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THE SPECIFIC APPLICATION OF BIG DATA IN THE RETAIL INDUSTRY

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Abstract

The application of big data in national life is becoming increasingly widespread and in-depth. The retail industry has become a widely used and beneficial industry due to its wide consumer reach and relatively simple access and cost to data. Under the new development pattern of dual circulation, the retail industry takes advantage of the development opportunities of big data technology, uses big data technology for application development transformation, transitions to the "new retail" development model, and accelerates the realization of development.

The focus of this article is on the application of big data in different retail industry models, from large classified applications to focus on small business scenarios, to deeply analyze the application of big data in the retail industry. The full text is divided into six parts: The first part is an introduction; The second part is related theories; The third part introduces the research methods of big data application development in the retail industry; The fourth part is based on the research on the application and development data of big data in the retail industry; The fifth part is the conclusion and suggestions. Through research, it can be found that there are both differences and similarities in the application of big data under different retail models. The data generated by every application is valuable, and using scientific methods for data mining and reuse has become an important means for the retail industry to improve products and services, break consumer expectations, and thereby enhance enterprise efficiency and achieve industrial upgrading.

Keywords: Big data, Retail industry, Application Developments

Introduction

After entering the information age, behaviors, characteristics, products, services, etc. in human society are becoming more and more easily data-driven. At the same time, the data information used by everyone is very rich, collect, and process is also increasing (Alicia, 2018). The popularity of the internet and the promotion of smartphones, as well as the development of social networks, search engines, and cloud computing, have all provided convenience for collecting and utilizing data

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resources. The research a large amount of data and information will change people's lives Institute for the first time proposes that "the era of big data has arrived". China has a huge population base and consumer base, making it the most promising owner of big data. We are in an era of continuous popularization and rapid development of the Internet, and a huge transformation is unfolding in the marketing models of enterprises worldwide.

Since 2013, the contribution rate of consumption to domestic economic growth has been increasing year by year, and the retail industry plays an extremely important role in national life (Zhang, 2020). The vigorous development of the retail industry means the continuous expansion of the retail weighing equipment market. Under the traditional social division of labor and efficiency, goods from producers to consumers need to circulate multiple times, with many cumbersome links in between. However, these links are inevitable in traditional trade. The process where the product ultimately reaches the hands of consumers is usually referred to as the retail process. With the popularization of the Internet and the rise of e-commerce, manufacturers that were originally just producers can also directly engage in transactions with consumers as retailers.

Research Objectives

(1) To study the specific application status of big data in the retail industry.

(2) To identify the problems and reasons behind the application of big data in China's retail industry.

(3) To examine solutions to the problems of big data application in the retail industry.

Literature Review

The concept definition section mainly explains the main concepts related to big data, retail industry, and business models in this study.

Big Data

The term "BIG DATA" has been used since the 1990s. Bill Enmen, the father of the US data warehouse, first proposed the term "big data". In 2011, McKinsey, the world's famous management consulting company, published a report related to big data and proposed the concept of big data in the report. Big data refers to data sets that are larger than the collection, storage, management, and analysis capabilities of typical data software. Some American scholars have made different but similar interpretations of the concept of big data, and also predicted that big data will sweep the world in an unstoppable state.

Retail Industry

According to the relevant definition of retail industry, retail refers to sales activities primarily aimed at end-consumers (such as residents). Retail industry is a combination of factors formed by retailers of goods that meet different consumer needs in different forms. Gong (2009) believes that the retail industry refers to the

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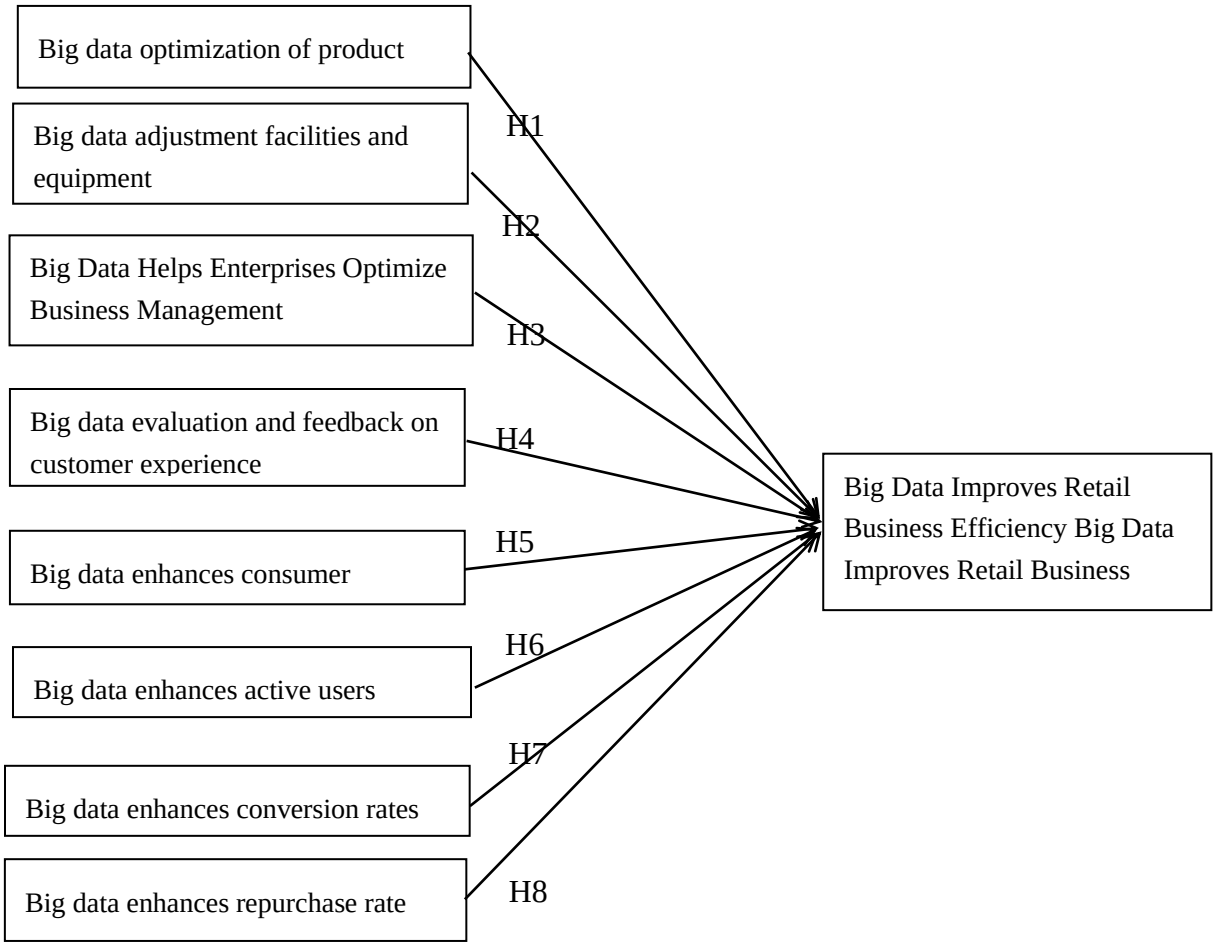
commercial industry in which producers' goods are sold to households or social groups for public use through buying and selling. Retail formats can be divided into two categories: convenience stores with stores and convenience stores without stores, including convenience stores, supermarkets (large, medium, and small), warehouse style membership stores, department stores, and shopping centers. In this article, food retail is defined as a commercial form, including convenience stores, small and medium-sized supermarkets, hypermarkets, and other forms of retail.

Business Model

The existing research on the definition of business models mainly starts from the perspectives of business operations, institutional structure, stakeholders, and value. From the perspective of business operations, the focus of a business model is on the ways and processes of value realization. From the perspective of institutional structure, business models are mainly representative of institutional structure. From the perspective of stakeholders, the focus of a business model is to handle the relationships between customers, partners, and competitors well. From a value perspective, the focus of a business model is to achieve value creation, and all of its preliminary work is to ultimately obtain value.

Research Conceptual Framework



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Research Hypothesis

(1) Big data optimization of product display

In traditional retail, store owners adjust the display of goods through vertical display, centralized display, end display, and other display methods. At the same time, adjust the display of goods based on sales situation. However, for offline consumers, a major factor affecting their purchase is whether the product is discovered, which in turn attracts consumers (Carlsson, 2004). A common example encountered is when consumers discover a product during the aimless "shopping" process, which then stimulates their desire to purchase. So 'whether it can be discovered' is very important. By mining data, retail enterprises can discover more products in a correlated manner, thereby creating purchasing opportunities.

H1: Big data can promote the improvement of retail business efficiency by optimizing product display

(2) Big data adjustment facilities and equipment

In the era of information technology, the development of various industries is a key issue, some retail enterprises have begun to use electronic price tag systems linked to wireless WiFi, changing the traditional offline retail method of relying on manual replacement of paper price tags (Chaffey, Ellis & Mayer, 2009). This way, the system prices and the prices displayed to consumers can be synchronized in real-time, avoiding price complaints. At the same time, there is a QR code on the price tag, which allows you to scan and understand the entire supply chain data information of the product, such as which base it comes from, which transportation method it uses, and which warehouses it has been turnover in, all of which can be publicly and transparently displayed to consumers.

H2: Big data can promote the improvement of retail business efficiency by adjusting facilities and equipment

(3) Big Data Helps Enterprises Optimize Business Management

Apart from conducting transactions in the store, consumers' behavior trajectories in the store can also form data. With the support of high-tech camera equipment, facial recognition technology, and network transmission, retail enterprises have the ability to collect, sort, and precipitate all consumer behavior data in the store. For example, when a customer stays in a certain area for a long time, which products have stopped to select, and combined with the customer's final purchase order, a closed-loop analysis can be formed, which products are often purchased by customers with certain label characteristics, and which products they are interested in but have not converted into purchasing power (Riker, 2014).

H3: Big data helps enterprises optimize business management and promotes the improvement of retail industry efficiency

(4) Big data evaluation and feedback on customer experience

After consumers end their offline experience, traditional supermarkets often conduct questionnaire surveys at the entrance and exit to understand their shopping experience, including evaluations of products, environment, service attitude, etc. The

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retail industry has developed to the present day, and traditional paper survey questionnaires are still being used, but research through mobile apps is gradually replacing traditional methods (Cong & Yu, 2020). After offline shopping, consumers are increasingly providing feedback through online apps because it is more convenient and efficient, and there is no direct disturbance to customers. Understanding analysis through Mastery of customers' voices, many businesses even offer gifts or vouchers as a way of expressing gratitude to customers after completing surveys. These feedback data are combined into valuable information to drive enterprises to optimize links and improve services.

H4: Big data can improve the operational efficiency of the retail industry by providing feedback on customer experience through evaluation

(5) Big data enhances consumer stickiness

As the founders of the community, retail enterprises have also benefited from it. Promotion information can be quickly and freely disseminated, and some simple customer complaints can also be resolved in the first place to avoid the risk of proliferation (Chen & Kong, 2021). And consumers' stickiness and loyalty to retail enterprises are also increasing.

H5: Big data can promote the efficiency of retail operations by increasing consumer stickiness

(6) Big data enhances active users

This is an era that values traffic, where traffic brings economic benefits. The most important indicator for measuring traffic is DAU, which refers to daily active users and reflects customer stickiness. DAU is the first step in generating online transactions, which involves opening the app first. Just like offline shopping, how can customers expect to consume in the store if they don't even come in. The most common way to guide online traffic is through pop-up advertising links, but consumers are not very satisfied with this method. According to statistics, among all forms of advertising, pop-up ads rank second in popularity with a 70% probability of rejection, followed by video ads played during content loading with a 57% probability (Zhang, 2021). So how to enable more consumers to open apps more frequently has become a top priority for online retail enterprises to consider.

H6: Big data can enhance the operational efficiency of the retail industry by enhancing active users

(7) Big data enhances conversion rates

Triage is the first work and then needs to achieve transformation, which is to make potential customers real customers, generate real buying and selling transactions, and realize the value of retail enterprises. In 2022, the conversion rate of website visits for global e-commerce was only 2.86%, which means that only one opportunity to generate revenue for the store occurs out of approximately 35 visits (Jiang, 2023). Meanwhile, data shows that in 2022, 41% of consumers can celled transactions during online shopping (Liu P, 2023). So low conversion rate is the main factor restricting the increase in online sales, and through data processing technology

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can effectively help enterprises improve conversion rate and accelerate the pace of consumers from "browsing" to "buying".

H7: Big data can promote the efficiency of retail operations by increasing conversion rates

(8) Big data enhances repurchase rate

The dividend for new users is limited, and only through multiple repeat purchases by users can a company achieve long-term profitability and survival. Firstly, the cost of repeat purchases is lower for users, and secondly, the returns on products that are constantly re purchased are higher.

H8: Big data can promote the efficiency of retail operations by increasing repurchase rates.

Research Methodology

In the development process of the traditional retail industry, it is necessary to use various schemes to cope with the various impacts of the current online retail, further realize its own transformation, so as to create a high-quality online and offline combination model, in this link, the e-commerce platform should pay attention to the gradual development of the stock level zero-sum game model (Yu, Chavez & Jacobs, 2018). At present, in the process of the development of e-commerce platforms, the operation and drainage costs have increased significantly, and more and more e-commerce stores have begun to attach importance to the corresponding combination with physical stores. Both the single entity model and the e-commerce model have encountered bottlenecks in the development process, and these factors have also promoted the rapid progress and development of the new retail industry. The combination of offline mode and logistics mode. The three core factors in the development process of new retail and traditional retail are personnel, goods and venues. However, under the new retail model, the reaction direction of the above three factors has changed, thus realizing the traction from the consumption field to the production field. Under the influence of the new retail environment, the retail industry is in a state of gradual transformation (Raffoni, Visani & Bartolini, 2018). At present, various emerging concepts such as social media marketing and scene marketing have emerged. As one of the most important retail formats, the current competition of physical supermarkets also reflects the characteristics of white-hot. The development of online channels has become a development strategy that the current entity needs to attach great importance to, which has directly led to a new industry reshuffle (Dremel, Wulf & Herterich, 2017).

Samples Size

This article mainly uses big data technology to collect and statistically analyze the application of big data in physical offline retail and online retail. The retail industry involved includes retail products such as food, clothing, and hardware. The sample size includes sales data and big data technology applications from 300 online

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and offline retail enterprises. During this process, sales data and big data technology applications of 300 retail enterprises were collected based on the three categories of food, clothing, and hardware.

Research Methods

Conduct theoretical analysis on the application of big data through literature research, and master the main statistical analysis methods of big data application. Then, data entry and simple statistical work are carried out using EXCEL software, and in-depth statistical analysis is conducted using SPSS data analysis software.

Data analysis

Data analysis mainly uses Excel and SPSS software to statistically analyze the collected data and analyze the application of big data technology in the retail industry.

This article uses the spatial Tobit model to analyze the application research data of the big data retail industry. The goal of studying the spatial Tobit model is to explore the relevant relationships that exist in space, in order to help us better understand the social relationships of things.

Spatial matrix (w): Used to represent the spatial distance weights between planar data, it is a particularly important parameter and can be the difference distance in economic, spatial, and other regions.

Moran's index (I): mainly used to test whether there is spatial autocorrelation in the data, in order to conduct spatial Tobit models! There are three ways to test for spatial relationships, with increasing strictness. Of course, there are many other methods to test spatial relationships. Local Moran's test is the existence of local spatial autocorrelation indicators (aimed at measuring the differences between a certain region and its surroundings, to represent the differences in the distribution of high and low levels around it, 0 represents no differences between regions, 1 represents positive correlation between regions, high to high, low to low relationships, etc.).

Research Finding and Discussions

Analysis of the Overall Effect of Big Data on the Development of Retail Industry Applications

Table 1 of Benchmark Regression Results of Big Data on the Development of Retail Industry Applications

Variable	Uncontrolled variables	Adding control variables
Big Data Improves Retail Business Efficiency Big Data Improves Retail Business	1.625	1.327
Big data optimization of product display		0.254
Big data adjustment facilities and equipment		0.629

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Big Data Helps Enterprises Optimize Business Management		0.371
Big data evaluation and feedback on customer experience		0.226
Big data enhances consumer		0.247
Big data enhances active users		0.392
Big data enhances conversion rates		0.342
Big data enhances repurchase rate		0.156
Constant term	0.162	-0.427
sample size	300	300
R^2	0.852	0.916

Data source: SPSS statistics

The results show that the estimated coefficients of big data for the application and development of the retail industry are significantly positive, indicating that big data can significantly promote the application and development of the retail industry as a whole as shown in Table 1. This indicates that the application of big data technology in the retail industry can promote the transformation and upgrading of the retail industry and achieve digital operation through expanding sales channels, updating business models, etc., and improve the digitization, informatization, and intelligence level of the retail industry as shown in Table 2.

Table 2 Test Results of Model Estimation Form

	index	Statistic	df	p
LM inspect	Moran's I	9.352	1	0.000***
	LM	132.264	1	0.000***
	Robust	126.352	1	0.003***
LR Wald inspect	LR chi	40.362		0.000***
	Wald chi	26.547		0.000***
Hausman	LR chi	15.623		0.000***

Data source: SPSS statistics

*Remarks: *, * *, and *** respectively represent passing significance tests at the 10%, 5%, and 1% levels.*

In order to better reflect the impact of big data on the development of retail applications, this article constructs spatial Tobit models based on geographic distance weight matrices for random effects (nonF), individual fixed effects (sF), time fixed

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effects (tF), and individual time double fixed effects (stF) for estimation as shown in Table 3.

Table 3 Spatial Measurement Results of Big Data on the Development of Retail Industry Applications

variable	nonF	sF	tF	stF
Big Data Improves Retail Business Efficiency Big Data Improves Retail Business	0.625	0.451	0.625	0.623
Big data optimization of product display	0.103	0.210	0.105	0.121
Big data adjustment facilities and equipment	0.095	0.106	0.142	0.210
Big Data Helps Enterprises Optimize Business Management	0.169	0.127	0.204	0.216
Big data evaluation and feedback on customer experience	0.062	0.068	0.059	0.044
Big data enhances consumer	0.204	0.168	0.218	0.221
Big data enhances active users	0.096	0.057	0.062	0.087
Big data enhances conversion rates	0.163	0.205	0.215	0.123
Big data enhances repurchase rate	0.326	0.320	0.225	0.241
Constant term	0.221	0.214	0.216	0.214
sample size	0.201	0.120	0.212	0.106
R^2	0.216	0.215	0.246	0.274

Data source: SPSS statistics

Based on the estimation of the four spatial econometric models mentioned above, the individual fixed effects are selected to decompose the spatial spillover effects by combining the model R2 and coefficient estimation results. The results show that all three effects of big data are significantly positive, indicating that big data can drive the development of retail applications in the local and neighboring regions. From a practical perspective, big data itself has high permeability and radiation, which can promote the development of the local retail industry and form a demonstration effect, providing advanced experience and reference for neighboring regions, thereby indirectly promoting the application and development of the retail industry in neighboring regions.

Conclusion and Recommendation

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Conclusion

Throughout the history of the entire retail industry, we can easily see two characteristics: firstly, the changes in retail formats are closely related to the development of technology, and secondly, these two mutually promoting processes are moving forward at an increasingly fast pace. From traditional department stores to supermarkets and shopping centers, to e-commerce, mobile e-commerce, and today's new retail, the duration of each stage is becoming shorter and shorter, and the development speed of business and technology far exceeds people's imagination. This acceleration has led to a common problem faced by the retail industry: in the past, retail mainly relied on experience - where to open a store, what to sell, and how to place goods. Today, relying on years of accumulated experience, retailers can still do something, but they will clearly feel that doing it becomes more and more difficult. Young users, fast iteration trends, and ever-changing demands all make experienced retailers feel at a loss.

Recommendation

Big data should help promote supply side reform in the retail industry

At present, the domestic fresh product supply chain is long, and farmers far from the market usually can only choose planting varieties based on last year's market situation, or obtain market information from wholesalers and rural brokers. However, this information is often lagging behind. If fresh products with good sales last year are planted on a large scale this year, it will lead to oversupply and a shortage of supply for other categories, leading to unsold and rush to buy agricultural products, In the second year, farmers will continue to choose best-selling products based on this year's market, which will cause the prices of this category to plummet next year. As a result, fresh food prices have skyrocketed and fallen into a vicious cycle.

Retail enterprises should maintain a correct attitude towards the use of big data

Retail enterprises should first attach importance to big data, development of data centers and big data technology, and make collecting a wider range of data, including customer data and enterprise data, an important part of their work. Secondly, a training system and management mechanism should be established to provide big data training and instill concepts in internal personnel of the enterprise. Thirdly, based on business needs, clarify which data needs to be collected as a priority. However, non-priority data is not garbage, and it also needs to be properly stored for future needs. Fourthly, within our capabilities, we should build the infrastructure required for big data in advance, such as data storage centers.

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