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Artificial Intelligence and Data Science in the Transformation of Internet Business Models

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Abstract

The internet industry has experienced a profound evolution of business models since its inception, with advertising, e-commerce, and content platforms emerging as the core paradigms. In the digital era, the integration of artificial intelligence (AI) and data science has become a transformative driving force, redefining the operational logic and profit-making mechanisms of internet enterprises. This paper reviews the historical evolution of internet business models, systematically analyzes the multi-dimensional roles of AI and data science in optimizing user experience, enabling personalized services, and innovating profit models across advertising, e-commerce, and content sectors. The study identifies key trends of AI-driven internet business model transformation, including algorithmic monetization, data-driven precision operation, and cross-domain ecological integration. Meanwhile, it also explores potential risks such as data privacy breaches, algorithmic bias, and market monopoly caused by the over-reliance on AI and data technologies. The findings of this paper reveal that AI and data science are not only technical tools but also core strategic elements for the sustainable development of internet businesses, and provide insights for enterprises and regulators to balance technological innovation and risk control.

Keywords

artificial intelligence, data science, internet business models, personalized service, profit model innovation, platform ecosystem, digital transformation, small and medium-sized enterprises

1. Introduction

The challenges stem from a fundamental limitation: legacy models were designed to scale user numbers, not to deepen user value. In this context, artificial intelligence (AI) and data science have emerged as transformative forces, enabling enterprises to move beyond scale-based growth and unlock new layers of value from user data. AI—encompassing machine learning, natural language processing, and predictive analytics—combined with data science techniques such as user profiling and behavioral forecasting, allows internet firms to understand, predict, and respond to user needs with unprecedented precision [3]. These technologies are not merely tools for optimization but core strategic assets that redefine how value is created, delivered, and captured across advertising, e-commerce, and content ecosystems. This article addresses the following three research questions and draws corresponding conclusions: How have AI and data science redefined the operational logic of business models for advertising, e-commerce, and content platforms? What specific mechanisms enable these technologies to enhance

user experience, personalize services, and innovate revenue streams? What are the dominant trends and inherent risks associated with this AI-driven transformation? Compared with existing studies, this research makes three contributions. First, it systematically examines how AI and data science reshape the operational logic of business models for advertising, e-commerce, and content platforms. Second, it explores the mechanisms through which these technologies enhance user experience, personalize services, and innovate revenue streams. Third, it identifies key trends and potential risks associated with AI-driven business model transformation, providing insights for both practitioners and regulators.

2. Theoretical Background

2.1 Core Connotation of Internet Business Models

A business model is the logical framework for an enterprise to create, deliver and capture value [6]. For internet enterprises, the core of the business model lies in how to attract and retain users through digital products or services, convert user traffic into commercial value, and form a sustainable profit mechanism. The three classic internet business models studied in this paper have distinct value creation and capture characteristics: the advertising model takes user traffic as the core asset, sells advertising space to advertisers, and realizes value through free for users, paid for advertisers; the e-commerce model builds a digital transaction platform, connects supply and demand sides, and gains profits through transaction commissions, platform service fees and value-added services; the content platform model takes high-quality content as the core attraction, accumulates user stickiness, and realizes monetization through advertising, paid content, content e-commerce and other ways. The common feature of these models is the scale effect based on network externalities—the more users the platform has, the higher its commercial value and the stronger its market competitiveness [2]. However, the traditional internet business model focuses on the scale of users rather than the depth of user value mining, which leads to the problem of low efficiency of value conversion in the era of traffic saturation.

2.2 AI and Data Science: Core Technical Connotation in Internet Context

Data science is a cross-disciplinary field that uses scientific methods, processes, algorithms and systems to extract knowledge and insights from structured and unstructured data [3].In the internet industry, data science primarily involves the collection, cleaning, analysis, and mining of user data, enabling enterprises to construct accurate user profiles, predict behavior, and identify latent demand. Artificial intelligence is an extension of data science, which uses machine learning, deep learning and other algorithms to enable machines to simulate human intelligent behaviors, such as perception, reasoning, decision-making and learning [4]. In the internet field, the core application of AI is to realize the automation and intelligence of business decisions, such as algorithmic recommendation, intelligent customer service, and precision marketing.

2.3 Theoretical Basis of Technology-Driven Business Model Innovation

The resource-based view (RBV) provides a theoretical basis for the analysis of AI and data science driving the transformation of internet business models. The RBV holds that an enterprise's sustainable competitive advantage comes from its valuable, rare, non-imitable and non-substitutable heterogeneous resources [1]. In the digital era, user data and AI technology have become the heterogeneous strategic resources of internet enterprises. Different from traditional physical resources, user data has the characteristics of non-depletion and cumulative value-added, and AI technology can realize the efficient development and utilization of data resources. By integrating AI and data science into their business models, internet enterprises can develop unique value propositions and revenue mechanisms, achieving sustainable competitive advantages that are difficult for competitors to imitate.

3. Literature Review

3.1 AI and Data Science in the Transformation of the Internet Advertising Model

The internet advertising model is the earliest and most basic profit model of the internet industry, and its traditional form is mainly based on contextual advertising and display advertising, with low targeting accuracy and low conversion rate [5]. With the application of AI and data science, internet advertising has

realized the transformation from traffic-based extensive delivery to data-based precision delivery. Relevant studies have shown that AI-driven user portrait construction and predictive analytics are the core technologies to optimize internet advertising models [3]. By collecting multi-dimensional user data (browsing history, search records, social behavior, consumption habits, etc.), data science technology can construct fine-grained user portraits, and AI algorithms can predict user advertising click-through rate, conversion rate and other key indicators through machine learning models such as collaborative filtering and logistic regression. Kumar et al. (2018) conducted an empirical study on Google's advertising platform and found that the application of AI precision marketing technology has increased the advertising conversion rate of the platform by an average of 35%, and the advertising revenue has increased by more than 20%. Beyond such technical optimization, the evolution of AI-powered internet advertising has also shaped a new computational advertising ecosystem, where digital media platforms are inherently interdependent with this ecosystem [7]. On the one hand, these platforms provide the foundational technological support for the operation of computational advertising, such as data storage, algorithm operation and ad delivery channels; on the other hand, they act as a critical intermediary that mediates the institutional relationships among all stakeholders in the advertising industry, including advertisers, advertising agencies, ad buyers, data brokers, and even regulatory authorities. This intermediary role enables the seamless flow of data, resources and demands among different subjects, and becomes an indispensable link for the efficient operation of the AI-driven precision advertising model. In addition, AI-generated content (AIGC) has further enriched the form and content of internet advertising, and improved the attractiveness and interactivity of advertising [4].

3.2 AI and Data Science in the Innovation of E-Commerce Business Model

E-commerce is the core pillar of the internet economy, and its traditional business model is mainly based on platform transaction matching, with the problems of information asymmetry between supply and demand, low efficiency of commodity recommendation, and poor user shopping experience [6]. AI and data science have penetrated all links of e-commerce operation, from commodity selection, recommendation, pricing to after-sales service, and have realized the all-round innovation of the e-commerce business model. First, AI algorithmic recommendation technology has solved the problem of information overload in e-commerce platforms and realized personalized commodity recommendation [3]. By analyzing users' browsing, collection, purchase and other behaviors, AI algorithms can mine users' potential consumption demand and push matching commodities to users in real time. An empirical study on Alibaba's e-commerce platform by Chen & Zhang found that the application of a deep learning recommendation algorithm has increased the platform's commodity click-through rate by 40% and the user purchase conversion rate by 25%. Consistent with this, research on digital content commerce shows that AI-driven personalization technologies can enhance user engagement by 37.2% across enterprise applications, and have become a core revenue driver for e-commerce and digital content platforms [8]. This is because personalized recommendations not only solve this problem but also optimize the conversion efficiency of platform traffic, forming a win-win situation for users and enterprises. Second, data science-based dynamic pricing technology has optimized the profit model of e-commerce enterprises [5]. AI algorithms can adjust commodity prices in real time according to market supply and demand, user price sensitivity, competitor pricing strategies and other factors, so as to maximize the profit of a single transaction and the overall revenue of the platform. Third, AI technologies such as intelligent customer service and machine vision have optimized the user shopping experience of e-commerce platforms [4]. Intelligent customer service based on natural language processing can answer user questions 24 hours a day, improve the efficiency of customer service, and machine vision technology such as image search and virtual try-on can reduce the cost of user information acquisition and improve the shopping experience. In addition, AI and data science have promoted the transformation of the e-commerce business model from platform transaction to ecological operation [6]. E-commerce platforms take user data as the core, integrate upstream and downstream resources of the industrial chain through AI technology, and provide one-stop services such as commodity supply, logistics distribution, financial payment and after-sales service for merchants and users. For example, Amazon leverages AI and big data to build a global e-commerce ecosystem, integrating e-commerce, cloud computing and logistics into a diversified profit model with transaction commissions, cloud service fees and content subscription fees as the core. While artificial intelligence and data science are driving the e-commerce business model to deeply transform from single-transaction matching to ecological operation, their innovative empowerment also extends to the core carrier of Internet content consumption - content platforms. Content platforms have completely different operational logics and development pain points from e-commerce.

They rely on user engagement and content monetization. Artificial intelligence and data science have also brought profound changes to their development models.

3.3 AI and Data Science in the Upgrading of Content Platform Business Model

The content platform is the main carrier of internet content consumption, and its traditional business model is mainly based on advertising monetization, with the problems of a single profit channel and difficulty in matching content supply and user demand [2]. AI and data science have realized the precision matching of content supply and demand and the diversification of profit models, and promoted the high-quality development of content platform business models.

On the one hand, AI algorithmic recommendation technology is the core driving force for the rapid development of content platforms, which has realized the personalized content distribution of people find content to content find people [3]. Goodfellow also pointed out that deep learning algorithms such as neural networks can analyze users' content reading, viewing, commenting and sharing behaviors, and accurately capture users' content preferences, so as to push personalized content to users. Taking TikTok/ Douyin as an example, its core algorithm, For You Page (FYP), can realize real-time adjustment of content recommendation according to users' real-time behavior, which makes the platform have extremely high user stickiness and activity. The research of Kumar et al.(2018) shows that the application of AI content recommendation technology has increased the average daily usage time of content platform users by more than 60%, and laid a solid foundation for the platform's advertising monetization and content e-commerce development. On the other hand, AI and data science have promoted the diversification of content platform profit models [6]. First, AIGC technology has reduced the content production cost of the platform and enriched the content supply [4]. AI can generate short videos, articles, pictures and other content according to user preferences and hot topics, which not only solves the problem of insufficient high-quality content supply on the platform but also reduces the content creation cost. Second, the precision matching of content and user demand realized by AI has promoted the development of content e-commerce and paid content, and broken the single profit pattern of advertising [3]. Content platforms can realize the precision matching of content and commodities through AI algorithms, and guide users to generate consumption behavior while consuming content; at the same time, the platform can push personalized paid content to users according to users' content consumption preferences, and realize the monetization of high-quality content. The above analysis combs the application of AI in the three core internet business models and their reshaping effects. However, a comprehensive review of existing studies reveals that there are still obvious research gaps in this field.

3.4 Research Gaps in the Current Literature

The existing literature has conducted in-depth research on the application of AI and data science in a single type of internet business model, and confirmed its positive effect on optimizing business operations and improving profit efficiency [5]. However, there are still two main research gaps: first, most studies focus on the technical application level, and lack a systematic analysis of the overall reshaping mechanism of AI and data science on the three core internet business models (advertising, e-commerce, content platforms); second, the existing research mostly focuses on the positive effects of AI and data science, and the research on potential risks such as data privacy, algorithmic bias and market monopoly in the process of business model transformation is relatively scattered, and lacks a comprehensive and in-depth discussion. Third, market monopoly risks. Internet enterprises with advanced AI technology and massive user data can form a data-technology barrier, which is difficult for new entrants to compete with. Moreover, as the core intermediary of the digital industrial ecosystem, leading platforms have concentrated the power of resource allocation and stakeholder connection in the industry chain [7], which further strengthens their market monopoly position and hinders the fair competition of the internet industry. This paper will fill the above research gaps through systematic discussion and synthesis.

4. Discussion

4.1 From Scale to Value: The Common Transformation Logic of AI-driven Internet Business Models

AI and data science have realized the in-depth reshaping of advertising, e-commerce and content platform business models, and these three types of business models show three common transformation laws under the drive of AI and data science, with such changes not only altering operational logic but also reshaping enterprises' long-term strategic capabilities from the perspective of the 'dynamic capabilities theory' —the ability to integrate, build and reconfigure internal and external resources to adapt to rapidly changing digital markets [6]. First, the core of business operation has shifted from traffic scale to user value. The traditional internet business model is based on the network externality, and takes the expansion of user scale as the core goal [2]. In the era of traffic saturation, AI and data science enable internet enterprises to mine the deep value of users through fine-grained user portraits and behavior prediction, and realize the precision operation of users . Across advertising, e-commerce and content platforms, personalized user value creation becomes the core of operational logic [3] and can realize the improvement of commercial value through the improvement of user stickiness and value conversion rate, a resource reconfiguration capability central to dynamic strategic adaptation. Second, the profit model has realized the transformation from singleization to diversification. The traditional internet business models have relatively single profit channels: the advertising model relies on advertising revenue, the e-commerce model relies on transaction commissions, and the content platform model is mainly supported by advertising [6]. AI and data science have broken the boundary between different business models, and promoted the cross-integration of advertising, e-commerce and content in line with the 'platform ecosystem theory', which emphasizes the synergetic value creation of multi-stakeholder networks [2]. For example, content platforms have realized the integration of content + advertising + e-commerce through AI algorithms, and e-commerce platforms have realized the combination of transaction + content + advertising [5]. This cross-integration has made the profit model of internet enterprises more diversified, reduced the business risks caused by a single profit channel, and built sustainable ecosystem synergy as a key strategic capability. Third, the operational decision-making has realized the transformation from experience-driven to data-driven. The traditional internet business operation mainly relies on the experience and judgment of managers, with strong subjectivity and low decision-making efficiency [1]. AI and data science have built a data-driven decision-making system for internet enterprises, which can realize real-time collection and analysis of business data (user data, transaction data, content data, etc.), and make scientific and rational decisions on advertising delivery, commodity recommendation, content distribution and other links through AI algorithms [4]. This data-driven decision-making model has improved the operational efficiency and accuracy of internet enterprises, and more importantly, forged the real-time resource sensing and decision-making capability that underpins enterprises' dynamic strategic adaptation, becoming the core support for their sustainable development in the digital era. While AI drives the three business models to show common transformation laws, the unique value creation logic of each model leads to differentiated application characteristics of AI and data science, which is the key to understanding the targeted application of AI in the internet industry and will be analyzed in detail in this section.

4.2 Differentiated Empowerment: Analysis of the Specific Application Paths of AI and Data Science in Various Business Models

Although AI and data science drive the evolution of all internet business models with the same core impetus, their application features vary based on each model's unique value creation logic. For the advertising model, the core application is precision delivery, focusing on boosting ad-user matching and conversion rates; for the e-commerce model, applications span the entire transaction chain—from product selection and recommendation to pricing and after-sales—centered on enhancing shopping experience and transaction efficiency; for the content platform model, core applications include personalized content distribution and AIGC production, prioritizing improved user stickiness and content supply efficiency [3]. What's more, AI forms a closed-loop ecosystem across all models: it not only delivers targeted services but also continuously optimizes platform algorithms through the user data generated by these services. These distinctive application features are dictated by each model's core value proposition, also embodying the targeted application of AI and data science in the internet industry.

4.3 Limitations of the Current Application of AI and Data Science

The current application of AI and data science in internet business models still has certain limitations. First, its application is highly dependent on high-quality user data, and data silos and poor data quality plaguing many internet enterprises restrict AI algorithm efficiency [3]. Second, AI algorithms feature low interpretability—the so-called "black box" of deep learning algorithms in particular makes it hard for enterprises to explain algorithmic decision-making logic, increasing operational risks [4]. Third, constrained by technical and capital barriers, small and medium-sized internet enterprises (SMEs) have insufficient AI and data science adoption, widening the digital divide in the internet industry [5]. This deficiency has spawned stark competitive inequality between SMEs, start-ups and large internet conglomerates, with far-reaching ramifications for the industry ecosystem and broader social economy. Unlike industry incumbents endowed with massive capital, mature technical teams and troves of high-quality user data accumulated through long-term operations, SMEs and start-ups face multi-dimensional predicaments in AI adoption: they lack funds for high-end AI talent and algorithm R&D, cannot access large-scale, diversified user data for algorithm training and optimization, and are unable to bear the trial-and-error costs of black-box AI algorithms. Such resource gaps deprive these small innovative players of the ability to leverage AI and data science to optimize operations, enhance user experience or innovate profit models—core competitive capabilities in the digital era.

This unequal AI application landscape severely undermines healthy competition in the internet industry ecosystem. Bolstered by AI advantages, large platforms further consolidate market positions through precision operation and ecological expansion, forming a self-reinforcing "data-technology-capital" loop that latecomers cannot easily break. This has led to rising industry oligopolization, with the innovation vitality of SMEs and start-ups stifled. Once a major source of disruptive innovation in the internet industry, these small players are now marginalized or even eliminated in competition, resulting in a lack of diverse exploration in business models and technological applications. Beyond the industry, this inequality triggers notable social impacts. The widening enterprise digital divide leads to an uneven distribution of industrial dividends: large conglomerates monopolize digital transformation opportunities, while numerous SMEs and start-ups face survival pressures, which may further cause employment contraction in the internet and its supporting industries. Furthermore, the lack of diverse market participants weakens checks on large platforms' dominant position, increasing the likelihood of data abuse, algorithmic bias and unfair trading—practices that harm consumer interests and social equity. In the long run, failure to reverse this unequal AI application status will not only hinder the high-quality, sustainable development of the internet industry but also erode the inclusiveness and fairness of the overall digital economy.

4.4 Potential Risks of AI-Driven Internet Business Model Transformation

The limitations of AI applications in the internet industry have further given rise to interrelated, multi-level potential risks during the AI-driven business model transformation, which not only impede the healthy development of the internet industry but also exert far-reaching impacts on social equity and the sustainable development of the digital economy. This section elaborates on three core risks and their formative mechanisms as follows:

First are technical risks centered on data privacy and security breaches. The application of AI and data science in the internet industry is inherently dependent on the collection and analysis of large-scale user personal data. To pursue higher algorithm accuracy and commercial gains, some internet enterprises excessively collect user data, use it without authorization, or adopt inadequate security protection measures, seriously violating users' data privacy and information rights [1]. Moreover, AI-driven cross-domain integration of internet business models has accelerated data flow across different business links and platforms, further elevating the risks of data leakage and abuse. Large-scale data breaches will not only cause huge economic losses to users and enterprises but also undermine the credibility of the entire internet industry and digital economy.

Second are industrial risks dominated by market monopoly and unfair competition. Large internet platforms have formed a self-reinforcing "data-technology-capital" loop, leading to increasingly prominent market monopoly risks in the AI-driven internet industry [2]. Enterprises with advanced AI technologies and massive user data can build insurmountable data-technology barriers for new entrants and SMEs, hindering

fair market competition. As core intermediaries of the digital industrial ecosystem, leading platforms have also concentrated industrial chain resource allocation and stakeholder connection power [7], further consolidating their monopoly position. This not only stifles industrial innovation vitality but also may induce platform abuse of dominant market power—such as arbitrary fee hikes—damaging the interests of merchants and users and restricting the high-quality development of the internet industry.

Third are social risks reflected in algorithmic bias and impaired social equity. AI algorithms are trained on historical user data, and inherent biases in training data (e.g., gender, age, regional, or income biases) will lead to biased algorithmic decisions, resulting in discriminatory phenomena in ad delivery, commodity recommendation, and content distribution [4]. For instance, some algorithms may push low-quality job opportunities to women or low-income groups, or display differentiated product prices to users of different backgrounds. Such biases not only infringe on the legitimate rights and interests of specific groups but also amplify existing social inequalities. In addition, the AI-induced digital divide between large platforms and SMEs has caused an uneven distribution of digital dividends: large conglomerates monopolize digital transformation opportunities, while numerous SMEs face survival pressures, which may trigger employment contraction and other social problems, eroding the inclusiveness and fairness of the digital economy.

Notably, the above three types of risks are not isolated but mutually reinforcing: data privacy and security risks undermine the social credibility of AI and restrict its further application; market monopoly risks exacerbate data silos and hinder AI technological innovation; algorithmic bias and social equity issues arouse public doubts about AI and impose higher requirements for regulatory governance. Accordingly, risk control for AI-driven internet business model transformation requires a systematic, multi-dimensional approach and joint efforts from all stakeholders.

5. Conclusion

This study systematically synthesizes empirical and theoretical research on how artificial intelligence (AI) and data science reshape three mainstream internet business models—advertising, e-commerce, and content platforms—clarifying their unique application mechanisms and shared transformation laws in the digital age. Unlike existing studies focusing on single-model technical analysis, this research conducts cross-model integrated exploration and comprehensively examines the multi-dimensional risks and industrial ecological impacts of AI-driven transformation, including the digital divide between large platforms and SMEs and social equity issues stemming from algorithmic bias. It thereby provides an integrated research framework and novel perspective for subsequent studies on internet business model innovation and AI-enabled digital transformation, filling the gap of fragmented analysis in existing literature. In practice, the research offers actionable insights for stakeholders: Internet enterprises should leverage AI and data science as core strategic assets, strengthening technological R&D and ethical application while prioritizing user data privacy protection and algorithmic fairness. Regulatory authorities are recommended to establish a sound digital economy regulatory system, including data security and algorithm governance norms, to standardize AI application, curb market monopoly, and balance technological innovation with risk control. Only through such collaborative efforts can the internet industry achieve high-quality, inclusive, and sustainable development in the AI era. This study still has limitations that it focuses on literature synthesis and lacks quantitative empirical verification with enterprise microdata. Future research could conduct quantitative analysis to test the impact of AI application intensity on business model transformation efficiency; it could also explore differentiated AI application paths for diverse platform types (e.g., B2C vs. C2C e-commerce) and cross-border regulatory coordination mechanisms for AI-driven business models.

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Conflicts of Interest

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