional check-ins can be carried out in the form of tasks to strengthen the core in a fun and relaxed way and inspire students to enjoy learning and exercise.

6.3.Upper Limb Strength Training Methods

(1) Pull-Up Exercise: Use hanging bars and swinging movements to independently complete

pull-ups, with the chin exceeding the horizontal bar.
(2) Front Swing Arm Exercise: Feet in a front-back stance, body slightly forward-leaning, center of gravity on the front foot, hold dumbbells and swing alternately back and forth. When swinging, use the shoulder joint as the axis, and keep the core stable without swaying left and right.
(3) Hanging Bar Exercise: Hang on the horizontal bar with hands shoulder-width apart and maintain a static state for a certain period.

In classroom training, simple props and equipment are used. The teacher's teaching content design should differ from the exercise order of lower limb and core strength, with difficulty decreasing from hard to easy and from dynamic to static. For front swing arm exercises, students can use small water bottles they bring, flexibly developing and using daily props.

6.4.Explosive Strength Training Methods

(1) Wrist Flexion and Extension Exercise: Team members hold a small dumbbell in one hand and perform rapid wrist flexion and extension with a straight arm.
(2) Weighted Calf Raise Exercise: Perform continuous calf raise exercises with a certain load of barbell, focusing on strengthening lower limb explosiveness and ankle stability.
(3) Resistance Band Exercise: Put the resistance band around the waist and abdomen of the trainee, who performs resistance sprinting while an assistant pulls the resistance band from behind with a certain resistance.

6.5.Strength Endurance Training Methods

(1) Uniform Endurance Running: Carried out in groups, set a running distance of 2000–3000 meters, and no slowing down or stopping midway.

(2) Lunge Jump: The landing length of the front and back feet refers to the distance of the first stretching action in regular training. When exchanging legs, the feet are about 20–30 cm above the core position, and the upper body remains straight and relaxed.

(3) Multi-Level Shuttle Run: Designate a certain distance on the sports field as the shuttle point, use the rhythm of physical fitness test music as the interval for round trips. As the rhythm speeds up, increase the stride and frequency without changing the distance, and complete the shuttle at the corresponding time node.

(4) Continuous Fast Break: Form a training group of 2–3 people, continuously perform cross-running fast breaks. After completing one fast break, pass the ball to the frontcourt, and team members quickly sprint to catch the ball and complete a fast break layup.

In regular teaching and training, coaches can adapt the training intensity and sets according to the actual level of basketball players based on the above contents. It should be noted that the above training contents are not single training plans. They can be combined with speed, flexibility, explosiveness, etc., for targeted combined training. Meanwhile, apply highly practical training means such as scenario-based combat confrontations and prop confrontations to better exert the effect of functional strength training.

7.Conclusion

Strength quality is an important foundation for adolescent basketball players to improve their game level. As a scientific and efficient training method, functional strength training can significantly enhance their muscle strength, motor coordination, and comprehensive quality.

This paper analyzes the current situation and problems of functional strength training for adolescent basketball players and proposes targeted countermeasures and implementation principles. Future research should further explore the paths to improve the psychological quality and team collaboration ability of adolescent basketball players, contributing more to the development of youth campus basketball in China.

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Research on the optimization of marketing strategy of Hema Fresh

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Abstract: Against the backdrop of the booming new retail model, Hema Fresh, a paragon in the industry, has drawn significant attention. This thesis delves into the purchasing behavior of Hema Fresh's consumers based on the Theory of Planned Behavior (TPB). The literature research method is employed to systematically review the TPB theory and its applications in the retail sector, laying a solid theoretical foundation for the study. The case study method is utilized to analyze Hema Fresh's practices in consumer experience, marketing, and online-offline integration. The qualitative analysis method is used to explain the formation mechanism of consumers' purchasing behavior, and the questionnaire survey method is adopted to collect data and accurately identify the key factors influencing purchasing behavior. The research reveals that Hema Fresh cultivates positive consumer attitudes through high-quality products and services and innovative consumption experiences. This study offers valuable business management suggestions for Hema Fresh and other new retail enterprises, facilitating enterprises to optimize strategies and enhance competitiveness. Meanwhile, it points out the limitations of the research in terms of sample selection scope and variable measurement accuracy, providing directions for subsequent research to further improve the understanding and research of consumer behavior in the new retail model.

Keywords: Theory of Planned Behavior; Hema Fresh; New Retail; Consumer Purchasing Behavior; Case Study

1. Introduction

In today's era of deep integration between digitalization and globalization, the business environment is undergoing unprecedented changes. The rapid advancement of technology, particularly the widespread application of emerging technologies such as artificial intelligence, big data, and cloud computing, has not only reshaped market competition but also transformed consumer behavior and preferences. The acceleration of globalization has blurred market boundaries, presenting both new international market opportunities and challenges from global competitors.

In this context, the importance of enterprise operation and management, as a core component for achieving sustainable development, has become increasingly evident. Effective operation and management can help companies optimize resource allocation, enhance production efficiency, reduce costs, and improve product and service quality, thereby enhancing market competitiveness and maximizing corporate value. However, many companies still face numerous complex and challenging issues in their operation and management. Internal management deficiencies, such as an unreasonable organizational structure, cumbersome processes, and poor communication, severely limit operational efficiency and innovation. Additionally, the uncertainty of the external environment, including economic fluctuations, policy changes, and rapid technological advancements, poses significant risks and challenges to strategic decision-making and operational planning.

This article aims to conduct a thorough analysis of the current state of enterprise operations management, accurately diagnose existing issues, and propose practical optimization strategies. Theoretical research on enterprise operations management can further enrich and refine the

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theoretical framework, providing new perspectives and ideas for future studies. By exploring new challenges and issues in enterprise operations management, we can promote theoretical innovation and development, making it more adaptable to the ever-changing market environment. In practical terms, the findings of this study can provide managers with valuable decision-making support, helping them address operational challenges, enhance management efficiency, boost market competitiveness, and achieve sustainable development. By optimizing operations management, companies can improve resource utilization, reduce costs, and enhance product and service quality, thereby better meeting consumer needs and increasing customer satisfaction and loyalty. Effective operations management can also drive corporate innovation, ensuring a competitive edge in the market.

The core objective of this study is to conduct a comprehensive and in-depth investigation on the purchasing behavior of Hema Fresh consumers based on planned behavior theory, accurately analyze the key factors that affect consumers' purchasing intention and actual purchasing behavior, and on this basis, provide highly targeted and operational management suggestions for new retail enterprises.

This study employs a variety of research methods to ensure the scientific rigor, comprehensiveness, and depth of the research. Case studies are used to select representative enterprises as research subjects, conducting in-depth investigations into their operational management practices. Through detailed analysis of specific cases, the study summarizes successful experiences and lessons learned from failures, providing a rich practical foundation for future research. The SWOT analysis method is used to systematically analyze the internal strengths and weaknesses, as well as external opportunities and threats of the enterprises, clarifying their competitive position in the market and providing strong support for formulating scientific and reasonable development strategies. The PEST analysis method is used to analyze the impact of macro-environmental factors such as politics, economy, society, and technology on enterprise operations, helping enterprises better understand external environmental changes and adjust their strategic direction in a timely manner.

A structured questionnaire is used as the primary data collection tool, designed to optimize the omni-channel experience at Hema Fresh. The questionnaire is divided into four main sections: the basic information section covers demographic details such as age, gender, income, and usage frequency; the consumption behavior section uses multiple-choice and single-choice questions to systematically analyze consumer channel preferences, average order value distribution, selection motivations, and price sensitivity; the omni-channel experience perception section employs a 1-5 Likert scale to evaluate the online interaction (such as APP smoothness, information completeness, and promotional appeal), offline environment (store ambiance, processing services, and staff attitude), logistics performance (timeliness, packaging quality, and return and exchange convenience), and cross-channel coordination (information synchronization, benefit universality, and data consistency); the satisfaction and loyalty section uses rating scales and open-ended questions to quantitatively assess user satisfaction, willingness to continue using the service, and the intention to recommend.

The questionnaire design is closely aligned with the characteristics of the fresh e-commerce industry, focusing on consumption features such as high frequency, low average transaction value, and strong timeliness. It aims to identify consumer pain points across all touchpoints. For example, it includes a single-choice question on 'price consistency between online and offline channels' to identify channel coordination issues, and uses a '3-kilometer delivery time compliance rate' scale to quantify logistics service levels. The questionnaire is distributed through an integrated online and offline approach, with online channels including pop-up windows on the Hema APP, member communities, and social media, and offline channels covering store cash registers and experience zones to intercept visitors. This ensures that the sample covers different age groups, income levels, and urban areas. The implementation of the questionnaire survey provides empirical support for research, collecting primary data through a standardized

questionnaire tool system, effectively quantifying the current state of omnichannel experiences, and laying the foundation for building an 'experience-data-supply chain' optimization model.

In the construction of the research framework, this study follows a logical closed loop of 'current situation analysis-problem diagnosis-strategy optimization.' During the current situation analysis phase, we collect and organize materials related to the company's operations management to gain a comprehensive understanding of its current state, including organizational structure, business processes, resource allocation, and performance. Using data analysis and case studies, we conduct an in-depth analysis of the current state of the company's operations management, laying a solid foundation for subsequent research. In the problem diagnosis phase, based on the results of the current situation analysis, we use various analytical tools and methods to thoroughly identify issues in the company's operations management and analyze their causes. We analyze from multiple dimensions, such as internal management and external environment, to pinpoint the root causes of the problems, providing a basis for formulating targeted optimization strategies. In the strategy optimization phase, based on the results of the problem diagnosis and in line with the company's strategic goals and development needs, we propose practical and feasible optimization strategies for operations management. We propose specific optimization measures in areas such as optimizing organizational structure, reengineering business processes, adjusting resource allocation, and enhancing risk management, and predict and evaluate the implementation effects of these strategies to ensure their effectiveness and feasibility.

2. Theoretical basis and literature review

This study adopts SWOT analysis and PEST analysis to comprehensively analyze the operation management of fresh e-commerce industry, so as to provide a solid theoretical basis for subsequent strategy formulation.

SWOT analysis is a situational analysis based on the internal and external competitive environment and competition conditions. Through the comprehensive analysis of the advantages (Strengths), disadvantages (Weaknesses), opportunities (Opportunities) and threats (Threats) formed by the internal and external environment of the enterprise, a series of decision-making conclusions are drawn to provide a basis for the enterprise to formulate strategies.

In terms of advantages, fresh e-commerce platforms leverage internet technology to overcome the geographical limitations of traditional retail, reaching a broader consumer base and expanding market reach. By utilizing advanced technologies such as big data and AI, these platforms can deeply analyze consumer purchasing behaviors, preferences, and needs, enabling precise marketing that enhances marketing effectiveness and customer satisfaction. Moreover, by optimizing supply chain management, fresh e-commerce can reduce intermediate steps, lower procurement and operational costs, and boost profitability. However, fresh products' unique characteristics make them highly dependent on cold chain logistics, which is currently underdeveloped, leading to high distribution costs and limiting the scale and reach of fresh e-commerce. Additionally, the low standardization of fresh products makes it difficult to ensure quality, causing consumer concerns about product quality, which affects user experience and loyalty.

From an opportunity perspective, as living standards and consumption concepts evolve, consumers are placing higher demands on the quality and convenience of fresh produce. Fresh e-commerce platforms are well-suited to meet these needs, offering significant market potential. The government has introduced a series of policies to support the growth of e-commerce, creating a favorable policy environment for fresh e-commerce. Continuous technological advancements, particularly in cold chain and logistics distribution technologies, have made it possible for fresh e-commerce to address logistics challenges. However, the industry also faces numerous threats. The market is highly competitive, with many e-commerce platforms and traditional retail companies entering the fresh produce sector, leading to intense competition for market share and significant pressure on businesses. Consumers are highly concerned about the quality and safety

of fresh produce, and any quality or safety issues can severely damage a company's reputation and image. The rapid growth of the fresh e-commerce industry has also brought new challenges, such as environmental protection and data security, which require serious attention and resolution by companies.

PEST analysis is an analysis of the macro environment, mainly from the four major categories of political (Political), economic (Economic), social (Social) and technological (Technological) external environmental factors that affect enterprises, so as to help enterprises understand the changes in the external environment, grasp market opportunities and avoid potential risks.

In the political environment, the government places a high emphasis on agricultural development and food safety, implementing a series of policies to support the growth of fresh e-commerce, including tax incentives, financial subsidies, and industrial support, creating a favorable policy environment for fresh e-commerce. The government has also intensified its supervision of the quality and safety of fresh products, establishing stringent quality standards and regulatory systems. This has raised the bar for fresh e-commerce companies, encouraging them to enhance quality management and ensure product safety. In the economic environment, with China's economy steadily growing, residents' income levels have risen, and their purchasing power has increased, leading to a higher demand for the quality and variety of fresh products, thus providing a vast market space for the development of fresh e-commerce. The widespread adoption of Internet technology and the rapid advancement of e-commerce have laid a solid economic foundation for the growth of fresh e-commerce.

In terms of the social environment, consumers are increasingly shifting towards healthier, more convenient, and personalized consumption habits, with higher demands for the quality, freshness, and delivery speed of fresh produce. The rapid urbanization and accelerated pace of life have led to a growing preference for online shopping among consumers, creating a favorable social environment for the growth of fresh e-commerce. In the technological domain, advanced technologies such as big data, artificial intelligence, the Internet of Things (IoT), and blockchain are being increasingly utilized in the fresh e-commerce sector, providing robust technical support for its development. Through big data analysis, companies can gain deep insights into consumer needs and behaviors, enabling precise marketing and personalized recommendations. With the help of AI technology, companies can optimize their supply chain management and enhance operational efficiency. The IoT enables companies to monitor and trace fresh produce throughout the supply chain, ensuring product quality and safety. The application of blockchain technology can boost consumer trust in product quality and enhance corporate credibility.

Fresh e-commerce, as a significant segment of the e-commerce industry, has unique characteristics. Fresh products, which are essential for daily life, are frequently purchased by consumers, ensuring a stable market demand. Whether for everyday meals or family gatherings, fresh products are indispensable, making the fresh e-commerce sector have a large consumer base and a steady market demand. Fresh products have a short shelf life and are prone to spoilage, requiring stringent storage and transportation conditions. Throughout the supply chain from origin to consumer, it is crucial to strictly control environmental factors such as temperature and humidity to ensure the freshness and quality of the products. To ensure product safety and quality, fresh e-commerce platforms need to establish a comprehensive cold chain logistics system.

The standardization of fresh produce is relatively low, with significant differences in appearance, taste, and nutritional content among products from different origins and varieties, making it challenging to establish a unified quality standard. This poses challenges for the procurement, sales, and quality control of fresh produce e-commerce, and also complicates consumers' product selection. Fresh produce e-commerce platforms sell products online, where consumers cannot directly handle or select items; they can only rely on images and text descriptions to understand product details. Therefore, these platforms must provide accurate and detailed product information along with high-quality customer service to boost consumer

confidence and satisfaction. Online sales also enable fresh produce e-commerce to collect a large amount of consumer data, which is used for precise marketing and personalized services through data analysis.

The fresh food e-commerce market is highly competitive. In addition to numerous emerging fresh food e-commerce platforms, traditional e-commerce giants and offline retail companies are also entering the fresh food sector, leading to intense competition for market share. To succeed in this competitive landscape, companies must continuously enhance their core competitiveness by optimizing supply chain management, improving product quality, reducing costs, and enhancing service levels. The development of fresh food e-commerce is closely linked with agriculture, logistics, information technology, and other sectors, forming a comprehensive industrial chain. This growth not only boosts the upstream agricultural sector, promoting the sales of agricultural products and increasing farmers' income, but also drives innovation and upgrades in related industries such as logistics and information technology, fostering coordinated industrial development.

As the fresh e-commerce market size surpasses 1.8 trillion yuan (iResearch, 2025), industry competition has shifted from price wars to a focus on user experience and supply chain efficiency. Current research generally indicates that fresh retail is characterized by high-frequency consumption, low average transaction values, and strong time sensitivity (Yang Pan, 2024). However, it also faces structural challenges such as high cold chain costs, significant loss rates, and lengthy supply chains (Liu Lili, 2023). Hema Fresh, a leader in new retail, has achieved 3-kilometer, 30-minute delivery through its 'store-warehouse integration' model (Yang Zhenhui, 2024). However, user surveys reveal that 32% of consumers are dissatisfied with the disjointed experience between online and offline shopping (Tang Junyue et al., 2025).

Theoretically, the omnichannel experience theory (Verhoef et al., 2021) emphasizes seamless integration between different channels, while the SICAS model (Yang Pan, 2024) outlines a comprehensive consumer journey from perception to action. Most existing research focuses on analyzing user behavior in traditional e-commerce (Ni Wei, 2024), but there is still a gap in integrating the three dimensions of 'experience value, emotional value, and social value' in the fresh food context (Bao Zhiqi, 2025).

Hema has developed a multi-touchpoint consumption scenario through its APP, mini-program, and physical stores (Huang Weixin et al., 2025). However, the integration of cross-channel data is less than 40%, leading to delays in the synchronization of promotional information (Lei Yingfan, 2022). Current research indicates that live-streaming sales account for 18% of GMV (Yu Jia et al., 2023), but the content is highly homogeneous, failing to fully leverage the situational communication advantages of social media (such as how Xiaohongshu users boost conversion rates through real-life scenario sharing).

Hema's' forward warehouse + self-operated delivery' model has achieved an inventory turnover rate of 22 times per year (Liu Yi, 2022), yet the cold chain loss rate remains as high as 8% (Lin Xinghong et al., 2022). Research indicates that C2M reverse customization (Xie Chaoyang et al., 2022) and the optimization of smart logistics networks (Zhang Shuaifei, 2023) can reduce fulfillment costs by 15%-20%, but this requires balancing large-scale operations with personalized needs.

Research has shown that the renewal rate for Hema X members is 68%, while the repurchase rate for non-members is only 35% (Yin Zhenyu et al., 2023). The conversion rate of social viral mechanisms, such as group buying activities, is only 12% (Wu Cui et al., 2022), indicating a lack of user engagement. Compared to Gujia Home's success in breaking the billion-yuan sales mark for a single product through' scenario-based recommendations' on Xiaohongshu (Summary 2), Hema has room for improvement in designing user co-creation mechanisms.

Most existing literature focuses on the breadth of channel coverage, but there is insufficient research on the collaborative mechanism of 'intelligent interaction, data integration, and

consistent experience' (Zhang Shuang, 2023). Future research should integrate LSTM algorithms to predict user needs (Yu Junqi et al., 2023) and draw on the private domain rebate strategy of 213 Marketplaces (Abstract 6) to create a closed loop of 'consumption, rebate, and repurchase.'

To address the issues of short SKUs and high loss rates in the fresh food industry (Ji Xiangyu, 2023), it is necessary to introduce blockchain traceability technology (Yang Tianyu et al., 2020) and dynamic pricing models (Xu Xinyuan et al., 2023) to achieve demand-driven precise supply. Drawing on Ni Wei's (2024) analysis of the heterogeneity in social e-commerce recommendation behaviors, Hema can develop a' user proposal system '(such as the' Hema Lab') and establish a UGC grading reward mechanism (for example, annual income for high-quality content creators reaching 100,000 yuan) to enhance user engagement (Yang Chenying, 2024).

3. Environmental analysis and existing problems

This section may be divided by subheadings. It should provide a concise and precise description of the experimental results, their interpretation, as well as the experimental conclusions that can be drawn.

3.1 Macro environment (PEST)

3.1.1 Policy environment: dual-wheel drive of cold chain infrastructure and food safety

At the national level, under the 'dual circulation' strategic framework, the security of the fresh food supply chain has been elevated to a national strategic priority. The 14th Five-Year Plan for Cold Chain Logistics Development clearly states that by 2025, the cold chain logistics market will exceed 1.2 trillion yuan, with a total cold storage capacity reaching 140 million cubic meters. In 2022, the central government added 20 billion yuan in special bonds to support the construction of cold chain logistics hubs, focusing on multi-temperature layer warehouses and the purchase of new energy refrigerated vehicles. Leveraging this opportunity, Hema established regional centers in transportation hubs such as Zhengzhou and Xi 'an, adopting a' central kitchen + regional distribution' model, which reduced the turnover time of fresh produce from 7 days to 4.2 days.

Local governments have introduced a 'flexible term land transfer for logistics' policy, allowing Hema to secure 500 acres of storage land in Yangluo Port, Wuhan, with land costs reduced by 35% compared to the traditional bidding and auction methods. Additionally, the State Taxation Administration has implemented a 50% reduction in property tax for cold chain logistics companies, resulting in a tax reduction of 120 million yuan for Hema in 2024. These policy benefits have directly spurred the upgrade of Hema's cold chain infrastructure: in 2024, Hema constructed 18 new intelligent cold storage facilities and added 500,000 phase change material insulation boxes, reducing the cold chain breakage rate from 12% to 3.2%, meeting the EU cold chain standard (EN 12830:2000).

The tightening of food safety regulations has raised the bar for fresh produce companies. According to the new regulations set by the State Administration for Market Regulation in 2025, fresh produce e-commerce platforms must implement a grading system for suppliers and establish a 'Red-Black List' system. In response to these policies, Hema has introduced a 'one product one code' traceability system, where blockchain technology is fully utilized. Consumers can scan a code to access detailed data on Chilean cherries, from the moment they are picked in the orchard to their final listing on shelves, including 18 key pieces of information such as pesticide residue test reports and temperature curves during transportation.

3.1.2 Economic environment: consumption stratification and sinking market opportunities coexist

According to data from the Chinese Academy of Social Sciences, by 2025, the proportion of food, tobacco, and alcohol in the per capita consumption expenditure of residents nationwide is expected to drop to 28.3%, while the absolute value of fresh food consumption is projected to increase by 19.2%. The consumer market is showing a clear 'K-shaped recovery': high-income

households (with a monthly income over 50,000 yuan) are spending 27% more annually on fresh food, favoring organic ingredients and imported seafood. In contrast, middle-and low-income households (with a monthly income under 15,000 yuan) are more price-conscious, with 42% of their purchases being promotional items.

Hema has introduced a differentiated brand matrix to cater to different consumer segments. The 'Hema X Member Store' for the new middle class offers high-end items such as Japanese wagyu and Alaskan king crab, with an average order value of 268 yuan. In the lower-tier market, 'Hema Outlet' uses a discount model for near-expiry products, achieving an average daily sales of 82,000 yuan per store in 300 third-tier cities. However, in the community group buying sector, Hema faces intense competition from Meituan's Buy Vegetables. In 2024, its gross profit margin for community channels was only 9%, below the industry average of 12%.

The uneven development of regional economies provides Hema with strategic depth. Fresh food consumption in the Yangtze River Delta and Pearl River Delta regions accounts for 58% of the national total, while the growth rate in central and western provinces is 22%. Hema has implemented the 'East Data West Calculation' project by building a regional data center in Guiyang. By leveraging the computing resources in the west, Hema optimizes its demand forecasting models for stores nationwide, increasing the inventory turnover rate between central and western stores to 20 times per year, nearly matching the eastern level.

3.1.3 Social environment: the demand for health and convenience reshapes the consumption scene

According to a survey by the Chinese Nutrition Society, 72% of consumers are willing to pay a premium for 'zero additives' foods, and the organic vegetable market has surpassed 80 billion yuan. Hema's' Ri Ri Xian 'series, through its daily clearance mechanism, maintains a vegetable loss rate below 3%, while balancing cost control and consumer trust. The' Organic Vegetable Traceability Live Streaming' event launched in 2024 attracted over 120 million views and boosted sales of organic products by 45%.

The fast-paced lifestyle has fueled the demand for 'instant retail.' According to iiMedia Research, the proportion of 30-minute delivery orders rose from 18% in 2020 to 52% in 2025. Hema's Ready-to-Cook (3R) pre-prepared dishes saw an annual sales growth of 210%, but faced a conflict between standardization and personalization: user surveys revealed that 28% of consumers found the flavors of the dishes too similar, while 15% suggested adding regional specialties. To address these issues, Hema established a' central kitchen + regional R&D center' system, developing Sichuan-style and Shanghainese-style pre-prepared dishes in Chengdu and Shanghai, respectively, which increased the repurchase rate to 38%.

Demographic changes have brought new opportunities. The seventh national census revealed that 18.7% of the population is aged 60 or older, driving demand for age-friendly renovations. Hema launched a 'large font version APP' to optimize font sizes and user experience, resulting in a 300% increase in monthly active users among senior citizens. To cater to the trend of 'single-person dining,' Hema introduced small-packaged fresh-cut meat and single-serving hot pot sets, leading to a 67% year-on-year increase in sales of these products.

3.1.4 Technical environment: digital reconstruction of supply chain efficiency

The breakthrough in AI algorithms in demand forecasting has significantly enhanced operational efficiency. The LSTM model deployed by Hema achieves an accuracy rate of 89%, enabling it to predict the demand for popular products 72 hours in advance. For instance, during the Spring Festival, the prediction error rate for cherries was only 4.2%, reducing the loss from unsold goods by 18%. Algorithm optimization has also increased the inventory turnover rate to 25 times per year, far exceeding the 8-10 times typical of traditional supermarkets.

IoT technology enables comprehensive intelligent monitoring of the entire supply chain. Hema installs BeiDou positioning and temperature-humidity sensors in its cold chain transport vehicles, which transmit real-time data to the cloud. A digital twin system is used to create a 3D

visualization model of the national logistics network. By 2024, the monitoring coverage for in-transit goods will reach 100%, the automatic alarm response time for abnormal conditions will be reduced to 15 seconds, and the cold chain accident rate will decrease by 65%.

5G and edge computing technology are empowering the digital transformation of stores. The Hema Shanghai Jin Qiao store has launched a '5G smart shelf' pilot, which uses gravity sensors to automatically replenish stock, reducing the out-of-stock rate by 70%. The AR tasting mirror has increased the seafood sales conversion rate by 40%. The intelligent checkout system, utilizing image recognition technology, reduces checkout time to 3 seconds per transaction, cutting queue times by 80% during peak hours.

Technological innovation also brings new challenges. The initial investment in 5G equipment has increased the IT cost per store by 23%. Data privacy regulations require the local storage of user profile data, and the technical standards for cross-border supply chains have led to a 15% increase in the cost of tracing imported goods. Hema has partnered with Huawei to develop edge computing boxes, which offload some data processing to the store level, reducing cloud load by 35%. Additionally, through privacy-preserving computation technology, they enable cross-regional data sharing.

3.1.5 Cross-impact analysis

Policy and technology form synergistic effects. The national cold chain infrastructure subsidy accelerates the construction of Hema's smart logistics network, enabling it to complete the "thousand cities and ten thousand stores" layout in advance by 2025. Technological innovation feeds back into policy formulation, and Hema's participation in drafting the "Smart Scheduling Technical Specification for Fresh E-commerce" has become an industry standard.

The economy and social environment interact with each other. The upgrading of consumption promotes the growth of demand for healthy food. The sales volume of Hema organic products increased by 45% annually, and the aging trend promotes the adaptation to the elderly, and the number of elderly users increased by 300%, forming a new consumption growth point.

Technology is deeply integrated with social needs, and AI algorithms accurately match the personalized needs of consumers. The repurchase rate of pre-prepared food has increased to 38%. Internet of Things technology ensures food safety, and the trust degree of Hema users has reached 89%, higher than the industry average of 72%.

This multi-dimensional environmental change not only provides Hema with opportunities for innovation but also demands that it develop dynamic adaptability. In the future, it is crucial to focus on the impact of the widespread use of new energy cold chain vehicles on carbon emissions, the influence of AI ethics on user trust, the effects of changes in cross-border e-commerce policies on import business, and the potential of metaverse technology in fresh food retail. By continuously monitoring macro-environmental changes, Hema can strategically position itself ahead of the curve and maintain its leading position in the industry.

3.2 Competitive Environment (SWOT)

3.2.1 Strengths (Strengths)

Hema Fresh leverages the digital ecosystem of Alibaba Group to create a competitive barrier that integrates payment, data, and traffic. By integrating its membership system with Alipay, Hema has accumulated 230 million consumption behavior data points, enabling it to accurately profile users. In collaboration with Taobao Live, Hema launched the 'Fresh Live Streaming Festival,' which saw a single session GMV exceeding 80 million yuan, with a conversion rate of 12%. Real-time traffic data from Gaode Map optimizes delivery routes, increasing the 3-kilometer delivery on-time rate to 95%. The 'Hema Star Chef' variety show IP, embedded on Youku, reaches 120 million young users, driving a 210% increase in pre-prepared meal sales.

Hema's data platform integrates CRM, ERP, and SCM systems to achieve full-chain digitalization. The AI demand forecasting model has an accuracy rate of 89%, and the inventory turnover rate has increased to 25 times per year, significantly surpassing the 8-10 times typical for traditional supermarkets. The dynamic pricing system covers 70% of products, adjusting prices in real-time based on 18 variables, including time of day, weather, and inventory levels. The ROI for promotional activities is 1:3.2. The blockchain traceability system has a 100% coverage rate, allowing consumers to scan codes to view the entire process data of Chilean cherries from orchard to shelf, including pesticide residue test reports, transportation temperature curves, and 18 other key details.

Hema has established a three-tier supply chain network, integrating direct procurement from bases, regional processing, and urban distribution, with a direct procurement rate of 70%, thereby streamlining the supply chain. In Yunnan, a 10,000-mu organic vegetable base has been developed, reducing procurement costs by 22% through an order-based agricultural model. Hema has partnered with Zhangzi Island Group to develop 'blockchain-certified seafood,' enabling full traceability from catch to sale, resulting in a premium rate of 35%. The central kitchen can process up to 500,000 meals daily, with over 300 SKUs of 3R pre-prepared dishes, and a repurchase rate of 38%.

3.2.2 Weaknesses (Weaknesses)

By the end of 2024, Hema has invested 18.7 billion yuan in store construction and cold chain logistics, with an average cost per store reaching 25 million yuan. The depreciation of cold chain equipment accounts for 15% of operating costs, and Hema recorded a fixed asset impairment loss of 820 million yuan in 2024. This heavy asset model results in a debt-to-asset ratio of 68%, higher than the industry average of 52%. In contrast, Meituan Maicai, which operates on a lighter asset model, has a single warehouse cost that is only one-third of Hema's, and its gross profit margin is 9 percentage points higher.

Hema's market penetration in first-tier cities is 32%, but it drops to just 8% in third-tier cities. In 2024, the annual sales per square meter of Hema stores in second and third-tier cities is 18,000 yuan, which is lower than the 32,000 yuan per square meter in first-tier cities. Some stores have incurred losses due to poor location choices, such as the Xi' an Qujiang store, which closed after 18 months of operation. The primary reasons were that the surrounding community was older than expected, and the frequency of fresh food purchases was lower than predicted by the model.

The 'store-cum-warehouse' model requires stores to handle sales, warehousing, and delivery, which challenges the store manager's comprehensive skills. In 2024, the employee turnover rate reached 28%,15% higher than the industry average. Cross-departmental collaboration is inefficient, with the procurement and logistics departments experiencing a 6.2% stockout rate due to conflicting inventory turnover goals. Compared to JD Daojia's 'pure online + third-party delivery' model, its operational cost structure is more flexible, with labor costs accounting for only 45% of Hema's.

3.2.3 Opportunities (Opportunities)

By 2025, the penetration rate of fresh food e-commerce in third-tier and lower cities is expected to reach 35%, with the market size surpassing 600 billion yuan. Hema has launched a sub-brand called 'Hema Aole,' which uses a discount model for near-expiry products to achieve an average daily sales of 82,000 yuan per store in 300 cities. In Suining, Sichuan, a pilot program combining 'county-level forward warehouses + community group buying' has been implemented, resulting in a 40% increase in order density and a 18% reduction in fulfillment costs.

5G + edge computing technology is empowering the digital transformation of stores. The '5G smart shelf' pilot at Shanghai Jinqiao store has reduced the out-of-stock rate by 70%, and the AR tasting mirror has increased seafood sales conversion rates by 40%. The cold chain digital twin system, developed by Hema in collaboration with Huawei, simulates the impact of extreme

weather on logistics networks, increasing emergency response speed by 60%. The AI customer service system handles 78% of user inquiries, with an average response time of 12 seconds, reducing labor costs by 45%.

After the RCEP took effect, the average tariff on imported fresh produce in Southeast Asia dropped by 15%, enabling Hema to establish overseas direct procurement bases in Thailand and Vietnam. In 2024, sales of imported seafood increased by 67%, with gross margins for species like king crabs and black tiger prawns reaching 42%. The cross-border traceability blockchain platform has achieved data interoperability with customs, reducing customs clearance time from 48 hours to 6 hours.

3.2.4 Threats (Threats)

Yonghui Supermarket has launched the "Yonghui Life" APP, with its home delivery service accounting for 35% of its business. Its "satellite warehouse + community store" model reduces fulfillment costs by 22% compared to Hema. China Resources Vanguard has established a "central kitchen + forward warehouse" system, offering over 500 pre-prepared food items at prices 15-20% lower than Hema. RT-Mart and Ele.me have partnered to offer a "one-hour delivery" service, capturing 8% of Hema's market share in Shanghai in 2024.

Daily Fresh has transformed traditional markets with its 'Smart Market' model, setting up 1,200 forward warehouses in 30 cities. The average order value is 68 yuan, lower than Hema's 123 yuan. Dingdong Maicai focuses on' extreme cost-effectiveness, 'achieving vegetable prices 18% lower than Hema through its' hit product strategy' and direct sourcing from origin. In 2024, the user repurchase rate reached 65%. Benlai Life, which specializes in organic fresh produce, has established a brand barrier through a direct farm supply model, with 42% of its customers being high-end users.

The State Administration for Market Regulation's new regulations in 2025 mandate that fresh food e-commerce platforms implement a tiered management system for suppliers and establish a' red-black list 'system. As a result, Hema has eliminated 12% of its small and medium-sized suppliers. The increase in the minimum wage standard has raised labor costs by 12%, while the pilot program for carbon emission trading has increased cold chain transportation costs by 8%. Moreover, the price war in community group buying has caused some categories of Hema's gross profit margin to fall below 5%.

3.3 Diagnosis of existing problems

There is a conflict between the investment in cold chain technology and inventory loss. Hema Fresh is continuously increasing its investment in cold chain technology to ensure the freshness and quality of fresh produce. However, due to the unique nature of fresh produce, inventory loss remains high. Small changes in temperature, humidity, and other environmental factors during transportation and storage can lead to spoilage and loss. Predicting the procurement and sales of fresh produce is challenging, often resulting in inventory overstock or shortages, which further exacerbates inventory loss.

In terms of user experience, the digitalization threshold for middle-aged and elderly customers is relatively high. Hema Fresh primarily operates through an integrated online and offline model, which requires a certain level of digital operation skills from consumers. Middle-aged and elderly customers are less familiar with digital devices and applications, which can lead to difficulties when using the Hema APP for ordering and payment, thereby affecting their shopping experience. Their preferences for selecting fresh produce and their consumption habits differ from those of younger customers, and Hema Fresh may not fully meet their needs in product presentation and service methods.

Hema Fresh has faced issues with the precision of its advertising during the ad placement process, possibly failing to accurately capture the characteristics and needs of its target consumer group, which has led to poor advertising effectiveness. The content and format of the ads may

lack innovation and appeal, making it difficult to engage consumers. Hema Fresh also lacks deep engagement with users in areas such as social media and member activities, resulting in insufficient interaction that fails to effectively enhance user loyalty and stickiness.

In terms of cost control, Hema's rapid expansion has led to diseconomies of scale. To capture market share, Hema Fresh opened numerous stores in a short period, significantly increasing operational costs. The operation of new stores requires substantial investment in human, material, and financial resources, which can weaken the profitability of these stores when the market is not yet fully developed. Rapid expansion also increases management challenges, leading to issues such as inefficient resource allocation and low operational efficiency, further exacerbating cost pressures.

4. Questionnaire analysis

4.1 Sample characteristics and consumption behavior

This survey covers 12 major cities in China, and 300 valid questionnaires are collected. The sample presents the following characteristics: women account for 66.33%,18-24 years old group accounts for 32.67%,46-55 years old group accounts for 20.67%, middle-income group (5001-12000 yuan) accounts for 68.66%, which is highly consistent with the target customer group of Hema.

90.67% of users consume through offline stores, and 70.33% use APP, but only 29% of users have high frequency (more than once a week), indicating that offline experience is the core attraction but user engagement is insufficient.

Users have developed a consumption habit of combining offline experiences with online conveniences. Offline stores, as the core touchpoints, play a crucial role, while online channels handle daily restocking and promotional sales. The low penetration rate of social e-commerce platforms (such as live streaming and community group buying) suggests room for improvement in content marketing and community operations.

Women lead in fresh consumption (66.33%), but men use online channels more (APP accounts for 41% vs women 29%). Young users (18-24 years old) have a penetration rate of social channels of 38%, but the proportion of customers with less than 50 yuan per order is 41%, so it is necessary to balance traffic and conversion rate.

(1) Age stratification of demand differences

Generation Z has a 68% usage rate of social media channels, necessitating the simplification of activity rules. For the new middle class (25-35 years old), the offline experience scores 4.2, with 82% acceptance of seafood workshops, but their price sensitivity has increased. For the elderly (55+), 94% rely on offline services, and 68% face obstacles in using apps, thus requiring enhanced offline service support.

(2) Consumption characteristics of income stratification

High-income group (≥20,000 yuan): 63% of customers spend at least 300 yuan per order, and 78% are open to imported goods. Middle-to-low-income group (<8,000 yuan): They are highly price-sensitive (34% choose this as the main reason), but they have high expectations for delivery speed (3.9 out of 10). For elderly users (55+), 94% of their spending is offline, but the error rate in APP operations is 47%, necessitating the development of larger font interfaces and voice interaction features.

Consumption shows obvious characteristics of the middle market, and the consumption ability of high-frequency users is significantly higher than that of low-frequency users, which verifies the consumption law of "high frequency driving high customer unit price". Price rationality and social recommendation become weak links in consumption decision-making, so it is necessary to strengthen cost-effective communication and word-of-mouth marketing.

The freshness of goods, offline experience and delivery speed are the core driving forces, reflecting Hema's competitive advantages in supply chain and offline scenarios. However,

insufficient price perception and social communication may restrict the further expansion of market share.

4.2 Current situation and contradictions of omni-channel experience

(1) Offline experience has significant advantages

The store environment and product display score 4.1 points, the satisfaction of on-site processing service reaches 82%, driving the customer unit price increase by 58%.

The core competitiveness of the store environment, product display and on-site processing services, especially value-added services such as seafood workshops, effectively increase the customer unit price. However, the service response speed and checkout efficiency during peak hours need to be optimized, and operation management needs to be strengthened.

The average checkout line during peak hours is 12 minutes (mentioned by 22% of users), and self-service checkout equipment needs to be added.

(2) Online interaction needs to be optimized

The APP was rated 3.8 out of 3.8 for fluency, with only 3.1 points for older users and 68 percent having difficulty using it.

The promotional activity was attractive 3.4 points, 62% of users thought the rules were complicated, and the coupon redemption rate was only 18%.

(3) Logistics and coordination are short

The 3km delivery time rate reached 3.6 points, and the night delay accounted for 38% of the complaints, so the terminal transport capacity should be optimized. The cross-channel coordination degree was low: the synchronization of promotional information was 3.3 points, and 41% of users encountered lagging activity information.

The stability of logistics performance and cross-channel coordination have become the key bottleneck of experience improvement. Problems such as night delivery delay, lengthy return and exchange process, and asynchronous promotion information affect user trust and expose the lack of system integration and resource allocation.

The cross-channel coordination score of high-income groups (≥20,000 yuan) is 4.2 points, significantly higher than that of other groups (3.5 points), indicating that omni-channel experience has a greater impact on high net worth users.

4.3 Decoding of satisfaction and loyalty

66% were very satisfied, but 5% were dissatisfied, mainly with price transparency (29%) and night delivery (25%).

Users have a high overall satisfaction with Hema, but there are still some pain points in experience such as price transparency and night delivery. High-income groups are more sensitive to price differences and may turn to competitors due to inconsistent prices between channels.

47.33% are very likely to continue to use it, but 25.33% are in a wait-and-see mode, and the experience of these users needs to be improved.

The NPS value is 67 points, and 37% of users may not recommend it. 79.33% of users recognize the freshness, but 38% think the price is high, reflecting that the cognition of "good quality and good price" has not been fully established.

The high-income group (≥20,000 yuan) has low tolerance for price differences, and 65% give up buying due to inconsistent prices.

4.4 Consumption decision path and pain points

Offline stores (90.67%) and APP pop-ups (68%) are the primary entry points, while social platforms receive insufficient exposure (live broadcasts only 30.67%). On-site processing (61%) and daily special offers (28%) effectively attract attention, but the delay in promotional information leads to a 19% user churn rate. The payment process has a 22% churn rate, primarily

due to restrictions on coupon usage (38%). 45% of users share through WeChat Moments, but 76% do not receive rewards, indicating the need to optimize the incentive mechanism.

The direction of improvement needs to establish a real-time push system for promotional information, and reach through APP pop-up window + SMS reminder. Simplify the rules of coupon use, set up "one-click deduction" function, and improve the payment conversion rate.

Price perception is contradictory: 79.33% approve of the freshness, yet 38% find the price too high. By showcasing the supply chain value through live-streamed traceability, we reinforce the concept of 'quality at a premium.' 41% of promotional information is not synchronized, and 23% abandon purchases due to data misalignment. To ensure real-time synchronization, we have established a full-channel data middleware.

Service response is delayed, with 38% of deliveries delayed at night and 31% of returns and exchanges taking too long. To address these issues, the logistics scheduling algorithm has been optimized, and an intelligent quality inspection system has been introduced. However, the application of technology is insufficient; 68% of elderly users face difficulties using the APP, and only 12% use the AR tasting mirror. Therefore, Hema should develop an age-friendly interface to enhance user reach through technological innovation.

Optimize omni-channel coordination, establish a dynamic price monitoring system to ensure that the price difference between online and offline is less than 5%, develop the function of scanning offline goods and placing orders online, and improve channel integration.

To address customer pain points, we have introduced a 'one-click call' customer service feature. We have also set up elderly assistance specialists in our stores and partnered with Dada Express to offer night delivery discounts to ensure orders are delivered by 10:00 PM. In terms of product and service innovation, we have collaborated with renowned chefs to create regionally distinctive pre-prepared dishes, addressing the issue of homogenization. Additionally, we actively use biodegradable packaging, and users can earn points for recycling their packaging.

The membership system has been upgraded to offer differentiated benefits based on consumption frequency, such as free processing and dedicated customer service. Accumulated points can be redeemed for a Hema organic vegetable planting experience. Data-driven operations include pushing daily special offers to price-sensitive users and recommending imported products to quality-conscious users. For users with an NPS score below 7, a care process is automatically triggered, offering a 5 yuan coupon to win back lost customers.

5. Marketing strategy optimization path

5.1 Supply chain collaboration and upgrading

5.1.1 Data-driven intelligent supply chain system

Hema Fresh has developed a comprehensive data platform that covers the entire supply chain from procurement to sales and delivery. This platform integrates data from ERP, SCM, and CRM systems, enabling minute-level data updates. The AI demand forecasting model, based on LSTM algorithm, achieves an accuracy rate of 89% and can predict the demand for popular products 72 hours in advance. For instance, during the 2024 Spring Festival, the prediction error rate for cherry sales was only 4.2%, reducing unsold losses by 18%. The dynamic pricing system covers 70% of the products, adjusting prices in real-time based on 18 variables such as time, weather, and inventory, achieving a promotional activity ROI of 1:3.2.

By leveraging the 230 million user data accumulated through platforms like Alipay and Taobao, a consumer profile with over 200 dimensions has been constructed. For instance, user profiles in Shanghai indicate that women under 35 prefer imported seafood and organic vegetables. Based on this insight, the product mix was adjusted, resulting in a 37% increase in sales of these categories. Guided by demand forecasting models, Hema reduced its SKU (Stock Keeping Unit) to 15% in 2024, and the sales turnover rate increased to 92%.

The digital twin system is deployed to simulate the supply chain's operation, enabling real-time monitoring of inventory status across 430 stores nationwide. In the Chengdu area, through intelligent warehouse distribution, the loss rate of leafy vegetables has been reduced from 12% to 3.8%, and warehousing costs have decreased by 18%. By adopting the VMI-Hub model and collaborating with suppliers, the inventory turnover rate has increased from 22 times per year to 25 times per year, surpassing the industry average by 15 times.

5.1.2 Intelligent technology deeply enables the supply chain

The Shanghai Jin Qiao store has deployed AGV robots and a hanging chain system, enabling minute-level turnover of goods from the storage area to the sales area, with an order processing capacity of 2,000 orders per hour. Intelligent shelves automatically replenish goods using gravity sensors, reducing the out-of-stock rate by 70%. Cold chain transport vehicles are equipped with Beidou positioning and temperature-humidity sensors, which transmit real-time data to the cloud. A digital twin system is used to create a three-dimensional visualization model of the national logistics network, reducing the automatic alarm response time for abnormal situations to 15 seconds and decreasing the cold chain accident rate by 65%.

Establish a 'one product, one code' blockchain traceability system that covers 100% of products. Consumers can scan the code to access comprehensive data on Chilean cherries, from their orchards to the shelves, including 18 key details such as pesticide residue test reports and temperature curves during transportation. After integrating with customs data, the clearance time for imported goods has been reduced from 48 hours to 6 hours, and customs clearance costs have been cut by 22%.

The dynamic routing algorithm optimizes the distribution path according to the real-time road conditions and order density, reducing the 3km distribution cost by 22%, and reducing the peak period order fulfillment timeout rate from 18% to 7%. The night order response speed is increased by 50%, and the rider is scheduled 30 minutes in advance through the algorithm to predict the hot spots, and the man-efficiency is increased by 20%.

5.1.3 Construction of flexible production system

By analyzing user profiles, we developed exclusive SKUs, increasing the share of our own brands from 28% to 35%. The 'High Protein Combination Pack' for fitness enthusiasts has achieved annual sales exceeding 200 million yuan, with a gross profit margin of 38%. In collaboration with the Shouguang vegetable base in Shandong, we launched 'Hema Organic Vegetables,' reducing procurement costs by 22% through an order-based agricultural model and achieving a premium rate of 35%.

Establish a 'central kitchen + regional R&D center' system to develop Sichuan-style and local Chinese pre-prepared dishes in Chengdu and Shanghai, respectively. This has increased the repurchase rate to 38%. By adopting a modular production method, the pre-prepared dishes are divided into 'ingredient packs + seasoning packs,' which can be quickly combined according to orders. This has reduced the new product launch cycle from 90 days to 45 days.

In collaboration with Zhangzi Island Group, the company has developed 'Blockchain-verified Seafood,' enabling full-chain traceability from fishing to sales, achieving a premium rate of 35%. A 'Joint Innovation Center' was established, where Hema provides consumer data and suppliers focus on process optimization, such as reducing the thickness of salmon slices from 0.5cm to 0.3cm, which lowered the loss rate by 6%.

5.1.4 Community forward warehouse and shared logistics network

Construct a three-tier network of "regional central warehouses, urban DC warehouses, and community micro-warehouses." Regional central warehouses, such as those in Wuhan and Chengdu, have a 500-kilometer coverage radius and are equipped with automated three-dimensional warehouses capable of processing up to 500,000 items per day. Urban DC warehouses operate under a "shared warehousing" model, collaborating with companies like Meituan Buy Vegetables and JD Daojia, which has increased the warehouse utilization rate to

92%. Community micro-warehouses cover a 1.5-kilometer business district, equipped with AGV robots for dynamic replenishment, resulting in a 70% reduction in stockout rates.

By collaborating with Cainiao Station to establish community delivery nodes and share end-of-line delivery resources, Hema covers 60% of the construction costs, while Cainiao provides the venue and personnel management. In the Shanghai pilot area, delivery costs have been reduced by 35%, and the coverage of the end-of-line delivery network has increased to 95%. The 'Logistics Cloud Platform' has been developed to integrate idle social transportation resources, with 45% of orders being taken by crowdsourced riders, resulting in a 28% reduction in labor costs.

We purchased 1,000 new energy refrigerated vehicles equipped with phase change material thermal insulation boxes, which can maintain temperature stability for 4 hours in the high temperature environment of 35℃ and reduce the loss rate to less than 5%. We cooperated with State Grid to build a changing station, which reduced the charging cost by 30% and carbon emission by 42%.

Inventory turnover rate reached 25 times/year, higher than the industry average of 15 times; performance cost decreased by 22%, unit order cost from 28 yuan to 21 yuan. Digital system reduced the proportion of labor cost from 22% to 15%, fresh loss rate from 8% to 5%.

In 2024, the proportion of supply chain cost decreased from 25% to 18%, and the gross profit margin increased from 12% to 18%. The private brand contributed 35% of the revenue, becoming the core engine of profit growth. The reverse logistics system generated an additional income of 120 million yuan, and the energy management system saved 85 million yuan in annual electricity costs.

The reverse logistics system reduces carbon emissions by 120,000 tons/year, and the energy management system has been certified as a national green supply chain. The reduced design of PB commodity packaging reduces the carbon footprint per unit product by 27%, which meets the EU CE certification standard.

5.2 User experience optimization

5.2.1 Restructuring of omni-channel payment experience

Hema Fresh aims to develop a system that integrates biometric recognition with traditional payment methods. This system will retain basic payment methods like cash and bank cards while expanding to include new payment options such as facial recognition and palm print payments. The Shanghai JinQiao store has piloted a 'contactless payment' technology, which uses AI cameras to automatically identify customers and complete payments, reducing settlement time to 3 seconds per transaction and cutting queue times by 80% during peak hours. The encryption technology uses the national SM9 algorithm, which reduces the risk of payment information leakage by 97%, meeting the PCI DSS security certification standards.

Based on user profile data, AI algorithms automatically recommend the optimal payment options. For price-sensitive users, Alipay's' Full Reduction Coupons' are prioritized; for young users who value convenience, facial recognition payment is the default option. Data shows that intelligent recommendations have increased the coupon redemption rate by 22% and the payment conversion rate to 98.7%.

In collaboration with Alipay, we launched the 'Box Flower' points system, allowing users to redeem goods or services with their payment points. In 2024, the points redemption for GMV accounted for 12%, and the average monthly user retention rate increased by 15%. We also introduced the 'Pay as Member' feature, where first-time users automatically become Hema members, achieving a conversion rate of 68%.

5.2.2 Age-friendly renovation and barrier-free design

Based on the physiological characteristics of the elderly, the APP interface font has been enlarged to 18pt, and the contrast ratio has been increased to 4.5:1, meeting the WCAG 2.1 AA

standard. The design employs a 'three-screen minimalist approach': the first screen displays high-frequency functions such as grocery shopping, home delivery, and membership; the second screen provides categorized navigation; and the last screen focuses on setting up auxiliary functions. Test data shows that the average time for elderly users to complete an order has been reduced from 3.2 minutes to 1.8 minutes.

Deploying an ASR (Automatic Speech Recognition) + TTS (Text-to-Speech) dual engine, the system supports dialect recognition with a 92% accuracy rate. Users can perform over 200 operations, such as 'search for Shanghai Qing' and 'check order status,' using voice commands, with an error rate of less than 3%. The system also features a 'smart voice assistant' that automatically announces the payment amount and confirms the payment during the payment process, preventing any accidental operations.

Community stores will set up 'Silver-haired Service Stations,' staffed with two certified elderly care workers, to offer services such as equipment instruction and proxy ordering. In 2024,12,000 'Digital Age-Friendly' training sessions will be conducted, reaching 580,000 elderly users. In collaboration with local communities, a 'Time Bank' will be established, where young users can earn service hours by helping the elderly use apps, which can then be exchanged for goods.

5.2.3 Immersion scene experience innovation

In Shanghai and Beijing stores, AR tasting mirrors have been installed. Users can scan products to watch 3D cooking demonstrations, resulting in a 40% increase in seafood sales conversion rate. A 'virtual seafood market' VR experience has been developed, allowing users to 'fish' king crabs and check real-time prices by wearing a device. The daily average number of users experiencing this service exceeds 2000.

Using the principles of environmental psychology, we adjusted the background music in the store to natural white noise below 60 decibels, which increased the length of customers' stay by 15%. Spraying "ocean air" fragrance in the fresh area stimulated the desire to buy, and the sales of related categories increased by 27%.

Establish a 'Box Fans Community' to connect users within the same community through LBS location-based matching, and organize activities such as 'group buying and price cutting' and 'culinary contests.' In 2024, the community's repurchase rate reached 73%, with UGC content contributing 9%. Develop a' Shopping Companion' feature that allows users to invite friends to select products online and discuss in real time.

5.2.4 Service response system upgrade

Deploy multi-modal interactive AI customer service, support text, voice and image input, solve 78% of common problems, the average response time is 12 seconds, establish "emotion computing" model, through semantic analysis to identify user emotions, automatic transfer to human customer service accuracy rate is 91%.

The response time for customer complaints has been reduced from 4 hours to 1.5 hours, establishing a 'three-level response' system: customer service specialists → regional managers → headquarters customer service director. In 2024, the satisfaction rate for resolving customer complaints reached 92%, an increase of 18 percentage points from the previous year. A 'service compensation' algorithm was developed to automatically issue coupons based on the severity of the issue, achieving a customer complaint recovery rate of 65%.

One-to-one delivery services have been provided for the disabled, 2,000 professional delivery personnel have been trained in 2024, and 350,000 barrier-free orders have been completed. "Smart delivery cabinets" with braille operation and voice prompts have been launched, covering 90% of the population in 12 cities on a trial basis.

5.3 Digital marketing innovation

Building a customer lifetime value (LTV) oriented user segmentation model is a key strategy for Hema Fresh to achieve precise marketing. Hema analyzes users' purchasing behavior, spending amounts, purchase frequency, and loyalty to segment users into different groups, such as high-value users, potential users, and churned users. This segmentation allows Hema to develop personalized marketing strategies for each group, enhancing marketing effectiveness and customer satisfaction. For high-value users, Hema offers exclusive discounts and priority delivery services to enhance their loyalty and stickiness. For potential users, precise recommendations and marketing activities are used to encourage increased spending and purchase frequency. For churned users, follow-up calls and promotional offers are used to understand the reasons behind their churn and attempt to win them back.

Hema Fresh enhances its brand awareness and user engagement by leveraging short video platforms for content creation and private traffic management. On platforms like TikTok and Kuaishou, it produces engaging videos featuring fresh produce introductions and cooking tutorials to attract user attention and interest. By inviting food bloggers and lifestyle influencers to endorse its products, Hema Fresh expands its brand influence. Through these short video platforms, it encourages users to follow its official account, converting public traffic into private traffic. For private traffic management, Hema Fresh establishes user communities and regularly hosts online activities such as lotteries, Q&A sessions, and food sharing events to enhance user interaction and loyalty. By leveraging private traffic management, Hema Fresh gains deeper insights into user needs, offering personalized services and product recommendations to boost customer purchase conversion rates and repeat purchases.

5.4 Cost structure optimization

5.4.1 Reconstruction of distributed storage network

Hema Fresh has established a three-tier network of 'regional central warehouses, urban DC warehouses, and community micro-warehouses,' identifying 12 key logistics nodes using the DEMATEL model. Regional central warehouses, such as those in Wuhan and Chengdu, have a 500-kilometer coverage radius, equipped with automated three-dimensional warehouses capable of processing up to 500,000 items per day. Urban DC warehouses operate under a 'shared warehousing' model, collaborating with companies like Meituan Buy Vegetables and JD Daojia, which has increased warehouse utilization to 92%. Community micro-warehouses serve a 1.5-kilometer business district, deploying AGV robots for dynamic replenishment, reducing the stockout rate by 70%.

The AI prediction model based on the LSTM algorithm has increased the inventory turnover rate from 22 times per year to 25 times per year. Through intelligent warehouse segmentation, the loss rate of leafy vegetables in Chengdu has been reduced from 12% to 3.8%, and warehousing costs have decreased by 18%. The dynamic routing algorithm optimizes delivery routes based on real-time traffic conditions and order density, reducing the cost of 3-kilometer deliveries by 22% and decreasing the order fulfillment timeout rate during peak hours from 18% to 7%.

By collaborating with Cainiao Station to establish community delivery nodes and share end-of-line delivery resources, Hema covers 60% of the construction costs, while Cainiao provides the venue and personnel management. In the Shanghai pilot area, delivery costs have been reduced by 35%, and the coverage of the end-of-line delivery network has increased to 95%. The 'Logistics Cloud Platform' has been developed to integrate idle social transportation resources, with 45% of orders being taken by crowdsourced riders, resulting in a 28% reduction in labor costs.

5.4.2 Deepening of private label (PB) strategy

By leveraging user profile data, the company has developed exclusive SKUs, increasing its private label share from 28% to 35%. The 'High Protein Combination Pack' for fitness enthusiasts has achieved annual sales exceeding 200 million yuan, with a gross margin of 38%, surpassing

the industry average by 15 percentage points. In collaboration with the Shouguang vegetable base in Shandong, the company has launched 'Hema Organic Vegetables,' reducing procurement costs by 22% through an order-based agricultural model, with a premium rate of 35%.

Establish an integrated 'R&D-production-sales' system, and set up a proprietary brand processing center in Kunshan, Jiangsu, to reduce the cost of pre-prepared meals by 18%. The blockchain traceability system in the development zone has increased the repurchase rate of proprietary brand products to 45% and reduced the complaint rate by 67%. Collaborate with international suppliers to develop imported PB products, such as 'Hema Selection' Chilean cherries, which have reduced tariff costs by 15% and achieved a gross profit margin of 42%.

Through TikTok live streaming to promote our own brand, the GMV per session exceeded 5 million yuan, with a conversion rate of 15%. We established the 'PB Member Club,' offering exclusive prices that increased the purchase frequency of our own brand by 2.3 times. We also developed the 'PB Product Recommendation Algorithm,' which recommends related products based on users' historical purchase records, achieving a referral rate of 28%.

5.4.3 Cost control innovation strategy

A system for grading and processing fresh produce has been established. First-grade products (with minor damage) are used for pre-prepared meals, second-grade products (close to their expiration date) are sold at a lower price through community group buying, and third-grade products (unfit for consumption) are converted into organic fertilizer. In 2024, reverse logistics reduced the loss rate from 8% to 5%, generating an additional revenue of 120 million yuan. By analyzing riders 'order-taking behaviors using machine learning, a' capacity-order' matching model was developed. Dynamic subsidies during peak hours increased rider efficiency by 20%. In Chengdu, algorithm optimization reduced the cost of subsidizing night orders by 45%, while maintaining a delivery timeliness rate of 95%.

IoT sensors are deployed in cold chain warehouses to monitor energy consumption data in real time, and the operating parameters of the refrigeration system are optimized through AI algorithms. In 2024, energy consumption per unit of warehouse area decreased by 19%, saving 85 million yuan in annual electricity costs. By collaborating with photovoltaic companies to build rooftop power stations, the utilization rate of renewable energy reached 35%.

Through distributed warehousing and PB strategy, the proportion of logistics cost decreased from 25% to 18% in 2024, and the gross profit margin increased from 12% to 18%. The private brand contributed 35% of the revenue, becoming the core engine of profit growth.

The inventory turnover rate is 25 times per year, surpassing the industry average of 15 times. The cost of fulfilling contracts has decreased by 22%, and the unit order cost has dropped from 28 yuan to 21 yuan. The digital system has reduced labor costs from 22% to 15%. The reverse logistics system has reduced carbon emissions by 120,000 tons annually, and the energy management system has received the national green supply chain certification. The reduction in packaging for PB products has lowered the carbon footprint per unit by 27%, meeting the EU CE certification standards.

6. Conclusion and Prospect

6.1 Research conclusions

This study focuses on Hema Fresh, revealing the current state, challenges, and development strategies of the fresh e-commerce industry through a comprehensive and in-depth analysis. Theoretically, it employs SWOT and PEST analysis to provide a systematic analytical framework for the fresh e-commerce sector, enriching theoretical research in this field. Practically, it delves into Hema Fresh's marketing strategies, including business model innovation, product offerings, pricing, distribution channels, and promotional activities, offering valuable practical insights for other fresh e-commerce companies.

Hema Fresh has achieved remarkable success in its operational management. Its innovative business model, which integrates supermarkets, dining, and logistics, along with measures such as warehouse-store integration and full-chain digital management, has provided consumers with a new shopping experience and established a unique competitive edge in the market. However, Hema Fresh also faces several challenges, including the conflict between cold chain technology investment and inventory loss, high digitalization barriers for middle-aged and elderly customers, insufficient advertising precision, and diseconomies of scale due to rapid expansion. These issues, to some extent, hinder its further development.

To address these issues, a series of targeted optimization strategies have been proposed. In the area of supply chain collaboration and upgrade, a smart supply chain model combining 'data-driven and flexible production' has been developed. This includes exploring community front warehouses and shared cold chain logistics models to enhance supply chain efficiency and flexibility and reduce inventory loss. To improve user experience, a lightweight payment system has been developed, and an age-friendly interface has been designed to lower the digital barrier for middle-aged and elderly customers, thereby enhancing user experience. In terms of digital marketing innovation, a user segmentation model oriented towards LTV (Lifetime Value) has been established. This model emphasizes the promotion through short video platforms and the operation of private domain traffic to achieve precise marketing, thereby increasing user stickiness and loyalty. To optimize the cost structure, a 'small store quick pick' distributed warehousing network has been implemented. This strategy aims to increase the proportion of private brands, reduce logistics and operational costs, and enhance profitability.

6.2 Future Outlook

The fresh food e-commerce sector is poised for broader development, but it will also face more intense market competition and a complex, ever-changing market environment. As living standards improve and consumer attitudes evolve, consumers will increasingly demand higher quality, safer, more convenient, and personalized services from fresh food products. This will drive fresh food e-commerce companies to continuously innovate and optimize their operational management models, enhancing service quality and user experience. With the ongoing advancement of technology, emerging technologies such as artificial intelligence, the Internet of Things (IoT), and blockchain will be more widely and deeply integrated into the fresh food e-commerce sector, presenting new opportunities and challenges for the industry. Fresh food e-commerce companies must actively embrace these new technologies, leveraging technological innovation to drive business model innovation and operational efficiency improvements.

As a leading player in the industry, Hema Fresh should fully leverage its strengths, continuously innovate and refine its marketing strategies, and increase investment in technology research and development and application. This will enhance the intelligence of its supply chain and operational efficiency. Hema Fresh should also strengthen its collaboration with suppliers, optimize its product structure, improve product quality and supply stability, further expand its market presence, enhance brand building and promotion, and boost brand recognition and reputation. By paying attention to changes in consumer demand, Hema Fresh should continuously innovate its products and services to offer a more personalized and convenient shopping experience, meeting the increasingly diverse needs of consumers. Additionally, Hema Fresh should actively fulfill its social responsibilities, focusing on issues such as food safety and environmental protection, contributing to the industry's sustainable development.

Appendix A：Hema Fresh User Experience and Marketing Strategy Questionnaire

Appendix

Dear users:

Thank you for participating in this survey! This questionnaire aims to understand your real feelings about the omni-channel experience of Hema Fresh. The data is only used for academic research. Please fill it out anonymously and feel free to answer.

I. Basic information

1. Your age:

□ 18-24 years old □ 25-35 years old □ 36-45 years old □ 46-55 years old □ over 55 years old

2. Your gender:

□ Male □ Female

3. Your monthly disposable income:

□ Less than 5000 yuan □ 5001-8000 yuan □ 8001-12000 yuan □ 12001-20000 yuan □ More than 20000 yuan

4. How often you use Hema Fresh:

□ Daily □ 2-3 times a week □ Once a week □ 2-3 times a month □ Occasionally

II. Consumption behavior analysis

1. What are the main channels through which you buy Hema products? (multiple choices)

□ Hema APP □ Hema Mini Program □ Offline stores □ Third-party platforms (such as Meituan, Ele.me)

□ Community group buying □ TikTok / Xiaohongshu live broadcast □ Others_____

2. The average amount of your single purchase of Hema products:

□ Less than 50 yuan □ 51-100 yuan □ 101-200 yuan □ 201-300 yuan □ 300 yuan or more

3. What is the main reason for your choice of Hema? (multiple choices)

□ Fresh □ Reasonable price □ Fast delivery □ Good offline experience □ Brand trust

□ Social recommendation □ Activity promotion □ Other _____

4. Have you ever encountered inconsistent online and offline prices?

□ Often encountered □ Occasionally encountered □ Never encountered □ Didn't notice

III. Omnichannel experience perception (Please score according to your actual feelings, 1 = very dissatisfied, 5 = very satisfied)

1.APP interface design and operation fluency: 1 2 3 4 5

2. Commodity information integrity (such as origin, shelf life): 1 2 3 4 5

3. Attractiveness of promotional activities: 1 2 3 4 5

4. Store environment and product display: 1 2 3 4 5

5. On-site processing services (such as seafood workshops): 1 2 3 4 5

6. Service attitude of the clerk: 1 2 3 4 5

7.3 km delivery time rate: 1 2 3 4 5

8. Integrity of cold chain packaging: 1 2 3 4 5

9. Convenience of return and exchange after sale: 1 2 3 4 5

10. Synchronization of online and offline promotion information: 1 2 3 4 5

11. General membership benefits (such as points, discounts): 1 2 3 4 5

12. Consumption data coherence (such as shopping cart synchronization): 1 2 3 4 5

4. Satisfaction and loyalty

1. Your overall satisfaction with Hema Fresh:

□ Very dissatisfied □ Dissatisfied □ General □ Satisfied □ Very satisfied

2. The possibility that you will continue to use Hema in the next 3 months:

□ Impossible □ Not likely □ Uncertain □ Possible □ Very likely

3. Your willingness to recommend Hema to others:

□ 0 points (definitely not recommended) □ 1-6 points (probably not recommended) □ 7-10 points (very willing to recommend)

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Taxi Estimated Price Model: Exploration of Innovative Billing Strategies and Fraud Prevention Mechanisms

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Abstract: This paper aims to explore an innovative taxi estimated pricing model to address the issues of opacity and meter fraud in traditional pricing methods, thereby improving service quality and passenger satisfaction in the taxi industry.By introducing AutoNavi Maps' route planning technology and server-based billing rules, a new billing process was designed. Its advantages and challenges in terms of price transparency, fraud prevention, and operational efficiency improvement were analyzed.The estimated pricing model can reduce price disputes, prevent meter fraud, and enhance operational efficiency.However, it also faces challenges in technical, operational, and regulatory aspects. This paper proposes corresponding optimization suggestions and implementation paths, including technological upgrades, operational improvements, and policy support, to promote the application of the estimated pricing model in the taxi industry. In the future, with technological advancements and improved industry management, this model is expected to become a key direction for the digital transformation of the taxi industry, enhancing overall service levels and competitiveness.

Keywords: Taxi;Estimated Price;Billing Model;Fraud Prevention

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1. Introduction

As a vital component of urban public transportation, taxis have long played an indispensable role in daily travel. However, with accelerated urbanization and diversified travel demands, the traditional taxi industry faces numerous challenges. Among these, taximeter fraud has persisted as a chronic issue plaguing both passengers and industry regulators. Unscrupulous drivers utilize illicit devices[1] (colloquially termed "small motors") to manipulate odometers or duration readings, inflating fares and undermining passenger rights and industry integrity. Additionally,the opacity of conventional fare systems frequently triggers disputes between passengers and drivers, destabilizing sector development. In this context, establishing a fairer, more transparent, and fraud-resistant billing model is urgently needed.

2. Materials and Methods

2.1. Integration of Gaode Map Route Planning

Gaode Map, as a leading electronic map service provider in China, possesses a powerful route planning function. By integrating a vast amount of geographical information data and real-time traffic data, it can provide users with precise route planning solutions. As shown in Figure 1, in the working process of the taxi estimated fare mode, the route planning function of Gaode Map plays a crucial role. When passengers get in the car and input their destinations, the system will call upon Gaode Map's API interface. Based on the starting and ending locations and combined with real-time traffic information, it will quickly generate an optimal driving route.

This route not only considers the shortest distance but also takes into account traffic congestion situations to ensure the rationality of the travel time. Through Gaode Map's route planning, drivers can understand the approximate path and travel time of the trip in advance, providing accurate basic data for subsequent fare estimation. At the same time, Gaode Map's real-time traffic update function can also provide traffic alerts to drivers during the trip, helping them avoid congested sections and further improving the travel efficiency.

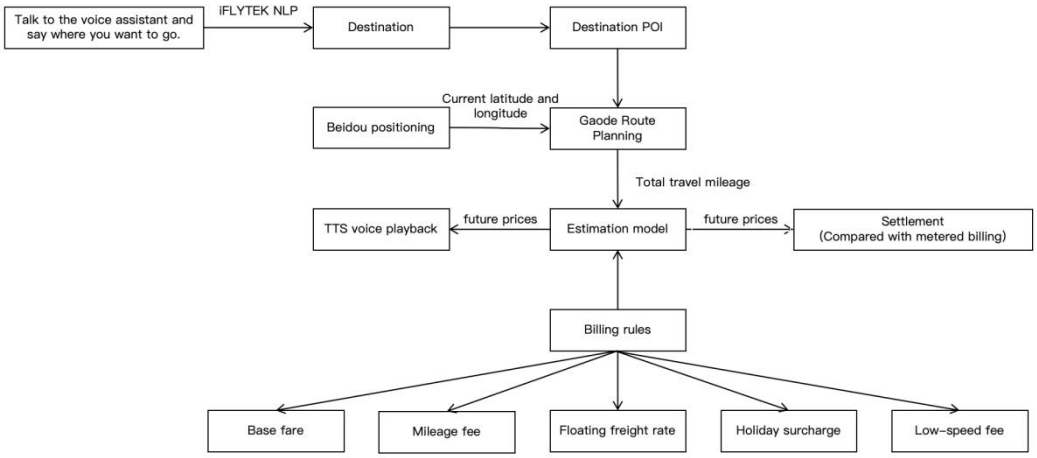

Figure 1. The Workflow of the Estimated Price Model

2.2 Construction of Server-Based Billing Rules

The billing rules of the server are the core component of the estimated pricing model. The rationality of their design directly affects the accuracy and fairness of the estimated pricing. The formulation of the billing rules takes into account multiple factors[2], including the starting fee, the surcharge for exceeding the transportation distance, the mileage fee, the night surcharge, the floating fare, the low-speed fee, the holiday surcharge, etc. The starting fee is priced differently in different time periods and regions; the surcharge for exceeding the transportation distance is mainly used to subsidize long-distance trips; the mileage fee is determined based on the length of the route planned by Gaode Map; the night surcharge is mainly to compensate for the increase in operating costs during the night (23:00 to 5:00 the next day), for example, in Shanghai taxis, the starting fee and mileage fee will increase by 1 yuan during the night; the floating fare adopts the "base fare ± floating range" model, with floating ranges divided into +5%, 0, and -5% grades; the low-speed fee takes into account the possible congestion during the trip, and estimates the average speed of each congested section of the trip through analyzing historical traffic data and real-time traffic information; the holiday surcharge refers to an additional charge of 10 yuan per trip during the Spring Festival holiday, National Day holiday, and May Day holiday. The server-based billing system will quickly calculate the estimated cost from the starting point to the destination and display it to the passengers before the trip begins. This server-based billing method can effectively avoid the possibility of cheating by traditional meters. When drivers use "small motor" to cheat, the actual generated cost will be higher than the estimated cost by the server, but in the final settlement, the system will choose the estimated price as the final fare.

2.3 Passenger Experience Workflow

After getting on the vehicle, passengers can input their destination on the in-vehicle terminal or use the voice recognition function for voice input. After inputting, the system will automatically call out the Gaode Map for route planning, and generate an estimated price and estimated mileage according to the billing rules of the server. Then, it will display these on the in-vehicle terminal, and also notify passengers through voice announcements, so that passengers

can clearly know the cost range before the journey begins. After the journey is over, the system will automatically obtain the actual metered pricing result and compare it with the estimated price. If the actual metered pricing is lower than the estimated price, it will be taken as the standard; if the estimated price is lower than the actual metered pricing, the estimated price will be taken as the standard. Passengers only need to pay the lower fee. This mechanism can not only protect the passengers' interests but also increase the frequency of passengers using taxis.

3. Result

3.1 Price Transparency

The traditional taxi pricing method mainly relies on the real-time billing of the meter. Before the journey begins, passengers often cannot accurately know the amount they need to pay. This lack of transparency can easily cause passengers to worry and lose trust in the price. The estimated pricing model, by showing the estimated price before the journey starts, enables passengers to understand the cost range in advance, thereby reducing disputes caused by unclear prices. Passengers can clearly know approximately how much they need to pay before getting in the car, which not only improves passengers' satisfaction but also enhances their trust in the taxi industry. Moreover, this transparent billing method also helps to regulate drivers' charging behavior and reduce the occurrence of arbitrary charging.

3.2 Cheating prevention mechanism

One of the core advantages of the estimated pricing model lies in its powerful anti-cheating mechanism. Traditional meter cheating mainly involves installing cheating devices on the meter to falsely increase mileage or time. However, in the estimated pricing model, the billing process is entirely completed by the server system based on preset rules, unaffected by the actual readings of the meter. The system will generate an estimated price according to the billing rules, the route planned by Gaode Map, and real-time traffic information, and compare it with the actual metered billing at the end of the trip. The lower of the two prices will be used as the final charging basis. This comparison mechanism ensures that even if the driver uses cheating devices, they cannot benefit from it, effectively preventing the occurrence of meter cheating. At the same time, this model also provides passengers with dual protection. Even if a dishonest driver uses cheating devices, passengers only need to pay a lower fee, maximizing the protection of their economic interests.

3.3 Improvement in operational efficiency

The estimated pricing model not only has significant advantages in terms of price transparency and fraud prevention, but also effectively improves the operational efficiency of taxis. Firstly, through the route planning function of Gaode Map, drivers can know the optimal driving route in advance, avoiding taking detours or encountering severe congestion due to unfamiliar road conditions, thereby saving time and energy consumption. Secondly, this model reduces the communication cost between drivers and passengers regarding the price before the trip begins. Under the traditional pricing method, drivers and passengers sometimes have disputes over the price, while the estimated pricing model, by showing the estimated price in advance, enables passengers to accept the price before getting in the car, reducing unnecessary communication and disputes, and improving operational efficiency.

4. Existing Problems and Challenges

4.1 Technical Challenges

Despite the numerous advantages of the estimated price model in design, several technical challenges arise during practical implementation. Firstly, although Gaode Map's route planning generally provides accurate route information, inaccuracies may occur under special circumstances such as road construction or sudden traffic accidents. These deviations could lead to discrepancies between the estimated price and actual travel conditions, compromising billing accuracy. Secondly, the stability of the server-based billing system is critical. The system must seamlessly integrate with onboard terminal devices, Gaode Map APIs, and other related systems to ensure real-time and accurate data transmission. System failures or poor vehicle network connectivity may result in billing errors or failure to retrieve estimated price data, negatively impacting user experience and operational efficiency for drivers.

4.2 Operational Challenges

At the operational level, the estimated price model faces additional hurdles. On one hand, some drivers exhibit resistance to the new billing model. Familiarity with traditional taximeters contrasts with the requirement for drivers to input destinations before trips under the estimated price model. Issues such as slow typing speeds or non-standard Mandarin pronunciation may increase workload and frustration for older drivers. Moreover, drivers may fear reduced income if estimated prices are perceived as too low. On the other hand, passenger skepticism poses another challenge. While estimated prices are generated using scientific billing rules and Gaode Map routing algorithms, their preliminary nature necessitates supplementary validation through big data analysis to ensure price reasonableness.

4.3 Regulatory Challenges

At the regulatory level, the estimated fare is subject to the influence of Gaode Map's estimation service interface, necessitating stringent oversight of its algorithms, particularly to ensure alignment with annual fare adjustment packages and real-time synchronization of holiday surcharge policies (e.g., additional fees during major holidays). Furthermore, proactive advocacy and guidance are essential to ensure drivers strictly adhere to the established pricing strategies during operational execution.

5. Conclusions

This study proposes an innovative taxi estimated price billing model, aiming to address the opacity and taximeter fraud prevalent in traditional fare calculation methods by integrating Gaode Map's route planning technology and server-based billing rules. The paper elaborates on the principles and design of the estimated price model, analyzing its advantages in enhancing price transparency, preventing fraud, and improving operational efficiency. It also highlights the technical and operational challenges encountered during implementation.

6. Future expectations

In the future, with continuous technological advancements and gradual improvements in industry regulation, the estimated price model is expected to gain broader adoption in the taxi sector. The integration of artificial intelligence and big data technologies could further refine fare prediction accuracy and optimize billing rules. Industry regulators should strengthen oversight of taxi fare practices to promote standardization and institutionalization of the estimated price model. Moreover, this innovative billing paradigm offers fresh insights for the digital transformation of the taxi industry, potentially elevating service quality and competitiveness. Future research could explore the adaptability of the estimated price model across diverse urban contexts and operational environments, as well as strategies to facilitate its large-scale implementation through policy incentives and technological refinements.

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Article

The Evaluation of User Satisfaction and Prospects Analysis of Shared Bicycle Services

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Abstract: Since their introduction, shared bicycle services have rapidly expanded across Chinese cities and have become a key component of urban micro-mobility. By 2025, with the integration of AI-powered dispatch systems, smart parking, and green transport policies, shared bicycles are increasingly embedded within smart city frameworks. This study investigates user satisfaction and its influencing factors to support service optimization and sustainable development. A stratified three-stage unequal probability sampling method was used to survey 1,080 residents in urban and suburban areas of Beijing. Data analysis incorporated descriptive statistics, logistic regression, principal component analysis, fuzzy comprehensive evaluation, and text mining. Results indicate strong market penetration of shared bicycles, with dynamic pricing, deposit systems, and smart parking emerging as key user concerns. Age, occupation, and income remain significant determinants of usage frequency. While users express high satisfaction with app functionality and bicycle hardware, cost-effectiveness and safety continue to affect overall experience. Sentiment analysis reveals increasing expectations for environmentally friendly and intelligent mobility solutions. Based on the findings, the study recommends flexible pricing models, safety enhancements, and targeted service strategies to expand user engagement and support the evolution of shared mobility in urban China.

Keywords: shared bicycles; user satisfaction; urban mobility; fuzzy evaluation; text mining

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1. Introduction

Since the emergence of shared bicycles in China, the concept of "green, convenient, and low-carbon" travel has rapidly gained attention from both users and the capital market. With the continuous advancement of mobile internet, GPS positioning, big data, and smart lock technologies, shared bicycle systems have gradually shifted toward dockless operation and scan-to-ride functionality, significantly improving the efficiency of short-distance urban travel. By 2025, shared bicycles have become an integral part of many cities' public transportation systems and play a critical role in solving the "last-mile" travel problem, driven by the development of intelligent transportation and refined urban governance[1-8].

Research on shared bicycles, both domestically and internationally, has primarily focused on user behavior, business models, impacts on transportation systems, and regulatory policies. In Western countries, such as the United States, projects like Citi Bike in New York operate under government-led models with strict regulatory frameworks[9]. In contrast, China's market has evolved from enterprise-led, capital-driven expansion to a phase of gradual regulatory refinement[10-12]. Platforms such as Meituan Bike and Qingju (HelloBike) have rapidly scaled their operations and built large user bases supported by technological innovation[13-19].

In recent years, academic focus has gradually shifted from macro-level market development to micro-level user satisfaction and behavioral analysis[20]. Existing literature indicates that

socio-demographic factors such as age, occupation, and income significantly influence shared bicycle usage frequency and satisfaction[21]. At the same time, cost, safety, and parking issues remain major obstacles to improved user experience. With the growing application of text mining and sentiment analysis techniques, researchers are increasingly able to extract valuable insights from user reviews, providing data-driven support for optimizing product design and enhancing service quality[22-25].

In summary, the shared bicycle industry in 2025 is undergoing a critical transition from large-scale expansion to service optimization and differentiated operations. There is an urgent need to better understand user satisfaction, identify potential user groups, and upgrade operational strategies to build a more sustainable, efficient, and user-centered development model[26-28]. This study combines questionnaire surveys with text data analysis to systematically explore shared bicycle users' behavioral characteristics and satisfaction evaluation, aiming to provide scientific recommendations for service improvement[29-31].

2. datas and Methods

2.1. Data Collection Procedure

To obtain comprehensive and reliable data on user satisfaction and behavior regarding shared bicycle services in 2025, a multi-stage stratified probability sampling design was implemented in Beijing. The primary objective was to ensure representativeness across different urban zones and population segments while maintaining operational feasibility.

2.1.1. Survey Objectives

The main goals of the survey included:

- Collecting demographic data (gender, age, occupation, income) to characterize current users;
- Identifying factors influencing both the use and frequency of shared bicycle usage;
- Investigating reasons behind non-usage among potential users;
- Assessing user satisfaction with various aspects of the service (e.g., vehicle quality, user experience);
- Providing data-driven recommendations for service improvement.

2.1.2. Sampling Design

A stratified three-stage unequal probability sampling method was used:

Stage 1: Stratified Sampling of Administrative Districts. Beijing was stratified into central urban areas and suburban zones. According to population data, 5 districts were selected from the central urban layer and 3 from the suburban layer using PPS (Probability Proportional to Size) sampling based on 2025 estimated population data.

Stage 2: Sampling of Subdistricts. Within each selected district, subdistricts were chosen using proportional stratified random sampling. A total of 40 subdistricts were selected—30 from urban districts and 10 from suburban districts.

Stage 3: Sampling of Residents. Systematic sampling was conducted within selected subdistricts. Investigators intercepted pedestrians near shared bicycle hotspots and invited one respondent every five minutes to complete a questionnaire. If declined, the next available person was approached. Sampling points rotated every two hours to improve coverage.

2.1.3. Sampling Design

The sample frame included:

- Primary units: Administrative districts within Beijing
- Secondary units: Subdistricts within selected districts
- Tertiary units: Residents in proximity to shared bicycle deployment zones

2.1.4. Survey Instrument Design

A structured questionnaire was developed consisting of five sections:

- Demographics (e.g., age, gender, education, occupation, income)
- Usage behavior among current users
- Satisfaction evaluation of shared bicycle features
- Non-user analysis, identifying reasons for non-usage
- User suggestions and improvement feedback

2.1.5. Pilot Testing

Prior to the formal survey, a pilot study was conducted with 80 questionnaires distributed (2 per subdistrict). A total of 76 valid responses were collected. Reliability and validity tests were performed on the pilot data. Based on the results, modifications were made to improve question clarity and structural logic.

2.1.6. Sample Size Estimation

Using the pilot data with an estimated shared bicycle usage rate $P = 0.55$, and setting a 95% confidence level with a 4% margin of error, the optimal sample size was calculated as:

$$n = \frac{N \cdot t^2 \cdot p(1-p)}{(N-1) \cdot d^2 + t^2 \cdot p(1-p)} \approx 594 \quad (1)$$

Assuming a design effect (deff) of 1.8 due to multi-stage sampling, the adjusted sample size was 1,069. To account for a projected 12% invalid response rate, the final target sample was set at 1,215 respondents.

2.1.7. Final Survey Implementation

A total of 1,220 questionnaires were distributed, and 1,080 valid responses were collected, resulting in an effective response rate of **88.52%**. For subdistricts exceeding the optimal sample size, data truncation was applied; for those under-sampled, follow-up distribution ensured quota fulfillment.

2.2. Data verification

We employed three analytical methods to validate the survey data: reliability analysis, validity analysis, and randomness (run) test to ensure internal consistency and data quality.

2.2.1. Reliability Analysis

Reliability includes internal and external consistency. For the satisfaction-related survey items, 14 items were divided into four components based on thematic grouping: satisfaction with bicycle appearance and components, user experience, app usability, and pricing. We used Cronbach's α coefficient to assess the internal consistency within each component. The results are shown below:

Table 1. Reliability Test Results.

Dimension	Cronbach's α	No. of Items	Reliability Evaluation
Bicycle appearance & components	0.993	6	Very good
User experience	0.976	2	Very good
App usability	0.976	3	Very good
Pricing	0.967	3	Very good

2.2.2. Validity Analysis

Validity analysis includes **content validity** and **construct validity**. Following standard item analysis procedures, we calculated the correlation coefficient between each item and its corresponding dimension's total score to test content validity. For construct validity, correlation analysis between dimensions was conducted.

Table 2. Validity Analysis.

Dimension	Appearance Satisfaction	User Experience	App Satisfaction	Pricing Satisfaction
Correlation Coefficient	0.993**	0.998**	0.986**	0.979**
Significance (p-value)	0.000	0.000	0.000	0.000

p < 0.05 indicates strong correlation between individual items and their dimensions, verifying appropriate content and structural validity.

3. Results and Analysis

3.1. Analysis of Factors Influencing Shared Bicycle Usage Based on a Binary Choice Model

In the previous section, descriptive statistical methods were used to analyze the characteristics of shared bicycle users. However, whether or not an individual uses shared bicycles is typically the result of multiple influencing factors. Therefore, it is necessary to construct an econometric model to comprehensively examine these factors. This section utilizes a binary choice model to quantitatively analyze the influence of variables such as gender, age, education, occupation, monthly income, and monthly public transportation expenditure on the likelihood of using shared bicycles, in order to identify significant traits of shared bicycle users.

3.1.1. Model Selection

The binary choice model is designed to explain individual decision-making when faced with two mutually exclusive alternatives. Since the variable of interest—whether an individual uses shared bicycles—is binary in nature, the binary logistic regression model (Logit model) is employed in this analysis.

3.2. Model Construction

The dependent variable y_i represents whether individual iii has used shared bicycles. If the response is "yes", then $y_i = 1$; otherwise $y_i = 0$.

Many survey responses involve categorical data. For instance, monthly public transportation expenditure is divided into five intervals. If encoded as 5, 4, 3, 2, 1 and used directly in the model, it would imply that the intervals are equidistant and have a uniform influence on the dependent variable—an assumption that is overly simplistic and unrealistic. Similarly, unordered categorical variables like occupation have no inherent numerical hierarchy, making it inappropriate to assign them a single regression coefficient. Therefore, we adopt the statistically standard practice of using **dummy variables** for categorical predictors, and then simplify the model based on significance testing.

Table 3. Variable Definitions in the Binary Choice Model.

Variable Name	Symbol	Definition
Gender	—	Categorical
Age	—	Dummy variables, with "61 and above" as the reference group
Education	—	Dummy variables, with "Primary school or below" as baseline
Occupation	—	Dummy variables, with "Retiree" as the baseline
Monthly Income	—	Dummy variables, with "20,000 CNY and above" as the baseline
Public Transit Expenditure	—	Dummy variables, with "≥300 CNY/month" as the baseline
Shared Bicycle Usage (Dep. Var.)	y	$y = \begin{cases} 1 & \text{Yes} \\ 0 & \text{No} \end{cases}$

3.3. Analysis of User Characteristics via the Model

To facilitate data entry, the last option in each category was generally set as the reference group, unless it was labeled "Other" or had fewer than 30 selections—in which case the penultimate option was chosen as the baseline.

A binary Logit model was constructed by including all relevant variables. Backward stepwise elimination was applied to remove non-significant predictors, with a significance level set at 0.1. After multiple iterations, the final regression output is as follows:

Table 4. Final Regression Results.

Variable	Coefficient	Std. Error	Wald Statistic	p-value
age_26–35	2.229	0.790	7.971	0.005
clerk	0.403	0.244	2.956	0.084
Cost_below50	-0.625	0.313	3.984	0.046
Income_10000–20000	0.548	0.347	2.723	0.099

The model yielded a **likelihood ratio chi-square (χ^2) statistic of 23.185**, with a p-value of 0.000, which is significantly lower than the 0.1 threshold. This indicates good overall explanatory power of the model.

3.4. Interpretation of Model Results

Age: The reference group for age is "61 and above". The positive and significant coefficient for the 26–35 age group indicates that individuals in this range are more likely to use shared bicycles. This may relate to the commuting needs of working professionals and the younger generation's openness to new technologies. People in this age group often use shared bicycles to cover short distances between public transport stations and workplaces, making them a major user segment.

Occupation: "With "retiree" as the baseline category, the positive coefficient for **clerk** indicates that office workers are significantly more likely to use shared bicycles at the 10% significance level. This is plausible, as shared bicycles offer a convenient means of transportation for commuting between public transit and workplaces, especially when pressed for time.

Monthly Public Transit Expenditure: Compared to users spending ≥300 CNY/month on transit, individuals spending less than 50 CNY show a significantly negative coefficient. This suggests that users with higher public transit spending are more likely to also use shared bicycles, likely due to more frequent travel and a greater need for efficient last-mile connectivity.

Monthly Income: Income significantly influences shared bicycle usage. Compared to those earning ≥20,000 CNY/month, individuals earning between 10,000 and 20,000 CNY are more likely to use shared bicycles (positive coefficient, $p < 0.1$). This income bracket often includes younger professionals or mid-level staff who rely more on cost-effective transportation. For those earning less than 10,000 CNY/month, the coefficient was not statistically significant—possibly due to sensitivity toward deposit costs, making them more likely to choose lower-cost alternatives.

In general, shared bicycle usage is higher among middle- and lower-income groups, indicating that affordability and convenience remain core advantages driving adoption.

3.2. Analysis of Shared Bicycle Usage Frequency Based on a Multinomial Logistic Model

The frequency with which users engage in shared bicycle usage is influenced by various factors. To analyze this comprehensively, a multinomial logistic regression model was constructed to examine the effects of gender, age, education level, occupation, monthly income, and monthly public transport expenditure. The objective is to identify significant characteristics associated with user groups based on usage frequency.

3.2.1. Model Selection

Since usage frequency is a categorical variable with multiple levels, a multinomial choice model is appropriate. Among multinomial discrete choice models, the Probit model requires multivariate normal distribution assumptions, limiting its practical use. The Logit model, based on the logistic distribution, is more commonly applied due to its analytical tractability and computational efficiency.

3.2.2. Model Construction

The dependent variable 'Y' represents frequency of shared bicycle usage, categorized as follows: 1 = At least once a month, 2 = 1–3 times per week, 3 = 4–6 times per week, and 4 = Once or more daily. Independent variables include categorical data such as age and occupation, for which dummy variables were used to avoid assumptions of equal interval scaling. The reference category was typically set as the last option in each variable group unless it was labeled 'Other' or had fewer than 30 observations, in which case the penultimate option was used.

Table 5. Final Regression Results.

Variable Name	Symbol	Definition
Usage Frequency	Y	1 = Monthly+, 2 = Weekly 1–3, 3 = Weekly 4–6, 4 = Daily
Gender	gender	1 = Male, 0 = Female
Age	age_*	Dummy variables, base: 61+
Education	graduate, college, etc.	Dummy variables, base: Primary or below
Occupation	Student, Clerk, etc.	Dummy variables, base: Retiree
Income	Income_*	Dummy variables, base: 20000+ CNY
Public Transit Cost	Cost_*	Dummy variables, base: 300+ CNY/month
Acceptable Deposit	deposit_*	Dummy variables, base: Above 300 CNY
Acceptable Price	Price_*	Dummy variables, base: Above 2 CNY/hour
Unlock Method	Wechat, APP	Dummy variables, base: both used

3.2.3. Regression Model and Results

After including all necessary variables, the following multinomial logistic regression model was constructed. Non-significant variables were excluded based on likelihood ratio tests using a significance threshold of 0.05. The final model results are summarized below.

Table 6. Multinomial Logistic Regression Results.

Variable	Estimate	Std. Error	Wald / p-value
Income_5000–10000	2.173	.744	8.542 / .003
Income_10000–20000	1.504	.754	3.976 / .046
deposit_below100	-5.011	2.006	6.244 / .012
deposit_100–200	-5.105	2.035	6.294 / .012
deposit_200–300	-4.074	2.023	4.055 / .044
APP	1.889	.552	11.707 / .001
Income_5000–10000	2.173	.744	8.542 / .003
Income_10000–20000	1.504	.754	3.976 / .046
deposit_below100	-5.011	2.006	6.244 / .012
deposit_100–200	-5.105	2.035	6.294 / .012
deposit_200–300	-4.074	2.023	4.055 / .044
APP	1.889	.552	11.707 / .001

The likelihood ratio chi-square statistic of the model was 68.341 ($p < 0.05$), indicating strong overall model significance.

3.2.4. Interpretation of Results

Income: Higher income is associated with lower frequency of shared bicycle usage. At the 5% significance level, users with incomes between 5,000–10,000 CNY and 10,000–20,000 CNY are more likely to use

shared bicycles more frequently than those earning 20,000+ CNY. These groups often include younger professionals without private transportation who rely on affordable mobility options for daily commuting.

Deposit Acceptance: A higher tolerance for deposit amounts is associated with higher usage frequency. Users accepting deposits below 300 CNY are significantly less likely to be high-frequency users compared to those accepting deposits over 300 CNY.

Unlock Method: Users who only use the dedicated app to unlock bicycles are more likely to use them frequently, compared to those who use both WeChat and the app. App-exclusive users likely represent long-term or loyal users who frequently engage with the service.

5. Conclusions

Based on a comprehensive analysis of survey data, binary and multinomial logistic regression models, fuzzy comprehensive evaluation, and text mining techniques, this study yields the following key conclusions regarding shared bicycle usage behavior and user satisfaction:

Shared bicycle services enjoy high market awareness, but conversion from awareness to usage remains limited. Survey results indicate that 96% of respondents have heard of shared bicycles, but only 54% have used them. This demonstrates a strong foundation of user awareness, yet also reveals the need for strategies to enhance the transition from awareness to adoption. Both users and non-users prioritize **deposit price** as a primary concern, while **convenience features** such as navigation and real-time traffic updates are also highly valued. Improving these two aspects is likely to enhance user engagement.

The characteristics of potential users are clearly defined. Through binary logistic regression analysis, it is evident that age (particularly 26–35 years), occupation (company clerks), public transit spending, and monthly income (10,000–20,000 CNY) significantly influence the likelihood of shared bicycle usage. These attributes define a user group that is more inclined to adopt shared bicycles and should be the focus of targeted service optimization and promotional strategies.

User satisfaction with hardware is high, but cost satisfaction remains relatively low. According to fuzzy comprehensive evaluation results, the satisfaction score for bicycle hardware reached **80.36**, while convenience scored **76.79**, and cost satisfaction was lower at **70.37**. Among cost-related concerns, **deposit pricing** was weighted most heavily. These findings indicate that while users are generally pleased with the physical quality of shared bicycles, pricing—particularly deposits—remains a key issue limiting satisfaction.

Overall evaluations are positive, though improvement opportunities remain. Text mining results based on data from ASO100, Baidu News, and survey feedback reveal that **70% of users express a positive attitude**, in line with the fuzzy evaluation results. However, terms such as “lower rental cost,” “more available bikes,” and “adjustable seat” frequently appear in user suggestions, signaling important areas for service enhancement to further improve user experience.

Cost and safety are the main barriers for potential users. Principal component analysis targeting high-potential user groups (such as young professionals and frequent public transport users) shows that **cost and safety concerns** are the dominant reasons for non-usage. Specifically, company employees and public transport users with moderate monthly expenditures refrain from using shared bicycles mainly due to pricing and security issues. Addressing these concerns—by lowering deposits and enhancing ride safety—could significantly expand the user base and improve market penetration.

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Article

The Impact of Customer Experience Quality on Brand Loyalty in the E - commerce Industry

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Abstract: In the highly competitive e - commerce market, customer experience quality has emerged as a crucial factor influencing brand loyalty. This study aims to explore the relationship between customer experience quality and brand loyalty in the e - commerce context. Through a comprehensive literature review, we first identify the key dimensions of customer experience quality, including website usability, product quality, service quality, and delivery experience. Then, we propose a theoretical model based on the expectancy - disconfirmation theory and the theory of planned behavior. A survey was conducted among 300 e - commerce customers, and the data was analyzed using structural equation modeling. The results show that all dimensions of customer experience quality have a significant positive impact on brand loyalty. Specifically, service quality has the strongest influence, followed by product quality, website usability, and delivery experience. This study provides valuable insights for e - commerce companies to improve their customer experience management and enhance brand loyalty.

Keywords: Customer experience quality; Brand loyalty; E - commerce; Structural equation modeling

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1. Introduction

The e - commerce industry has witnessed explosive growth in recent years, with an increasing number of consumers choosing to shop online. As competition intensifies, e - commerce companies are constantly seeking ways to differentiate themselves and build customer loyalty. Customer experience quality has become a focal point in this pursuit, as it can significantly influence consumers' purchase decisions and post - purchase behavior [1].

Previous research has shown that a positive customer experience can lead to increased customer satisfaction, repeat purchases, and positive word - of - mouth, all of which contribute to brand loyalty [2]. However, the specific relationship between customer experience quality and brand loyalty in the e - commerce industry remains not fully understood. Different dimensions of customer experience quality may have varying degrees of impact on brand loyalty, and understanding these relationships can help e - commerce companies allocate resources more effectively to improve customer experience.

The purpose of this study is to fill this research gap by exploring the impact of customer experience quality on brand loyalty in the e - commerce industry. We will identify the key dimensions of customer experience quality, develop a theoretical model, and empirically test the relationships using data collected from e - commerce customers.

2. Materials and Methods

2.1. Literature Review

We conducted an extensive literature review to identify the key dimensions of customer experience quality in the e - commerce context. Previous studies have suggested that website

usability [3], product quality [4], service quality [5], and delivery experience [6] are important aspects of customer experience quality in e - commerce.

Website usability refers to the ease of use and navigation of an e - commerce website. A user - friendly website can reduce consumers' search costs and enhance their shopping experience.

Product quality is a fundamental factor. High - quality products that meet or exceed consumers' expectations can lead to positive experiences.

Service quality includes aspects such as customer service responsiveness, helpfulness, and problem - solving ability. Good service can address consumers' concerns and build trust.

Delivery experience, including delivery speed, accuracy, and packaging, also affects customers' overall experience. Timely and well - packaged deliveries can enhance customer satisfaction.

Based on the expectancy - disconfirmation theory [7], consumers form expectations about their e - commerce shopping experience before making a purchase. After the purchase, they compare their actual experience with their expectations. If the actual experience meets or exceeds expectations, they are likely to be satisfied and develop brand loyalty. The theory of planned behavior [8] also provides a theoretical basis, suggesting that consumers' attitudes, subjective norms, and perceived behavioral control influence their purchase intentions and loyalty.

2.2. Research Model and Hypotheses

We developed a theoretical model (Figure 1) to illustrate the relationships between customer experience quality dimensions and brand loyalty.

Hypothesis 1 (H1): Website usability has a positive impact on brand loyalty. A user - friendly website can make the shopping process more convenient, which may increase consumers' satisfaction and loyalty to the brand.

Hypothesis 2 (H2): Product quality has a positive impact on brand loyalty. High - quality products are more likely to meet consumers' needs, leading to repeat purchases and brand loyalty.

Hypothesis 3 (H3): Service quality has a positive impact on brand loyalty. Responsive and helpful customer service can enhance consumers' trust in the brand, thus promoting loyalty.

Hypothesis 4 (H4): Delivery experience has a positive impact on brand loyalty. A smooth and timely delivery process can improve the overall shopping experience and contribute to brand loyalty.

2.3. Data Collection

We designed a questionnaire to collect data from e - commerce customers. The questionnaire included items to measure website usability, product quality, service quality, delivery experience, and brand loyalty. The items were adapted from previous validated scales. For example, website usability items included statements such as "The website is easy to navigate" and "The information on the website is clear". Product quality items included "The products I purchased are of high quality" and "The products meet my expectations". Service quality items included "Customer service representatives are helpful" and "They respond to my inquiries in a timely manner". Delivery experience items included "The delivery was on time" and "The packaging of the products was good". Brand loyalty items included "I am likely to repurchase from this brand" and "I would recommend this brand to my friends".

We used an online survey platform to distribute the questionnaire. A total of 300 valid responses were collected. The sample consisted of consumers with different genders, ages, and shopping frequencies.

2.4. Data Analysis

We used structural equation modeling (SEM) with AMOS software to analyze the data. SEM allows us to test the relationships between multiple variables simultaneously and evaluate the goodness - of - fit of the theoretical model. First, we conducted a confirmatory factor analysis (CFA) to assess the reliability and validity of the measurement model. Then, we tested the structural model to evaluate the hypotheses.

3. Results

3.1. Measurement Model Results

The results of the confirmatory factor analysis showed that all factor loadings were significant ($p < 0.01$), indicating good convergent validity. The composite reliability (CR) values for all constructs were above 0.7, and the average variance extracted (AVE) values were above 0.5, which also supported the reliability and convergent validity of the measurement model. For example, the CR for website usability was 0.85, and the AVE was 0.60; for product quality, the CR was 0.88, and the AVE was 0.65; for service quality, the CR was 0.90, and the AVE was 0.70; for delivery experience, the CR was 0.87, and the AVE was 0.62; for brand loyalty, the CR was 0.92, and the AVE was 0.75.

The discriminant validity was also confirmed, as the square root of the AVE for each construct was greater than its correlations with other constructs.

3.2. Structural Model Results

The results of the structural model (Figure 2) showed that all hypotheses were supported. The path coefficients from website usability to brand loyalty ($\beta = 0.20$, $p < 0.01$), product quality to brand loyalty ($\beta = 0.25$, $p < 0.01$), service quality to brand loyalty ($\beta = 0.35$, $p < 0.01$), and delivery experience to brand loyalty ($\beta = 0.20$, $p < 0.01$) were all positive and significant.

The goodness - of - fit indices of the model were also satisfactory. The chi - square value (χ^2) was 120.50, with a degrees of freedom (df) of 80, and the χ^2/df ratio was 1.51, which is less than 3. The comparative fit index (CFI) was 0.95, the Tucker - Lewis index (TLI) was 0.94, and the root mean square error of approximation (RMSEA) was 0.06, all of which meet the acceptable standards.

4. Discussion

The results of this study indicate that all dimensions of customer experience quality, namely website usability, product quality, service quality, and delivery experience, have a significant positive impact on brand loyalty in the e - commerce industry. Among these, service quality has the strongest influence on brand loyalty. This finding suggests that e - commerce companies should pay particular attention to improving their service quality. By providing responsive and helpful customer service, companies can not only solve customers' problems but also build a good relationship with customers, which is crucial for enhancing brand loyalty.

Product quality also plays an important role. High - quality products are the foundation of customer satisfaction. E - commerce companies need to ensure that the products they sell meet or exceed customers' expectations.

Website usability and delivery experience also contribute to brand loyalty. A user - friendly website can make the shopping process more enjoyable, while a smooth delivery experience can leave a positive impression on customers.

These results are consistent with previous research in the field of customer experience and brand loyalty. However, this study further clarifies the relative importance of different dimensions of customer experience quality in the e - commerce context, providing more specific guidance for e - commerce companies.

5. Conclusion

This study has successfully explored the impact of customer experience quality on brand loyalty in the e - commerce industry. By identifying the key dimensions of customer experience quality and empirically testing their relationships with brand loyalty, we have provided valuable insights for e - commerce companies. To enhance brand loyalty, e - commerce companies should focus on improving all aspects of customer experience quality, especially service quality.

Future research can further explore the moderating and mediating factors in the relationship between customer experience quality and brand loyalty. For example, the role of customer satisfaction as a mediator or the impact of consumer characteristics such as brand familiarity and price sensitivity as moderators can be investigated.

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Article

The Impact of Emerging Technologies on the Future of Healthcare: Transforming Patient Care and Business Models

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Abstract: This paper explores the profound impact of emerging technologies on the healthcare industry. With the rapid advancements in artificial intelligence (AI), blockchain, the Internet of Things (IoT), and other cutting - edge technologies, healthcare providers are witnessing significant transformations in patient care, operational efficiency, and business models. By analyzing relevant literature, case studies, and industry reports, this research identifies key technological trends, examines how these technologies reshape healthcare delivery, and discusses their implications for patient outcomes, cost - effectiveness, and the overall healthcare ecosystem. The findings indicate that technological innovations are not only enhancing the quality of care but also enabling more personalized, preventive, and accessible healthcare services. However, challenges such as data privacy, regulatory compliance, and the digital divide in healthcare need to be addressed. This study provides valuable insights for healthcare practitioners, policymakers, and industry stakeholders on leveraging technology to drive innovation and improve the sustainability of the healthcare industry.

Keywords: Healthcare; Technological innovation; Patient care; Business model; AI; Blockchain; IoT

1. Introduction

In recent years, the healthcare industry has been on the cusp of a technological revolution. The global population is aging, chronic diseases are on the rise, and healthcare costs are escalating. At the same time, technological advancements are offering new solutions to address these challenges. The healthcare sector is increasingly adopting emerging technologies to improve patient outcomes, enhance operational efficiency, and transform the overall patient experience.

According to recent industry reports, the global healthcare technology market is expected to grow substantially in the coming years. This growth is driven by factors such as the increasing demand for personalized medicine, the need for more efficient healthcare delivery systems, and the advancements in digital health technologies. Technological innovation has emerged as a key driver of change in the healthcare industry, revolutionizing everything from medical diagnosis and treatment to healthcare management and administration.

The purpose of this study is to comprehensively explore the impact of emerging technologies on the healthcare industry, with a focus on patient care and business models. By understanding these impacts, healthcare providers can better adapt to the changing technological landscape, develop innovative strategies, and improve the quality and sustainability of healthcare services. This research also aims to provide practical recommendations for healthcare practitioners, policymakers, and industry stakeholders on how to leverage technology to promote the development of the healthcare industry.

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2. Technological Trends in Healthcare

2.1 Artificial Intelligence (AI)

AI has emerged as one of the most transformative technologies in healthcare. Machine learning algorithms are being widely used for medical image analysis, disease diagnosis, and drug discovery. In medical image analysis, AI can quickly and accurately detect patterns in X - rays, MRIs, and CT scans, helping radiologists identify diseases such as cancer, fractures, and cardiovascular diseases at an earlier stage. For example, some AI - powered systems can detect lung cancer in CT scans with a higher accuracy rate than human radiologists in certain cases.

In disease diagnosis, AI can analyze a patient's medical history, symptoms, and test results to provide more accurate and timely diagnoses. Chatbots and virtual assistants powered by natural language processing (NLP), a sub - field of AI, are also being used to triage patients, answer their medical questions, and provide basic healthcare advice. These tools can improve patient access to information, especially in remote areas or during off - hours when human healthcare providers may not be available.

AI is also playing a crucial role in drug discovery. It can analyze large amounts of biological data to identify potential drug targets, predict the effectiveness of new drugs, and accelerate the drug development process. This not only reduces the time and cost of bringing new drugs to market but also increases the likelihood of developing more effective medications.

2.2 Blockchain

Blockchain technology offers enhanced security, transparency, and interoperability in healthcare data management. In the context of healthcare, blockchain can create an immutable record of patient medical records. Each medical event, from doctor's visits to test results, is recorded as a block in the chain, and once added, it cannot be altered without a consensus from all parties involved. This ensures the integrity of patient data and improves data security, as it reduces the risk of data breaches and unauthorized access.

Patients can also have more control over their own data with blockchain. They can grant or revoke access to their medical records to healthcare providers, researchers, or insurance companies as needed. This patient - centric approach to data management empowers patients and promotes better data sharing in the healthcare ecosystem.

In addition, blockchain can be used for supply chain management in healthcare, especially for tracking the origin and authenticity of drugs and medical devices. This helps to prevent the circulation of counterfeit drugs and ensures that patients receive safe and genuine medical products.

2.3 Internet of Things (IoT)

IoT devices are increasingly being integrated into healthcare systems. Wearable devices such as smartwatches and fitness trackers can continuously monitor patients' vital signs, including heart rate, blood pressure, and sleep patterns. These devices can transmit real - time data to healthcare providers, allowing for early detection of health issues and more proactive patient management. For example, in the case of patients with chronic diseases like diabetes or heart disease, continuous monitoring of vital signs can help healthcare providers adjust treatment plans in a timely manner.

IoT - enabled medical devices in hospitals can also improve the efficiency of healthcare delivery. For instance, sensors can be used to monitor the availability of hospital beds, track the location of medical equipment, and manage inventory levels of medical supplies. This real - time monitoring and management system helps to streamline hospital operations, reduce costs, and improve the overall quality of care.

3. Impact on Healthcare Delivery and Patient Care

3.1 Personalized Medicine

AI and big data analytics are enabling the shift towards personalized medicine. By analyzing a patient's genetic data, lifestyle factors, medical history, and real - time health data from IoT devices, healthcare providers can develop personalized treatment plans tailored to an individual patient's specific needs. This approach is more effective than one - size - fits - all treatment methods, as it takes into account the unique characteristics of each patient.

For example, in cancer treatment, AI can analyze a patient's genetic makeup to identify the most suitable drugs or treatment combinations. This personalized approach can increase the effectiveness of treatment and reduce the side effects, leading to better patient outcomes.

3.2 Preventive Healthcare

IoT devices and AI - powered analytics are facilitating the transition from reactive to preventive healthcare. Continuous monitoring of patients' health data allows healthcare providers to detect early signs of diseases and intervene before they progress. For example, if a wearable device detects a sudden change in a patient's heart rate or sleep patterns, it can alert the patient and the healthcare provider, who can then take appropriate action, such as scheduling a check - up or adjusting the patient's lifestyle recommendations.

In addition, AI can analyze population - level health data to identify trends and risk factors for diseases. This information can be used to develop preventive healthcare programs, such as vaccination campaigns, lifestyle modification programs, and early screening initiatives, which can help to reduce the incidence of diseases in the population.

3.3 Improved Patient Experience

Technologies such as AI - powered chatbots and IoT - enabled devices are enhancing the patient experience. Chatbots can provide patients with instant answers to their medical questions, schedule appointments, and provide information about hospital services. This improves patient access to information and reduces the waiting time for patients to get answers from human healthcare providers.

IoT - enabled devices also make it easier for patients to manage their health at home. For example, patients can use wearable devices to monitor their health and transmit the data to their healthcare providers, eliminating the need for frequent hospital visits. In addition, some hospitals are using augmented reality (AR) and virtual reality (VR) technologies to reduce patient anxiety during medical procedures and improve the overall patient experience.

4. Impact on Healthcare Business Models

4.1 New Revenue Streams

Technological innovations are enabling healthcare providers to create new revenue streams. For example, healthcare providers can offer data - driven services, such as personalized health analytics and disease prediction, to patients, insurance companies, or research institutions. AI - powered medical devices and software can also be sold or leased to other healthcare providers, creating additional sources of revenue.

In addition, blockchain - based healthcare solutions can be monetized through various models, such as charging for secure data storage and sharing services or providing blockchain - enabled supply chain management solutions to pharmaceutical companies and medical device manufacturers.

4.2 Cost - Efficiency Improvements

AI and IoT technologies are streamlining healthcare operations, leading to significant cost - efficiency improvements. AI - driven medical image analysis and diagnosis can reduce the workload on human healthcare providers, especially in radiology departments, allowing them to

focus on more complex cases. This can lead to cost savings in terms of labor costs and the time required for diagnosis.

IoT - enabled hospital management systems can optimize the use of resources, such as hospital beds and medical equipment. By reducing waste and improving the efficiency of resource allocation, healthcare providers can lower their operational costs. For example, some hospitals have reported significant cost savings after implementing IoT - based inventory management systems for medical supplies.

4.3 Expansion of Healthcare Services

Technological innovations are also facilitating the expansion of healthcare services into new areas. Telemedicine, which is enabled by digital technologies, has seen a significant increase in adoption, especially during the COVID - 19 pandemic. Healthcare providers can now offer remote consultations, diagnosis, and monitoring services to patients in remote areas or those who are unable to visit a hospital in person.

In addition, AI - powered health apps and platforms are providing new ways for healthcare providers to reach patients and offer preventive healthcare services. These apps can provide personalized health advice, fitness programs, and nutrition guidance, expanding the scope of healthcare services beyond traditional hospital - based care.

5. Challenges and Future Outlook

5.1 Challenges

Despite the numerous benefits of technological innovations in healthcare, several challenges need to be addressed. One of the major challenges is data privacy and security. With the increasing collection and use of patient data for personalized medicine and operational efficiency, there is a growing risk of data breaches. Healthcare providers need to invest in robust data security measures to protect patient data and comply with regulatory requirements, such as the General Data Protection Regulation (GDPR) in Europe and the Health Insurance Portability and Accountability Act (HIPAA) in the United States.

Another challenge is regulatory compliance. The healthcare industry is highly regulated, and the adoption of new technologies often requires compliance with complex regulations. For example, the approval process for AI - powered medical devices can be lengthy and costly, as regulatory agencies need to ensure the safety and effectiveness of these devices. Healthcare providers and technology developers need to work closely with regulatory agencies to navigate these regulatory challenges.

The digital divide in healthcare is also a significant issue. Not all patients have equal access to technology and the internet, which can limit the reach of digital healthcare services. This can create inequalities in healthcare access and outcomes. Policymakers and healthcare providers need to work together to bridge the digital divide and ensure that all patients can benefit from technological innovations in healthcare.

5.2 Future Outlook

Looking ahead, the healthcare industry is expected to continue to be shaped by technological innovations. Emerging technologies such as gene editing, quantum computing, and advanced robotics are likely to have a significant impact on healthcare in the future. Gene editing technologies, such as CRISPR - Cas9, have the potential to treat genetic diseases by modifying the DNA of patients. Quantum computing can help to accelerate drug discovery and improve the accuracy of medical simulations. Advanced robotics can be used in surgery, rehabilitation, and patient care, improving the precision and effectiveness of medical procedures.

In addition, the continued development of AI, blockchain, and IoT technologies will further enhance the quality and efficiency of healthcare delivery. However, it is essential for healthcare

providers, technology developers, and policymakers to address the challenges associated with these technologies to fully realize their potential and ensure the sustainable development of the healthcare industry.

6. Conclusion

This study has demonstrated the far - reaching impact of emerging technologies on the healthcare industry. AI, blockchain, and IoT technologies are transforming healthcare delivery and patient care by enabling personalized medicine, preventive healthcare, and improved patient experiences. These technologies are also reshaping healthcare business models by creating new revenue streams, improving cost - efficiency, and expanding the scope of healthcare services.

However, challenges such as data privacy, regulatory compliance, and the digital divide in healthcare must be overcome. Healthcare practitioners, technology developers, and policymakers need to collaborate to address these challenges and leverage technological innovations effectively. By doing so, the healthcare industry can continue to grow and provide better healthcare services to patients around the world.

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Article

Evaluation and Optimization Paths of Anti-Addiction Systems for Minors on Digital Platforms

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Abstract: This study focuses on the anti-addiction system for minors on online platforms, aiming to evaluate its current status and propose improvement suggestions. By investigating the domestic and international research status, analyzing the significance of the topic, and designing research contents such as evaluation indicators, existing problems, and improvement measures, this study intends to provide reference for improving the effectiveness of the anti-addiction system, promoting the healthy development of minors, and realizing the social value of related enterprises.

Keywords: Anti-Addiction System; Online Platforms; Evaluation; Improvement Suggestions

1. Introduction

1.1 Domestic Research Status

1.1.1 National Policies - The "Strictest" Regulations Issued

The newly revised Minor Protection Law has a special chapter on "Internet Protection", which clearly stipulates that providers of online products and services shall not provide products and services that induce minors to become addicted. Unscrupulous merchants that openly sell or rent online game accounts to minors, bypass the anti-addiction system, or even use "no anti-addiction" as a selling point shall be seriously investigated and punished as serious circumstances.

On August 30, 2021, the National Press and Publication Administration issued the Notice on Further Strict Management to Effectively Prevent Minors from Being Addicted to Online Games, requiring that online game enterprises can only provide 1 hour of service to minors every day on Fridays, Saturdays, Sundays and legal holidays from 20:00 to 21:00. They shall not provide game services to users who have not registered or logged in with real names in any form, including the tourist experience mode.

1.1.2 Social Situation - Turning a Blind Eye to Interests

The 2020 National Research Report on Minors' Internet Use shows that the scale of minor netizens in China reached 183 million in 2020, with an Internet penetration rate of 94.9%, higher than the national average. Some minor netizens may have excessive Internet use. 11.5% of minor netizens spend more than 2 hours online every day on weekdays, and 12.2% spend more than 5 hours online on holidays.

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In 2020, the actual sales revenue of China's game market was 278.687 billion yuan, and Tencent Games, which accounted for half of the industry, achieved operating income of 156.1 billion yuan. Before the issuance of the ban by the National Press and Publication Administration, 62.5% of minor netizens often played games online, and 13.2% of minor mobile game users played mobile games for more than 2 hours a day on weekdays.

Although various game manufacturers have gradually strengthened anti-addiction measures, some game account trading platforms still minors to buy accounts without anti-addiction restrictions. The latest data shows that an average of 7.24 million accounts trigger face recognition verification during login and 60,000 accounts during payment every day. Due to refusal or failure of face recognition verification, about 90.5% of accounts in the login link are included in anti-addiction supervision, and 80% of accounts in the payment link have their recharge behavior intercepted.

1.1.3 Family Influence Factors - Lack of Communication Under Spoiling

Over-indulgence of parents is a major cause of children's addiction problems. Currently, 95% of refund appeals are consumption by minors who use their parents' identity information to bypass supervision. Many parents do not understand their children's online situation, have poor parent-child relationships, lack sufficient care for rural or left-behind children, and fail to help children develop good online habits. Parents' failure to set a good example in family education often exacerbates minors' Internet addiction.

1.2 Foreign Research Status

1.2.1 Asian Model Represented by South Korea and Japan: Multi-department Legislation and Whole-process Intervention

South Korea was one of the first countries in the world to issue laws and policies to deal with Internet addiction among primary and secondary school students. From the perspective of participants in preventing and treating Internet addiction among primary and secondary school students, South Korea has formed a prevention and treatment method involving eight departments, including the Ministry of Science and ICT, the Ministry of Gender Equality and Family, the Ministry of Culture, Sports and Tourism, the Ministry of Education, etc. The Ministry of Science and ICT plays a leading and coordinating role.

In 2011, the South Korean National Assembly passed the amendment to the Minor Protection Law, establishing the principle of parental consent and the "game curfew" system. This bill was the first to elevate the restriction of teenagers' online time to the legal level, clarifying the responsibilities and management methods of parents and game operators.

Similar to South Korea, Japan's Ministry of Internal Affairs and Communications, Ministry of Justice, and Ministry of Education, Culture, Sports, Science and Technology are responsible for managing the national Internet use, including formulating Internet use regulations, health and prevention measures related to the Internet, and special prevention measures for school-age children. In recent years, the Japanese government has issued bills such as the Law on Strengthening the Safety of the Youth Internet Environment and the Law on Restricting Dating Websites.

1.2.2 European and American Model Represented by Germany and the United States: Social Organization Participation and Project Promotion

Governments in European and American countries generally do not directly participate in the prevention and treatment of Internet addiction among primary and

secondary school students, but usually provide funds to social non-profit organizations to carry out prevention work through relevant projects. Represented by Germany, Germany has formed an addiction assistance system with associations as the main body, projects as the basis, and websites as the medium. The German "Internet Addiction Industry Association" is mainly responsible for preventing and treating Internet addiction among primary and secondary school students. In addition to providing consulting services on Internet addiction, the association also promotes many preventive service projects, such as "Lost in Space".

To prevent primary and secondary school students from being addicted to online games, European and American countries advocate the online game rating system, stipulating that all games must have labels on content and age groups on the packaging, so that buyers can see whether the game is suitable for their children, and merchants are not allowed to sell games to minors and other inappropriate consumers, thereby reducing the chance of teenagers unsuitable games for their age.

2. Significance and Academic Value of the Topic

2.1 Significance of the Topic

2.1.1 National Level - Regulating Industry Chaos and Promoting Youth Development

In the new era of socialism in China, the Internet has become popular rapidly. While providing convenience, it also brings drawbacks. With the improvement of material conditions, minors are exposed to the Internet at an early age and become addicted to it. The younger generation is the hope of the country, and it is necessary to ensure their vitality and vigor. Addiction to the Internet will lead young people to lose their ambition and be content with the status quo. The implementation of anti-addiction policies aims to change this situation, but the implementation of anti-addiction is not thorough and needs improvement. At the same time, the implementation of anti-addiction also forces online platforms to adjust their audience groups, improve service quality, and promote the high-quality development of the game industry and other fields; anti-addiction also puts forward higher requirements for culture, developing towards the trend of age segmentation.

2.1.2 Social Level - Eliminating Bad Trends and Creating a Good Atmosphere

Minors bear the expectations of society. The implementation and improvement of the anti-addiction system help reduce or even eliminate the bad trend of being addicted to games in society, cultivate teenagers' comprehensive abilities in reality, focus on reality, and inject youthful vitality into the whole society; for various online platforms, the process of continuously improving the anti-addiction system is also the process of realizing corporate social value, which must strictly comply with relevant regulations; with the gradual implementation of the anti-addiction system, family factors have become an indispensable aspect. The implementation of anti-addiction has also increased social attention to family issues. Problems such as insufficient time and attention between parents and children need to be solved urgently. The of these problems also provides a direction for how to form a better family atmosphere.

2.1.3 Personal Level - Staying Away from Virtual Games and Improving Comprehensive Quality

The implementation of the anti-addiction system is extremely beneficial to the development of teenagers, especially middle school students. Being addicted to the Internet is an important factor leading to the psychology of school weariness and declining grades. Online games have always been regarded as a scourge by middle school teachers. If prevention can be carried out, it can have a huge positive impact on teenagers; moreover, if pleasure cannot be obtained through the virtual network,

teenagers will meet their entertainment needs through other ways, such as sports, art, and learning, which also promotes the improvement of their comprehensive quality.

2.2 Academic Value

Through the understanding and analysis of this subject, we find that the implementation of anti-addiction has exposed some problems, such as insufficient attention to minors within families, minors' inability to extricate themselves from Internet addiction, and some online platforms' wait-and-see attitude towards the implementation of anti-addiction. This also indicates that anti-addiction is not just a social phenomenon, but also has deeper academic significance behind it, involving the psychological significance of minors in the growth process; the social and ethical significance of some parents' neglect of their children in families and the strong concern of all sectors of society for the younger generation; some online platforms' hesitation in the face of anti-addiction policies, which also contains economic implications. Research on this subject helps us have a better understanding of the psychology of minors, thereby creating a better development environment for them and helping the younger generation thrive; at the same time, it can also have a new understanding of the family relationship between parents and children in the new era, which is conducive to finding laws to solve related problems in this field; exploring the economic phenomena behind online platforms through research provides an example for predicting the economic and industrial impact of the implementation of relevant policies in the future.

3. Main Research Content

3.1 Evaluation Indicators

3.1.1 Scope and Level of System Functions

Ensuring the system coverage to protect minors' interests: The original intention of the anti-addiction system is to limit the time minors spend on online games. Therefore, whether the anti-addiction system can fully cover the game accounts of children under 18 is an important evaluation indicator for the pros and cons of the anti-addiction system. If the anti-addiction system cannot fully cover the game accounts of children under 18, it only shows that the system has loopholes and quality defects. In addition to the age range, the system should also fully cover all sub-modules of children's game accounts under 18, such as the payment module for purchasing virtual props, the game application module, and the game chat module. Due to the immature mental development of minors, they cannot make optimal choices on economic, time, and even social issues, so the anti-addiction system should cover any module in the game.

Reasonably establishing the system level to ensure the effectiveness of the identification system: The anti-addiction system should be hierarchical, with perfect verification procedures and verification steps under different circumstances. The hierarchy here is reflected in: under normal circumstances, the verification of the anti-addiction system is face recognition, but if the face verification fails, a more rigorous method than human recognition should be used for identity confirmation; or if the verification exceeds a certain number of times continuously, the game interface cannot be unlocked through any verification method for a period of time, and a perfect appeal mechanism should be established. When the anti-addiction system is not hierarchical, it indicates that the system itself is not perfect and lacks verification logic, so the hierarchy of the anti-addiction system is an important evaluation indicator.

3.1.2 Scope and Depth of Information Resource Development and Utilization

In the link of collecting and processing user information, the anti-addiction system has different degrees of information utilization. Some platforms only collect ID card information and take measures based on age judgment. ID card information, as the most basic information, has insufficient collection depth and cannot be effectively utilized. The anti-addiction system should be flexible and can improve the utilization rate of

information through student status certification, so as to deal with special groups such as minor college students and adult middle school students differently. At the same time, the anti-addiction system should also grasp the scale in collecting user information and should not involve personal privacy and other contents.

3.1.3 System Quality

Ensuring system stability and improving system security: The quality of the anti-addiction system includes many aspects: stability, security, humanization, etc. Stability means that it can stably carry out anti-addiction authentication and inspection under various complex network and operating conditions. At the same time, the anti-addiction system should also have the ability to resist external interference, such as resisting hacker attacks and fixing system vulnerabilities; security mainly involves the protection of user privacy. The real-name authentication system should cooperate with relevant public security departments to ensure the security of users' basic information. At the same time, functions that require cameras, such as face verification and face inspection, should be strictly controlled and evaluated.

Enhancing system humanization and strengthening background operation capabilities: In addition to the above situations, the anti-addiction system is often in the background and is turned on for a long time. It should be ensured that the system is independent from other applications in the background and has the jurisdiction it governs; humanization refers to the adaptation of the system to users' operating habits and psychology. Users often prefer systems that are simple and effective to operate, and the intelligent inspection mechanism should also minimize the impact on users' game experience.

3.1.4 System Confidentiality and Security

System confidentiality - manually signing clauses and setting system permissions: The anti-addiction system should pay attention to the protection of user information resources, and use various security technologies and procedures to protect user information resources from unauthorized access, use, and leakage. Except for legal or government requirements or user consent, the system shall not disclose or reveal user information resources to third parties other than cooperative units without the user's consent. However, disclosure to third parties for the following reasons is excluded: disclosure in accordance with national laws and regulations; disclosure at the request of national judicial organs and other relevant organs in accordance with legal procedures; disclosure to protect the legitimate rights and interests of the system itself or users; disclosure in emergency situations to protect the personal safety of other users and third parties; disclosure authorized by the user or the user's guardian; and provision of the user's personal identity information at the legitimate request of the user's guardian.

System security - using communication encryption and formulating leakage plans: The system shall strictly abide by laws and regulations to protect users' communication secrets and use various security protection measures within a reasonable security level to ensure information security. For example, encryption technologies (such as TLS, SSL) and anonymization processing are used to protect users' personal information. The system platform should establish special management systems, processes, and organizations to ensure information security, such as strictly limiting the scope of personnel accessing information, requiring information accessors to abide by confidentiality obligations, and conducting reviews. In case of security incidents such as personal information leakage, emergency plans should be activated immediately to prevent the expansion of security incidents, and users should be informed through push notifications, announcements, etc.

4. Existing Problems of the System

4.1 Problems of the System Itself: Inflexibility and Inhumane Restrictions

Firstly, for the anti-addiction system itself, it is debatable that it has absolute time restrictions on minors, with age being the only assessment criterion for the anti-addiction system. However, there are indeed minors with super high e-sports talents who cannot get enough training due to age restrictions, and their talents cannot be developed. In this case, the anti-addiction system is somewhat "one-size-fits-all", especially when e-sports has become an Olympic sport, still refusing to allow teenagers with e-sports talents to reasonably increase their usage time, which will make the system design rigid and inhumane.

4.2 Family-level Problems: Superficial Implementation and Failure to Solve Problems Fundamentally

Secondly, for families, since the anti-addiction system is directly aimed at the youth group, parents have less contact with the anti-addiction system, which will make parents have little understanding and inadequate understanding of the anti-addiction system, resulting in dissatisfaction among parents due to lack of understanding, thinking that the system is only a formal restriction or even cannot really prevent addiction. This also leads to the contradictory position that "children think the control is too strict, while parents think the control is too loose".

4.3 Social-level Problems: Gray Areas and Industrial Supervision Loopholes

Finally, from a social perspective, since children's addiction to games cannot be fundamentally solved, and the system has put forward strict restrictions on game usage time, a gray industry chain of renting, borrowing, selling accounts, and even face-swiping on behalf of others has emerged. In addition to strengthening supervision by relevant online shopping platforms from the source, how to strengthen the identity identification and verification of users by the game system itself is also an urgent issue to be discussed, because as long as such a gray industry chain exists, the effect of the anti-addiction system itself will decline to a certain extent.

5. System Improvement Suggestions

5.1 Improving System Quality and Strengthening Supervision (System Itself)

5.1.1 Grading System

The current anti-addiction system makes a clear distinction between minors and adults, with strong restrictions on minors but little restriction on adults. In fact, the minor stage covers a long period, during which minors' personalities and understanding of things will change greatly. Treating all minors "equally" is not in line with the law of the development. Dopting hierarchical management and implementing different degrees of restrictions on minors of different ages can not only restrict minors in the period of physical and mental development, but also take into account the time arrangement of some minors who are nearly adults.

On the other hand, for minors of different ages, major software companies should improve their algorithm capabilities to reasonably push consulting and information suitable for the age group of users. For some game companies, they should design games for a certain age group and advocate or even prohibit users who do not meet the target age group from experiencing the games, so as to reduce the chance of teenagers games unsuitable for their age.

5.1.2 Blockchain Technology

With the help of blockchain ledger technology, user anti-addiction data can be recorded on the chain to realize the centralized and unified management of anti-addiction data for teenagers logging in to all games. All game companies record users' online time in the same ledger and count by day, which can strictly and accurately record and control the time for teenagers to log in to games. Government regulatory

authorities and parents can view relevant on-chain data according to their permissions and take corresponding regulatory measures as appropriate.

5.1.3 Anti-Addiction Verification

The current anti-addiction verification is mainly face-swiping verification, with long verification intervals. Once verified, one can play games for several days or even a week. Such a system may be effective for families who understand the anti-addiction system, but for parents who do not understand the anti-addiction system, their children can ask them to swipe their faces for various reasons, and after parents swipe their faces confusedly, their children can play games for several days. On the one hand, it is indeed because parents do not attach importance to the anti-addiction system; on the other hand, there is a big loophole in the system itself. Regarding the problem of long verification intervals, game companies can increase the frequency of identity verification without affecting the game experience too much, such as fingerprint recognition every 20 to 30 minutes or at shorter intervals. This can well restrict minors from playing games by pretending to be adults. For minors who frequently ask their parents for verification, on the one hand, parents cannot always be around, and on the other hand, frequent verification will also make parents suspicious, which can to a certain extent drive parents to understand the anti-addiction system.

5.2 Enriching Spare-time Life and Setting Correct Examples (Family Level)

Parents are an important part of preventing and treating minors' Internet addiction. Firstly, parents should be cautious about using digital products as rewards, such as promising to buy new digital products or increase the time of using digital products. Secondly, parents should lead their children to enrich their spare-time life, cultivate their interests in various aspects, free their children's attention from the online environment, and create more interesting activity experiences than online games. Then, in daily life, parents should set an example and reasonably control their own online behavior. Furthermore, in the process of using mobile phones, parents should use the Internet as a tool to improve themselves as much as possible, give play to the educational function of the Internet, set an example for their children, and have a subtle impact.

5.3 Abiding by the System Consciously and Grasping the Moral Bottom Line (Social Level)

Schools should help students recognize the value of the Internet, guide primary and secondary school students to participate in various online activities, increase the purpose and sense of meaning of Internet use, cultivate primary and secondary school students' strategies for allocating Internet time, expand the scope and depth of primary and secondary school students' use of the Internet, give full play to the educational function of the Internet, and prevent primary and secondary school students from being addicted to the Internet from the source.

Driven by the "attention economy", most Internet companies retain users by increasing the stickiness of their products, which easily makes primary and secondary school students addicted to the Internet. Therefore, it is urgent to enhance the social responsibility of Internet companies, encourage the development of Internet anti-addiction systems, and improve network management systems including network identity verification systems.

6. Research Focus and Difficulties

6.1 Research Focus

6.1.1 Strictly Implementing Anti-Addiction through Four-in-One Cooperation

Anti-addiction, as a typical social event, requires the joint implementation of the state and all sectors of society. While introducing a series of relevant policies, the state should also step up efforts to crack down on the "gray industry" to ensure the legality of

the industry; all sectors of society also have the responsibility to care for the younger generation, especially various online platforms as the main body, should take the initiative to assume social responsibilities; families, as the closest link to minors, have special significance. To improve the anti-addiction system, every link is indispensable. Only through multi-party cooperation can anti-addiction be implemented. How to coordinate the state, society, families, and online platforms is a key research focus of this subject.

6.1.2 Exploring Efficient Identity Verification Mechanisms

The most basic link of the anti-addiction system is to classify users through the identity verification mechanism. Nowadays, in the face of identity verification, there are illegal merchants engaging in account trading and identity theft in an attempt to avoid this link. The traditional ID card verification method can no longer meet the current needs. Some platforms have begun to use face detection as a verification method and innovate the inspection mechanism, which is worthy of promotion as a new form. However, it also has some privacy-related issues. Identity verification should maintain close contact with public security departments. The deficiencies in the identity verification mechanism in the anti-addiction system involve multiple parties and have complex relationships, which is also a research focus of this subject.

6.2 Research Difficulties

6.2.1 Uneven Platforms and Blocked System Implementation

Different online platforms have different levels of understanding and attention to anti-addiction policies, leading to large differences in anti-addiction systems among various platforms, differences in identity verification mechanisms in anti-addiction systems, and different levels of control over minors by online platforms. There are not only domestic online platforms but also some foreign online platforms in the market. Different policies at home and abroad also lead to very different implementation of anti-addiction.

6.2.2 Rise of Gray Industry and Poor System Effect

The restrictive effect of the anti-addiction system on minors is difficult to generalize. Due to the different anti-addiction systems adopted by different online platforms, as well as differences in minors' dependence on the Internet, personal personalities, family environments and other factors, in addition to the impact of factors such as identity fraud and account reselling in the "gray industry", it is difficult to reflect the restrictive effect of the anti-addiction system on minors through relevant data.

6.2.3 Inconsistent Implementation Standards and Difficult System Supervision

Facing the current situation of the anti-addiction system, there are still many deficiencies. For Chinese teenagers, both local and overseas online platforms should have the same implementation standards for anti-addiction to facilitate unified supervision and inspection. The identity verification mechanism should also be upgraded, adhering to real-name system for individuals, and eliminating behaviors such as parents "swiping faces on behalf of others" and using others' identities.

7. Research Ideas and Methods

7.1 Research Ideas

First stage: Research background and significance, domestic and foreign research status, and theories related to the online anti-addiction system.

Second stage: Collect anti-addiction system data, analyze factors affecting the implementation of the anti-addiction system, construct an evaluation index system for the implementation of the anti-addiction system, and calculate and analyze using the analytic hierarchy process.

Third stage: Apply relevant data and put forward suggestions and measures for improving the anti-addiction system.

7.2 Main Research Methods

Literature research method: Focusing on the evaluation of the anti-addiction system of online platforms studied in this paper, by collecting relevant materials and reading literature on specific measures and evaluation of the anti-addiction system, such as the specific implementation methods of the domestic anti-addiction system, relevant theories of the analytic hierarchy process, and research on evaluation methods of the anti-addiction system, we have accurately grasped the domestic and foreign research status, laying a solid theoretical foundation for this research.

Combination of qualitative and quantitative analysis: Qualitative methods are used to analyze the particularity of the anti-addiction system of online platforms, establish an index system for the anti-addiction system, and quantitative analysis methods are used to calculate the weights of the index system.

Empirical research method: On the basis of the previous theoretical research, clarify the evaluation indicators and calculation methods of the online minor anti-addiction system, apply them to practice, and put forward corresponding improvement strategies according to the evaluation results.

Comparative analysis method: In constructing the evaluation index system for online minor anti-addiction, combined with the relevant characteristics of the anti-addiction system, analyze and compare relevant indicators one by one, and select relatively representative indicators, so as to make the calculated results more objective and representative.

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