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Research on the Impact Mechanism and Regulation of Algorithmic Recommendation Big Data on Consumer Behavior Choices

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Abstract: *In the current era of deep development of the digital economy, the integration of big data and artificial intelligence technology has promoted the comprehensive penetration of algorithmic recommendation systems into various consumer scenarios, becoming the core hub connecting consumer demand and market supply. Algorithmic recommendation relies on multi-dimensional user behavior data to construct accurate digital portraits, and achieves a transformation of the consumption paradigm of "finding people with goods" through personalized push. While improving consumption efficiency and optimizing the consumption experience, it also triggers alienation problems such as information cocoons, algorithmic discrimination, and privacy leaks, profoundly reshaping the logic of consumer behavior choices. Existing research mostly focuses on single dimensional effects or technological optimization, and the internal mechanism of the impact of algorithm recommendation big data on consumer behavior is not systematically decomposed, and the adaptability between regulatory paths and impact mechanisms is insufficient, making it difficult to cope with the new governance challenges brought about by algorithm technology iteration. Based on this, this article is based on the information cocoon theory, consumer decision-making theory, and multi-dimensional collaborative governance theory. It systematically analyzes the dual impact mechanism of algorithmic recommendation big data on consumer behavior choices, sorts out the current application chaos and regulatory shortcomings, and combines domestic and foreign governance experience to explore a scientific regulatory path for multi-dimensional collaboration. This study aims to enrich the theoretical achievements in the intersection of algorithm recommendation and consumer behavior, provide theoretical support and practical guidance for platforms to regulate algorithm behavior, regulatory authorities to improve governance systems, and consumers to safeguard their own rights and interests, and promote the healthy and orderly development of the digital consumption ecosystem.*

Keywords: *algorithm recommendation, big data, consumer behavior choices, impact mechanism, algorithm regulation*

1. Introduction

With the iterative upgrading of cloud computing and artificial intelligence technologies, big data-driven algorithm recommendation has become the core operating model of e-commerce, social networking, and content platforms, profoundly changing the way consumers obtain information and the logic of consumer decision-making. Algorithm recommendation captures multi-dimensional data such as consumer browsing trajectories, purchase records, and interest preferences, and relies on collaborative filtering, deep learning, and other technologies to construct dynamic user profiles, achieving accurate matching between products and needs, effectively reducing consumer information search costs, stimulating potential consumer demand, and promoting rapid expansion of the digital consumption market [1]. However, behind the empowerment of technology, there are multiple governance dilemmas hidden. The commercial orientation of algorithm design can easily lead to problems such as information cocoons and consumer inducement. Some platforms abuse their data advantages to implement algorithmic discrimination such as big data "killing", which not only violates consumers' rights to fair trade and privacy, but also disrupts market fairness and order.

Currently, there are many studies in academia focusing on the correlation between algorithm recommendations and consumer behavior, but there are still significant limitations: most studies focus on analyzing a single impact path, lacking a systematic breakdown of the dual impact mechanism; Some studies focus on technological optimization or single subject regulation, but fail to achieve precise

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alignment between impact mechanisms and diverse regulatory pathways; At the same time, there is insufficient attention paid to the impact of new technologies such as generative algorithms on consumer behavior [2].

In view of this, this article takes "influence mechanism existing problems regulatory path" as the logical mainline, systematically analyzes the positive driving and negative constraint mechanisms of algorithm recommendation big data on consumer behavior choices, sorts out the shortcomings of the current regulatory system, and proposes a diversified collaborative regulatory strategy that is suitable for China's national conditions based on advanced foreign experience. This study has both theoretical and practical value. It can not only improve the research framework of the intersection of algorithm recommendation and consumer behavior, but also provide practical guidance for platforms to fulfill their main responsibilities, regulatory authorities to strengthen precise supervision, and consumers to enhance their self-protection capabilities, helping to promote the high-quality development of the digital consumption ecology.

2. Analysis of the impact mechanism of algorithmic recommendation big data on consumer behavior choices

2.1 Core analysis framework for impact mechanisms

The impact of algorithmic recommendation big data on consumer behavior choices is not a linear effect in a single dimension, but rather relies on a closed-loop process of "data collection algorithm processing recommendation output behavior feedback", forming a multi-path and multi-level comprehensive influence system [3]. This framework is based on an algorithmic recommendation system as its core carrier and the construction of consumer digital portraits. It runs through the core logic of "technology empowerment behavior response rights game": the platform collects multidimensional data such as consumer personal basic information, consumption behavior trajectory, and interest preferences through terminal devices. After being cleaned, analyzed, and modeled by an algorithmic model, personalized recommendation content is output to trigger behavioral responses in consumer information acquisition, demand recognition, purchase decision-making, and other links; At the same time, consumer behavior feedback has a reverse effect on algorithm model optimization, forming a dynamic iterative influence loop. Among them, the two major paths of positive drive and negative constraint are intertwined and mutually balanced, jointly determining the final presentation of consumer behavior choices. Factors such as individual consumer characteristics, algorithm transparency, and regulatory strength regulate the strength of the two paths, further improving the transmission logic of the influencing mechanism and forming a complete analytical framework.

2.2 Positive driving mechanism: improving consumption efficiency and optimizing consumption experience

Algorithmic recommendation big data achieves positive empowerment of consumer behavior choices through three sub mechanisms: precise matching, personalized services, and scenario empowerment. The core lies in reducing consumption costs, meeting consumption needs, and expanding consumption scenarios. The precise matching mechanism relies on core algorithms such as collaborative filtering and content filtering to deeply explore potential needs in consumer historical behavior data, construct dynamically optimized user profiles, accurately match products, services, and consumer needs, effectively reduce consumer information search and decision-making costs, solve the information asymmetry dilemma of "people looking for goods" in traditional consumption scenarios, and promote the improvement of consumer decision-making efficiency. The personalized service mechanism is based on the diversity and timeliness characteristics of big data, accurately identifying the differentiated needs of different consumers, providing customized recommended content and services, breaking the limitations of homogeneous consumption, meeting consumers' personalized and diversified consumption demands, and thereby enhancing consumer satisfaction and consumption stickiness. The scenario empowerment mechanism combines real-time consumer scenario data to accurately push products and services that are adapted to the current scenario, effectively stimulating potential consumer demand, enriching the boundaries of consumption scenarios, promoting the transformation of consumer behavior from "passive response" to "active triggering", and further optimizing the consumer experience.

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2.3 Negative constraint mechanism: restricting freedom of choice and infringing on consumer rights and interests

Affected by the commercial orientation and technological alienation of algorithm design, algorithm recommendation big data not only empowers positively, but also forms negative constraints on consumer behavior choices through four sub mechanisms, infringing on the legitimate rights and interests of consumers. The information cocoon mechanism is the core constraint path, and algorithm recommendations are based on the logic of "preference reinforcement" to continuously push similar information and products, causing consumers to fall into a homogeneous information circle and lose opportunities to access diversified information and products, leading to a single consumer choice and exacerbating the polarization of consumer behavior. The consumption induction mechanism relies on psychological principles and interferes with consumers' rational decision-making and judgment through high-frequency push, induced interface design, false traffic packaging, etc., inducing consumers to engage in irrational behaviors such as impulse consumption and excessive consumption, which goes against consumers' real consumption needs. The algorithmic discrimination mechanism is reflected in some platforms abusing their data advantages, implementing differentiated pricing and recommendations based on consumer consumption ability, region, consumption habits, and other characteristics, that is, "big data killing", which infringes on consumers' rights to fair trade and information. The privacy leakage mechanism originates from non-standard behavior in the process of data collection, storage, and use. The illegal collection, abuse, or leakage of consumer privacy information not only violates consumer privacy rights, but also exacerbates consumer security risks, affecting consumer confidence and behavioral choice willingness.

2.4 Regulatory factors affecting the mechanism

The dual impact of algorithmic recommendation big data on consumer behavior choices is moderated by multiple factors and can be summarized into three main dimensions. Individual consumer characteristics are the fundamental moderating factors. Consumers with differences in age, education level, algorithm cognition level, and consumption rationality have varying levels of acceptance and recognition ability towards algorithm recommendations. Consumers with high algorithm cognition level and strong consumption rationality are better able to resist consumption temptations, reduce the negative impact of information cocoons, and have stronger autonomy in making choices; Consumers with lower cognitive levels and insufficient consumer rationality are more susceptible to algorithmic push and have weaker autonomy in their behavioral choices. The transparency of platform algorithms is a key regulatory factor. The higher the transparency of algorithms, the clearer consumers can understand the recommendation mechanism, data usage scope, and decision-making logic. They can effectively exercise their right to know and supervise, reduce negative effects such as algorithm discrimination and consumer inducement; On the contrary, the 'algorithmic black box' will intensify the strength of the negative constraint mechanism. Regulatory intensity is an external regulatory factor. A sound regulatory system and strong law enforcement can effectively curb the abuse of platform algorithms, weaken the role of negative constraint mechanisms, and strengthen the positive impact of positive driving mechanisms; The lack of regulation will lead to the prominent problem of algorithm alienation, further infringing on the legitimate rights and interests of consumers.

3. Problems, regulatory status, and foreign experience reference in algorithm recommendation for big data applications

3.1 Core issues in algorithm recommendation for big data applications

While algorithm recommendation big data empowers digital consumption upgrading, it is gradually showing multi-dimensional application chaos driven by commercial interests and lagging technological regulation, with a core focus on the three major entities of platforms, consumers, and industries. At the platform level, the problem of algorithm abuse is particularly prominent. Some platforms violate algorithm ethics by excessively collecting sensitive consumer information and failing to fulfill their compliance disclosure obligations. The lack of standardized data storage and usage processes can easily lead to privacy leakage risks; At the same time, algorithm design tends to maximize traffic and benefits, deliberately constructing information cocoons, implementing consumer inducement and algorithm discrimination, forming an "algorithm black box", which makes it difficult for consumers to provide evidence for their rights protection. At the consumer level, there is a dual dilemma of damaged rights

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and insufficient self-protection ability. Consumers frequently encounter issues such as privacy breaches and infringement of fair trade rights in algorithmic scenarios. However, due to their limited understanding of algorithms, they lack effective self-protection measures for recommendation mechanisms and potential risks. Additionally, the process of safeguarding rights is cumbersome and costly, making it difficult to form effective constraints. At the industry level, the problem of imperfect self-discipline mechanisms is prominent, lacking unified industry standards and ethical norms. Some platforms blindly pursue commercial interests, forming vicious competition, further exacerbating the chaos of algorithm abuse, and the overall governance efficiency of the industry is insufficient.

3.2 Regulatory status and shortcomings of algorithm recommendation big data in China

China has gradually established a multi-level algorithm regulation system and formed a preliminary governance pattern. At the regulatory policy level, based on the Network Security Law, the Data Security Law and the Personal Information Protection Law, the Administrative Provisions on Algorithm Recommendation of Internet Information Services clearly defines the basic criteria and regulatory requirements for algorithm recommendation services, and the "Qinglang" series of special actions continue to rectify algorithm abuse and achieve the initial supervision of key platform algorithms. At the level of regulatory mechanisms, a graded and classified security management system for algorithms should be established. The regulatory pattern featuring coordinated planning by the cyberspace administration and division of responsibilities among relevant departments should be clarified, an algorithm filing system should be implemented, and the targeting of regulation should be gradually improved. However, there are still obvious shortcomings in the existing regulatory system: firstly, there is a lag and ambiguity in legal regulation, which makes it difficult to cover the governance challenges brought by new technologies such as generative algorithms. Some provisions are too principled and lack specific implementation standards and penalty rules; Secondly, regulatory technology and capabilities are insufficient, and the complexity and concealment of algorithms make it difficult for traditional regulatory methods to adapt. Regulatory departments lack professional technical personnel and monitoring tools, resulting in regulatory blind spots; Thirdly, the multi-dimensional collaborative regulatory mechanism is not sound, and the collaborative efforts of government regulation, platform self-discipline, industry guidance, and consumer supervision are insufficient, resulting in insufficient regulatory synergy; Fourthly, the transparency and interpretability of algorithms are insufficient, and platform information disclosure is merely a formality. Consumers find it difficult to truly understand the logic of algorithms, and the rights to information and supervision are difficult to effectively safeguard.

3.3 Reference to foreign algorithm recommendation and big data regulation experience

Through long-term practice abroad, three typical regulatory models have been formed, accumulating valuable experience. The United States adopts a combination of market-oriented and legal regulation models, relying on laws and regulations such as the Federal Trade Commission Act and the California Consumer Privacy Act, to focus on protecting consumer privacy and fair trade rights, clarifying platform information disclosure obligations, and playing a market regulatory role to encourage industry self-discipline and technological innovation. The EU adopts a strict legislative and unified regulatory model, with the General Data Protection Regulation (GDPR) as the core, clarifying the rules for data collection and use, granting consumers multiple rights such as data access and deletion, establishing a unified regulatory agency, and strengthening the punishment for algorithmic abuse. Japan adopts a combination of industry self-discipline and government guidance, establishes internal self-discipline mechanisms through policy guidance platforms, improves algorithm transparency construction, strengthens consumer education, and forms a diversified collaborative governance pattern. Overall, foreign experience can be summarized into four points: a sound legal system, strengthening consumer rights protection, promoting algorithm transparency, and building a diversified collaborative regulatory framework. Based on China's national conditions, we can learn from its reasonable components, accelerate the improvement of algorithm regulation laws and regulations, and refine regulatory rules; Strengthen the mechanism for consumer rights protection and reduce the cost of rights protection; Clarify platform information disclosure standards and enhance algorithm transparency; Innovate regulatory technologies, improve diversified collaborative regulatory mechanisms, and form a governance system that is in line with the development of digital consumption in China.

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4. Algorithm recommends diverse collaborative regulatory paths for big data

4.1 Government level: Strengthen regulatory leadership and improve regulatory system

As the leading body of algorithm regulation, the government needs to focus on three key areas: institutional improvement, technological innovation, and law enforcement strengthening, in order to establish a solid regulatory foundation. First, improve the legal and regulatory system, revise and refine the Administrative Provisions on Recommendation of Internet Information Service Algorithms based on the Cyber Security Law and other superior laws, make up for the regulatory gaps in generative algorithms and other new technologies, clarify the definition criteria and punishment rules for algorithmic discrimination, privacy disclosure and other behaviors, and form a complete regulatory chain of "superior laws+special regulations+implementation rules". The second is to innovate regulatory technologies and methods, increase investment in regulatory technology research and development, build an algorithm monitoring and early warning platform, use big data and artificial intelligence technology to achieve dynamic monitoring and accurate traceability of the entire algorithm recommendation process, and solve the problem of "algorithm black box" regulation; Improve the algorithm classification and supervision system, implement differentiated supervision based on algorithm risk levels, and enhance regulatory efficiency. The third is to strengthen law enforcement efforts, clarify the division of responsibilities among departments such as cyberspace and market supervision, strengthen cross departmental collaborative law enforcement, severely crack down on illegal and irregular activities of algorithm abuse, increase the cost of illegal activities, and form an effective deterrent; Establish a sound algorithm filing and review mechanism, strengthen dynamic supervision of filing algorithms, and ensure effective policy implementation.

4.2 Platform level: Fulfill the main responsibility and standardize algorithm behavior

As the implementing entity of algorithm recommendation, the platform needs to adhere to algorithm ethics, actively fulfill compliance responsibilities, and achieve the unity of commercial interests and social responsibility. One is to adhere to the ethical bottom line of algorithms, integrate the principles of fairness, impartiality, transparency, and integrity into the entire process of algorithm design and optimization, abandon the design orientation of traffic first, actively crack the information cocoon, increase the diversity of recommended content, and eliminate consumer inducement and algorithm discrimination. The second is to standardize the data management process, strictly comply with relevant regulations on data security and privacy protection, clarify the scope and purpose of data collection, fulfill the obligation of full disclosure, obtain clear consent from consumers, improve the security management system for data storage, use, and destruction, and prevent privacy leakage risks. The third is to enhance the transparency of algorithms, publicize the principles of algorithm recommendation, data usage scope, and decision-making logic in a simple and understandable way, improve the interpretability mechanism of algorithms, and safeguard consumers' right to know and choose; Provide convenient algorithm recommendation shutdown and user tag deletion functions, respecting consumers' right to make independent choices. The fourth is to establish an internal regulatory mechanism, set up an algorithm ethics review committee and specialized regulatory departments, strengthen employee algorithm ethics and compliance training, and promptly detect and correct algorithm abuse behavior.

4.3 Industry level: Strengthen self-discipline guidance and form industry consensus

As a bridge connecting the government and the platform, industry associations need to fully play a guiding and coordinating role, strengthen industry self-discipline, and regulate industry order. One is to improve industry self-discipline standards, collaborate with platform enterprises and research institutions to develop unified algorithm recommendation industry standards and ethical guidelines, clarify industry bottom lines in algorithm design, data usage, information disclosure, and guide platform operations to be standardized. The second is to establish an industry supervision and punishment mechanism, form a professional supervision team, and conduct regular supervision of platform algorithm recommendation behavior. Enterprises that violate industry norms and infringe on consumer rights will be subject to measures such as notification and criticism, joint punishment, etc., to strengthen the binding force of self-discipline norms. The third is to strengthen industry exchanges and innovation, build a platform for algorithm governance exchange, promote advanced algorithm governance experience and technological achievements, and promote the benign iteration of algorithm technology in the industry; Carry out algorithm ethics publicity and education to enhance the overall ethical and responsibility awareness of the industry.

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4.4 Consumer level: Enhance cognitive abilities and strengthen self-protection

Consumers, as the direct target of algorithm recommendations, need to improve their own literacy, actively exercise their rights, and form effective constraints on the abuse of algorithms. One is to enhance the cognitive level of algorithms, through various channels such as government science popularization, media promotion, and industry guidance, to understand the operational logic and potential risks of algorithm recommendations, enhance the ability to identify issues such as information cocoons, consumer inducement, and algorithm discrimination, and establish a rational consumption concept. The second is to strengthen self-protection awareness, carefully authorize personal sensitive information, actively pay attention to platform data usage and algorithm recommendation rules, and develop good information protection habits; Rationally handle algorithmic push content and avoid being induced to engage in impulsive or excessive consumption behavior. Thirdly, actively exercise the right to protect one's rights and interests, clarify one's own legitimate rights and interests, understand the channels and processes for protecting one's rights and interests, actively complain and report behaviors that infringe upon one's rights and interests such as algorithm abuse and privacy leakage, and use legal means to safeguard one's rights and interests; Actively participate in algorithm governance feedback, provide reasonable suggestions for algorithm rule optimization, and play a role in consumer supervision.

5. Conclusion

This article is based on the background of the digital economy, with the correlation between algorithmic recommendation big data and consumer behavior choices as the core. Combining relevant theories such as information cocoon theory and consumer decision-making theory, it systematically analyzes the impact mechanism of algorithmic recommendation big data on consumer behavior choices, sorts out application chaos and regulatory shortcomings, and draws on foreign experience to propose a diversified collaborative regulatory path. After research, the following core conclusions are formed.

Algorithmic recommendation big data has a comprehensive impact on consumer behavior choices through a dual path of positive driving and negative constraints. Positive driving is reflected in precise matching, personalized services, and scenario empowerment, effectively improving consumption efficiency and experience; Negative constraints manifest as problems such as information cocoons and consumption inducement, limiting consumer choices and infringing on consumers' legitimate rights and interests, and this impact is moderated by factors such as individual consumer characteristics and algorithm transparency. At present, there are problems such as platform algorithm abuse and insufficient consumer self-protection in the application of algorithm recommendation big data in China. The existing regulatory system has shortcomings such as legal lag and insufficient regulatory capacity, making it difficult to effectively prevent and control algorithm risks.

Research has shown that building a diversified collaborative regulatory system led by the government, platform entities, industry self-discipline, and consumer participation is the key path to cracking the chaos of algorithm application, balancing technological empowerment and risk prevention and control. This article enriches the theoretical achievements in the intersection of algorithm recommendation and consumer behavior, providing practical guidance for platform standardization of algorithm behavior and regulatory authorities to improve governance systems.

Due to limitations in research conditions, this article lacks empirical analysis to quantify the strength of the impact mechanism and pays insufficient attention to new algorithm technologies. In the future, empirical research methods can be introduced to verify research conclusions, focus on the consumption impact of new technologies such as generative algorithms, explore specific implementation paths for algorithm transparency, further improve the diversified collaborative regulatory system, and help promote the high-quality development of the digital consumption ecosystem.

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