The Use of Big Data in the Take-out and Delivery Market in China

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Abstract

The initial development of the takeout industry was in the form of packaging. Later, with the popularity of telephones and mobile phones, people began to order by telephone to meet the needs of some customers who didn't want or didn't have time to go to restaurants. Since the 1990s, the Internet began to popularize, which made the takeout industry develop unprecedentedly.

Now, after several years of rapid development, the takeout industry has already developed a mature industrial chain. Although it is a labor-intensive industry, the current takeout industry has joined Big Data, cloud computing, Internet of things and other technologies. Especially in recent years, with the introduction of Big Data, major takeout companies have developed their own Big Data analysis system to continuously improve and optimize the takeout system through the introduction and analysis of a large amount of data.

This paper aims to study the boosting effect of Big Data on the takeout industry, especially how to analyze and optimize the takeout time, takeout path and so on through Big Data analysis in China's takeout market.

Keywords: Big Data, take-out, delivery industry

1. Introduction

In recent years, due to the rapid development of the Internet, the extensive use of the Internet of things and Big Data has brought new industrial upgrading to major industries. The sales volume of traditional offline stores is shrinking year by year, so the addition of e-commerce is almost unstoppable. The catering industry has gradually developed and transformed from the original offline industry into a form of online and offline interconnection. The traditional store consumption has gradually changed into today's o2o mode.

The full name of o2o is online to offline, which can be simply understood as a new trade model of two-way flow between online and offline. It mainly appears in takeout, retail and other e-commerce industries. By incorporating online sales channels, traditional offline enterprises can also supply diverse types of services. Customers can browse catalogs, check the price information and availability of products online, and even place orders before visiting offline stores. Therefore, online channels can increase the sales of offline channels. This successful mode is known as online to offline (O2O) commerce[1].

The establishment of o2o mode is inseparable from Big Data. The key to the establishment of o2o mode lies in the integrated marketing mode of online and offline. Behind this integration is massive data connectivity and information analysis. These need Big Data to achieve.

Therefore, Big Data has entered almost all e-commerce under o2o mode. With the advent of the information age and the continuous development of Internet technology, people have gradually entered the era of Big Data. The era of Big Data has brought great changes, not only in our daily life, work and thinking, but also in our business model and management model. It has brought about the transformation of the whole era.

Big Data is a field that treats ways to analyze, systematically extract information from, or otherwise deal with data sets that are too large or complex to be dealt with by traditional data-processing application software. Data

with many fields (rows) offer greater statistical power, while data with higher complexity (more attributes or columns) may lead to a higher false discovery rate[2]. In the takeout industry, the system intelligently matches orders through massive historical takeout order data, the positioning data of delivery personnel, accurate historical delivery timing and merchant positioning, so as to realize automatic allocation and optimal allocation of resources.

2. Background and Theory About Big Data

2.1 Background

2.1.1 Development History of Takeout Industry

a. Global Perspective

The earliest meal delivery service appeared in South Korea. The local specialty meal called Haejang-guk are often sent to the customers by the restaurant. But the first recorded meal delivery was on pizza: in Naples, Italy, in 1988, the king and queen wanted to taste local cuisine. So, people brought them delicious pizza. Later, people specially named this pizza Margherita. During this period, there was no so-called takeout industry. It was only a special service for the privileged. Large scale meal delivery appeared in India at the end of the 19th century. Since a large number of Indian workers have no time to return home for lunch at noon, there is "one who carries the box", which is locally called Dabbawala[3]. Dabbawala will bring lunch from home or restaurant to the workers' workplace and provide lunch delivery service. Unlike now, Dabbawala not only needs to provide lunch, but also needs to provide the service of cleaning lunch boxes. Then the first Chinese takeout appeared in 1922. Kin Chu restaurant in the United States uses telephone technology to provide reservation and delivery services. It is worth mentioning that a century later, the best takeout service is still Chinese food.

Large scale takeout service appeared in the 1950s. Due to the technology of telephone and telephone and the increase of car ownership, many restaurants began to provide meal delivery services one after another. Since the 1960s, the rules of takeout service have been gradually improved. This perfection was brought by the leading catering company at that time. When delivery times for takeout declined overall in the 1960s, the founders of domino pizza assured customers that their pizza would reach customers within 30 minutes. In the 1990s, Pizza Hut launched one of the earliest web-based food distribution websites. This also provides an early example for later digital distribution.

In 1995, the first online restaurant takeout platform was launched, called world-wide waiter. It was founded by Craig Cohen and Michael adelberg, graduates of Stafford University Business School. The emergence of world-wide waiter pioneered the concept of online restaurant ordering. It has more than 60 restaurants in San Francisco and provides delivery services to customers. Expanded to more than 1000 restaurants in 2017. This is the first appearance of online ordering platform[4].

In the 21st century, takeout service has rapidly become the mainstream with the popularity of the Internet era. Revenues in the takeaway industry have only increased since 2017 and can be seen in Figure 1. Major takeout platforms have emerged one after another, and takeout websites and takeout mobile applications basically dominate the takeout service industry. Customers only need to book and pay online to get the meal delivery service. In 2019, with the global outbreak of COVID-19, the development of takeout reached a new peak.

The emergence of COVID has brought global collective isolation, and various countries have introduced different degrees of going out ban and gathering ban. Many places have closed restaurants and various public indoor dining spaces. This means that if customers want to eat delicious food made by others, takeout is almost the only choice. This has brought major global take-out companies significant incremental sales (see Figure 1).

Figure 1. The COVID-19 delivery boom[5]

Restaurant takeout has shown an extremely rapid development trend in the past five years. It is estimated that the sales of online food distribution will reach 220 billion US dollars in 2023. In addition to personnel distribution, today's food takeout has even introduced various forms such as robot distribution. Countries have also emerged strong third-party restaurant delivery platforms. Major delivery service platforms in Europe include but are not limited to Deliveroo, Delivery hero / Food panda, Uber eats and Wolt. Food delivery services in South America include Doordash and Grubhub. India takes Zomato and Swiggy as the main platforms, and South Korea has Baedal Minjok, Yogiyo, Uber eats and Coupangeats. As the fastest-growing takeout market in China, its main platforms are Ele.me Yao acquired by Alibaba and Meituan supported by Tencent, which have strong strength.

b.   Chinese Perspective

In the Tang Dynasty of China (618-907 AD), takeout appeared. Like the origin of world development, takeout at that time mainly served the privileged class. The then emperor of the Tang Dynasty, Tang Xizong, urgently summoned his minister Wu Cuo, who was preparing a banquet to entertain his friends at that time. In desperation, Wu CuO sent people to buy dishes directly from the restaurant and arrange the banquet. This is the earliest takeout. But at this time, there is no large-scale specialization, just a single behavior of the privileged class. In the Song Dynasty (960-1279 AD), large-scale meal delivery appeared. In the Song Dynasty, there were specific people waiting at the door of high-end restaurants, waiting for the staff in the store at any time to give them tasks, like asking them to deliver meals to the door. The rich people who eat in restaurants will also let them run errands and help buy other things occasionally. The development of takeout in the Qing Dynasty appeared professionalization, and the takeout personnel were sparse and ordinary. The picture of Suzhou prosperity written by Xu Yang, a court painter in the Qing Dynasty, appeared the figure of takeout workers. Although the development of these takeout is very early and has a certain scale, they do not have a professional level. Takeout is not the main way for people to eat. In ancient times, takeout personnel were more like service personnel engaged in delivering goods and running errands. For them, they also provide the same service when you replace meals with anything else, like goods, vegetables, people.

In modern times, the first thing to appear is restaurant packing. Packaging is the earliest form of takeout. Although it is ancient, it continues to this day. Today, many people still buy meals by packing. Telephone orders follow. With the popularity of telephone and mobile phones, telephone ordering has gradually become the main means of takeout industry, which also makes the takeout industry develop rapidly. Compared with Restaurant packaging, telephone ordering has greatly stimulated the development of takeout industry with its advantage of no door-to-door. Then website ordering became a popular choice. With the popularity of the Internet in the 1990s,

the takeout industry has developed rapidly. Students and white-collar workers have become the main force of website ordering. It has also developed many Internet ordering enterprises.

We can simply divide the development process of takeout in modern times into three periods.

c.   Development Chaos Period

From 2008 to 2016, it can be said that it is the embryonic era of takeout and the pioneering era of takeout. This period is the dividend period of takeout. In this era, when there are three pillars and a scuffle among heroes, the rapid development stage of the takeout industry belongs to the "subsidy war" of the takeout platform, which has a large scale and impact. At the same time, it can be seen that the market is chaotic and there are no rules at this stage.

2.1.2 Intensive Tillage Period

From 2017 to 2018, the scale of China's takeout market has reached 400 billion yuan, and the pattern of takeout platform has been basically determined. The development of takeout has entered the situation of two strong forces competing for hegemony, and takeout has entered the era of intensive cultivation. Many physical catering brands with their own traffic have settled in the takeout platform, and these head catering businesses have also become the focus of platform operation services at this stage. At the same time, the number of small and medium-sized catering businesses on the platform is also growing.

2.1.3 Refined Operation Period

In 2019, the development of takeout has entered the era of fine operation, which is characterized by product foundation, traffic core and data operation. Convert data into traffic, and then convert traffic into profits. During this period, the scale of takeout continued to grow, but the year-on-year growth rate decreased. However, to protect the interests of businesses and users should be the original intention of takeout.

There is a very special form of takeout in China: WeChat ordering. As the most widely used social media in China, WeChat occupies a very important position in various markets in China due to its large applicable population and high-density social information. In 2012, with the rapid development of smart phones, WeChat developed rapidly with an irresistible momentum. On this basis, many secondary development around WeChat have been derived. Among them, the most striking and essential include the development of WeChat takeout. In the era of mobile applications dominated by app, WeChat secondary development, with its absolute advantage of no download and no occupation of desktop space, has occupied many app markets and become the preferred development field for businesses. Online ordering mode first emerged in the United States. Of course, the rise in the United States has its unique cultural advantages. For example, foreigners prefer to book meals in advance. Domestic online ordering is still in a chaotic state of feudalism, and each major website occupies its own soil and water. However, with the Matthew effect becoming more and more obvious, the online ordering market is also undergoing a new reshuffle. Ordering websites with sufficient funds are rapidly expanding their branches in major cities and occupying market share.

Based on the derivative of online ordering, half-hour WeChat ordering stands out from online ordering. As a service for Tencent's WeChat mobile app to obtain takeout information. Various WeChat functional services grafted through the half-hour WeChat open platform interface have greatly developed and enhanced the value of WeChat official account. Many ordering websites have opened WeChat service platforms to firmly grasp the huge resource of WeChat users and open up a broader market for their business. Using this service, you can not only get the information of takeout merchants, dishes and coupons around any service area. The service realizes direct ordering service and even online payment. This is a new take away ordering method and concept that breaks through the tradition.

From 12 years to now, China's takeout industry has experienced more than eight years of brilliant development. Users have increased from less than 100 million in 12 years to more than 400 million now. The scale of China's online takeout users has increased year by year. It is expected that the scale of China's online takeout users will continue to grow to 450-500 million in 2020. It can be seen that the overall takeout market is getting better and better. The catering takeout industry mainly includes three related industries: supply, distribution and demand, which are connected by the takeout platform. With the popularity of mobile Internet, the takeout platform has emerged. After the emergence of the platform, it has excavated the potential demand and activated the potential supply, accelerated the development of distribution, and gradually formed the current takeout form.

In fact, before the rise of domestic takeout platforms, there were also some takeout forms, such as Mai Le delivery, house express delivery, Lihua Fast food, and even restaurants. However, due to the limitation of the distribution capacity and scope of stores, they can only serve the surrounding customers.

However, with the rise of mobile Internet and mobile payment, the online takeout market really broke out in 2014; In that year, Dianping and Meituan successively launched the takeout channel, Baidu acquired glutinous
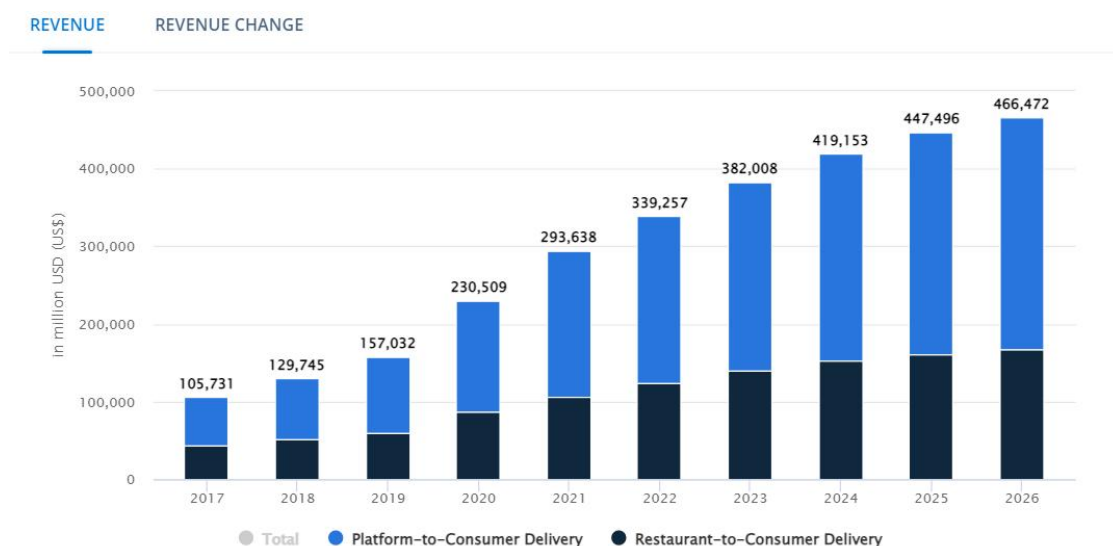
rice and launched its own takeout service, got $80 million capital injection from Dianping, and completed $50 million round D financing for home food.

2.2 Theory About Big Data

With the progress of the times, the rapid development of the Internet and the continuous upgrading of smart phones. It has brought more and more convenience to people. Many traditional industries have to constantly change to adapt to the changing times. The traditional catering industry takes dining in the store as the main service form, but with the emergence and development of takeout, more and more takeout platforms have emerged. Especially after the outbreak of COVID-19 in 2019, the situation of isolation and closure appeared all over the world. People have to stop many plans to go out and stay at home, which has led to the unprecedented rapid development of the takeout industry in three years.

In recent years, the income of the takeout industry has been growing. It is estimated that by 2022, the revenue of the takeout industry will reach more than $300 billion, see figure 2. The biggest income is in China. In other words, the development of China's takeout industry is second to none in the world.

With the continuous expansion of the takeout market, major takeout platforms began to optimize and improve themselves from all aspects, including background data collection, calculation, analysis, output prediction and so on. The addition of Big Data is a matter of course. Taking UberEATS as an example, customers place an order on the platform, the platform pushes the order to the merchant, the merchant prepares the meal, the distributor obtains the information, goes to the merchant to pick up the meal, and then arrives at the place designated by the customer according to the distribution path to complete the distribution. This whole step is inseparable from the monitoring and help of background data.

Figure 2. Online food delivery revenue[6]

2.2.1 The Evolution of Big Data

Big Data as a specialized term for computer information processing has only emerged in recent times. The term Big Data first appeared in research articles in the context of meteorology and ocean exploration, referring to roughly the processing of the large amount of data generated. It is only since the 21st century that the term Big Data has gradually become a proper noun in the field of computing. Although the term Big Data came late, the act of people organizing data, processing information and analyzing data emerged really early. Technically speaking, people were already analyzing and processing data when the American scientist Herman Hollerith created an electric tabulating machine based on electricity to store computational information in 1889. In Lee

divided the development of Big Data into three phases:1.0, 2.0 and 3.0 era. Lee considered 1994 to 2004 as the first Big Data development brought by the emergence of e-commerce. The technology at this time only analyzed the online activities of users. The 2.0 era, driven by social media from 2005 to 2014, has brought about the online interaction of users. From 2015 to the present is the 3.0 era according to Lee, which represents the development of IoT applications. It is a new era of combining image, audio and video[7]. The definition of Big Data is also becoming more complete with the development of Big Data. Doug Laney has pointed out the theory of 3 v's for Big Data - volume, variety, and velocity[8]. In addition to the original 3v's, the velocity of input and output of Big Data was also proposed[9]. Nowadays, Big Data has the concept of 7v, which adds Validity, Value and Volatility, Value and Visibility, Variability, Visualization, etc. The introduction of these concepts makes the definition of Big Data perfect and precise.

As a new data tool, Big Data has many characteristics that traditional data sources do not have, such as low cost, real-time, resource integration and so on. It is widely used in various fields of data collection, integration, analysis and prediction. People use it to extract existing data and predict future data. Weiss and Indurkhya note that ...very large collections of data ... are now being compiled into centralized data warehouses, allowing analysts to make use of powerful methods to examine data more comprehensively[10]. With the development of Big Data, it is gradually introduced into various fields and widely used in construction, government organizations, health care, education, media and other industries. Martin Hilbert once established a three-dimensional framework to completely discuss that Big Data provides a very effective prospect for decision-making in medical treatment, economic productivity, crime, nature and so on. Martin pointed out that Big Data provides additional information sources, including (a) information flow and (b) information storage, and (c) information processing[11].

With the application of Big Data involves a wide range of fields, relevant research also shows an obvious growth trend. Even though people realize that Big Data is gradually acquiring and analyzing customers' preferences through a large amount of historical information, the takeout industry is still an emerging industry in more countries. There are few relevant studies on the application of Big Data in the takeout industry and its impact on the takeout industry. In 2019, Hak Seon Kim and Jonghan Kim analyzed the impact of social networks in Google's web on takeout. They collected a large amount of keyword information on Google Web and Google new, and analyzed and sorted it through UCINET 6.0 and Netdraw. Finally, it is found that the takeout industry has a strong development trend and prospects[12]. Moreover, this through semantic network analysis by using Big Data is also an early example of analyzing the takeout industry through Big Data, which provides a reference paradigm for later research. Ravindra Kumar sing mentioned the positive role of social media in the takeout platform in today's Big Data era. It provides a lot of data for the takeout platform, so that takeout can accurately understand customers' preferences and continuously improve the efficiency of distribution these e-commerce businesses have obtained a very positive response from the consumers and are still improving. A successful demonstration can be seen in the online food delivery platforms here the time taken from ordering, to the food preparation, to its doorstep delivery is improving at an unbelievable pace[13]. Matthew keenly pointed out many benefits brought by Big Data in the article Big Data in food industry. It plays an irreplaceable role in monitoring traffic, construction weather, changes in routes, present climates, route changes, construction and distance [14].

The role and impact are obvious. Behind doing this is countless data accumulation, system optimization and algorithm operations. Batool and Hussam used cart and C4 5 decision trees, random forest, and rule-based classifier and other algorithm models to evaluate the accuracy of Big Data in predicting customer decisions. Finally, the best result is found, and the accuracy can reach more than 91%. Building the right prediction mode, which combines high prediction accuracy with sound reasoning, can assist decision-makers in reaching accurate conclusions about the major determinants of customer satisfaction, hence increasing the likelihood of repeat purchases[15]. Some scholars simulate the investigation of different factors on customer satisfaction through Big Data analysis. Using Octopus web data collector to collect online customer data, and analyze the data with Python program can quickly analyze the impact of food quality, distribution quality, takeout service quality and other factors on customer satisfaction[16]. Some restaurants order meals online through websites. Behind it are HTML, SQL and other databases and network data management systems. Customers place orders on the restaurant website, which manages all kinds of orders through programming code. The background management system then assigns and checks orders to help staff effectively execute orders. Karan Dhiman fully demonstrates this process in his paper, databases can be compared to a complex digital cabinet. That is what can help us organize all or most of the information throughout our app. We completely control the installation, modification, and deletion of our database[17].

There are also few scholars' relevant research on the prediction of delivery timing and path by Big Data. Some scholars use random forest (RF) algorithm to predict the delivery time of takeout. This algorithm has a significant advantage handles a large number of input variables speed[18]. With a large amount of data input, we can quickly get the distribution time with an accuracy of about 70 through the Big Data algorithm, including

traffic conditions, distribution distance and other factors.

2.2.2 Big Data and Organizational Management

In 2012 Andrew McAfee's article in Harvard business review suggested that the emergence of Big Data is a huge change in organizational management. With the explosion of data and the infinite influx of information flow, Big Data brings an unprecedented form of change. Thanks to Big Data, managers can see and judge their work from real information and continuously improve their methods and decisions from it[19]. This is why Big Data is seen by many business companies and organizations as a potential growth opportunity. These leading companies are listed and analyzed in GalbRaith's article *Organization Design Challenges Resulting from Big Data*. He points out that the emergence and introduction of Big Data has brought about two major characteristics of information: mass and immediacy. Due to the breadth and speed of data, it determines the change of today's management system. He needs new competent managers to make the right decisions in response to the massive amount of information. The first company to embrace and make changes will have a head start, with P&G and Google being good examples[20]. In her article, Janne J. KOrhOnen analyzes in detail how the analytical power of Big Data is reflected in the "requisite organization", and how it will change the organizational structure of the future. The powerful and accurate analytics of Big Data provide the basis for organizational structures that bring about data sharing across the enterprise. Quantitative fact-based analytics bring about a consistent organizational structure. Janne points out that the increasingly complex organizational structures of the future will require Big Data to tie them together. Requisite organization defines the complex ordering of organizations, and Janne hopes to incorporate new strategic dimensions to measure and document complex organizations through Big Data analytics strategies[21]. Almost everyone sees the new innovation and competitive advantage that Big Data brings, but the current targeting of how Big Data actually translates into productivity. How to create value from this ubiquitous real-time data, and how to turn this value into business models and governance tools are still being studied by scholars and experts in major fields.

While the more structural changes brought about by Big Data have yet to be fully analyzed, many of the advantages that Big Data brings are obvious. The most obvious one it offers is its economic advantage, as Big Data brings massive amounts of data and data storage at a low price. So, companies with Big Data can process more data in the same amount of time and at the same price, increasing their sales, sales volume and ROI on the side[22]. The first value of Big Data is that it can produce results that cannot be achieved with a small amount of data. Big Data analyzes and produces results based on massive data sources that are unmatched by other data analytics. The second important attribute of Big Data is that it overcomes the limitations of traditional sampling, and Big Data has an extremely wide range of data sources. The main sources are (1) public data, (2) private data, (3) data exhaust, (4) community data, and (5) self- quantification data[23]. Because the overall size is so large, Big Data will reduce inference and automate the collection of information to bring more certainty[24]. Big Data has a pivotal role in decision making due to the large sample size and accurate results. Big Data has strong predictive analytics capabilities, which include but are not limited to predicting outcomes, predicting patterns and relationships in analyzed data. The value between Big Data and Big Data analytics is realized by improving the quality of such decisions. Although there are many factors that affect the quality of such decisions, the more decision makers understand the relationships between variables, the higher the quality of decisions will be[25]. So, the advent of Big Data has changed the decision-making layer in the original organizational structure to some extent. It requires more competent decision makers to make more accurate decision analysis, thus changing the entire organizational structure framework. This has led some scholars to propose a new advantage that Big Data brings to management, namely dynamic decision-making capabilities. The dynamic capabilities (DCs) view suggests that organizations should be capable of renewing and recreating their strategic capabilities to meet the requirements of changing environments[26]. The term 'Big Data' refers to data sets that are very high in velocity, volume, and variety, which makes them incompatible with traditional techniques and tools. The effective use of fast moving and large-scale data sets can transform the decision-making approach taken by organizations[27].

Slimly put, the era of Big Data has brought great technological changes and changes in thinking for mankind change, with more emphasis on data integrity rather than randomness, confounding rather than and correlation rather than causation. The application of Big Data has provided researchers with unprecedented opportunities to understand human behavior on a large scale. unprecedented opportunities. They can reveal patterns of human behavior that are difficult to observe in laboratory studies and they can reveal patterns of human behavior that are difficult to observe in laboratory studies, and provide a level of biological validity that is often lacking in traditional studies. On one hand, they offer a wealth of opportunities to deepen our understanding of human behavior. On the other hand, they provide ample opportunities to deepen our understanding of complex organizational phenomena such as employee selection and recruitment, performance management, organizational decision making, team dynamics and behavioral interactions. On the other hand, it also provides a wealth of opportunities to deepen our understanding of complex organizational phenomena such as employee selection and recruitment, performance management, organizational decision making, and team dynamics and

behavioral interaction[28].

2.2.3 Big Data and Take-out Industry

In recent years, the restaurant industry has gradually shifted from in-store consumption to an online ordering model, or 020. the arrival of the epidemic era is pushing this model to the forefront. For the catering industry from offline to online transformation, the basis of which lies in logistics and distribution. When customers no longer go to restaurants but at the same time want to get delicious and warm dishes, instant and fast delivery becomes the key to determine the success of the take-out platform business model. Many scholars have recognized this digital sink in take-out platforms. Big Data is involved in everything from ordering, delivery, payment, evaluation, marketing, etc., i.e., Big Data site selection, supply chain, stocking and procurement, booking and dispatching, etc.[29].

The intelligent dispatching system is the core of take-out logistics, relying on massive historical order data, rider (deliverer) positioning data, accurate merchant characteristics data, and intelligent matching of orders for real-time rider scenarios (task volume, delivery distance, and single situation, rating to achieve automated dispatching and global optimal allocation of resources, maximizing user experience while ensuring system efficiency[30]. The so-called intelligent scheduling system is to meet the analysis and utilization of data through Big Data. The take-out delivery problem can be summarized as Instant Pickup and Delivery Vehicle Routing Problem with Time Windows (IPDVRPTW), and the study of this problem involves the intersection of multiple fields such as take-out, pickup and delivery path problems with time windows, and combinatorial optimization algorithms[31]. The problem that needs to be solved by Big Data is to reduce the delivery distance of the take-out workers, effectively improve the efficiency of the take-out workers, and reduce the delivery cost by reducing the distance, which is actually the TSP problem[32]. Among them, the complex roads of traffic flow in the city have a great impact on the optimal path finding problem for take-out delivery[33]. Different algorithms are different for finding the optimal path. Genetic algorithm is used to find the optimal path for the logistics delivery path of pharmaceutical products[34]. The university campus, which has a high concentration of college students and a strong consumption level, has become the main area for take-out delivery by third-party platforms, and the intricate delivery routes within the campus are often considered by take-out workers for delivery[35]. The adaptive genetic ant colony hybrid algorithm is used to solve the TSP problem of campus delivery, which can effectively solve the route planning problem of campus delivery[36].

The ability of Big Data to optimize the delivery path is the most obvious. In addition to this, thanks to the Internet, a direct feedback between the customer and the platform has opened up that has never been possible before. Customers fill out and post their reviews directly on the major platforms. And Big Data collects and organizes all of this so that merchants can launch more accurate product packages. Merchants can use Big Data to better segment their markets and improve the competitiveness of their take-out[37].

Meanwhile, the procurement and management of raw materials for take-out can also be made optimal through Big Data. It is easy to have calculated and verified the quantitative relationship between the quantity of ingredients purchased and the main factors, and the restaurant can easily calculate the total amount of ingredients needed daily for that time period with the required data[38]. Some scholars have also proposed building a food safety cloud data information platform to collect food safety information and thus build a data model to visualize the data to achieve Big Data regulation of food safety[39]. Restaurant Big Data plays a great role in the analysis of consumer habits to form consumer portraits, regulation of restaurant safety, and diversified service recommendations, processing and organizing seemingly disorganized data into dimensional connections[40].

3. Current Situation of Chinese Market

3.1 Chinese Takeout Market Management and Big Data Use

In 2018 the People's Republic of China published an article discussing the current state of development of the take-out industry. By 2017, there were more than 4 million employees in China's take-out industry. As a labor-intensive industry that relies heavily on manual labor, the take-out industry has gradually introduced high technologies such as Big Data, cloud computing, Internet of Things, artificial intelligence, and more. Merchants and takeout platforms use intelligent logistics dispatching systems to dispatch orders, Big Data to collect and analyze delivery data to plan the optimal route, and later customer evaluation systems to collect and analyze information. At present, Meituan, Ele.me, Baidu takeout and several other large Chinese take-out platforms have their own intelligent systems.

3.1.1 O2O

020 is online to offline, combining online and offline. For all the major types of industry enterprises, 020 is the inevitable trend of mobile Internet. And the outbreak of the new crown has accelerated this trend. As 020 connects online and offline information, so along with 020 is the data produced by the Internet all the time, the analysis and excavation of these massive data must require intelligent optimization of Big Data and assist in

decision-making. 020 is online to offline, combining online and offline. For all the major types of industry enterprises, 020 is the inevitable trend of mobile Internet. And the outbreak of the new crown has accelerated this trend. As 020 connects online and offline information, so along with 020 is the data produced by the Internet all the time, the analysis and excavation of these massive data must require intelligent optimization of Big Data and assist in decision-making. The O2O model takes advantage of the Internet's cross-regional, cross-temporal, massive data and large number of users, and holds an extremely large consumer data resource. And Big Data brings this data resource to the extreme, providing a competitive advantage for merchants. 020 combines online users and offline service transactions, while bringing large-scale, high-viscosity users through the analysis and processing of Big Data.

(1) Customer Precision Marketing

For merchants this advantage is almost obvious. 020 unifies online orders and offline consumption, so that all consumption behavior can be accurately counted. The addition of Big Data helps merchants and platforms to grasp relevant data about users, analyze and reuse it, thus achieving the purpose of accurate marketing and further maintaining and expanding users more easily. In O2O intelligent precision marketing in the context of Big Data, after mining customer data, we can understand the customer's consumption tendency, consumption habit and consumption level. Based on the results of Big Data mining, analysis and decision making will be made on more accurate data results, and the precision marketing model is built on this basis. The precision marketing model is based on this foundation[41].Take any large mall for example, the mall offers free Wi-Fi to all customers or discounts on purchases to encourage everyone who enters the mall to become a member. The members then enter any store to spend money and their spending behavior is recorded one by one. The mall will integrate online and offline membership data in the backend. Big Data is used to analyze consumers' spending habits, spending preferences, spending time and other information. In turn, the products suitable for them will be precisely pushed to enhance the consumption experience of members. Figure 3 illustrates this architecture.
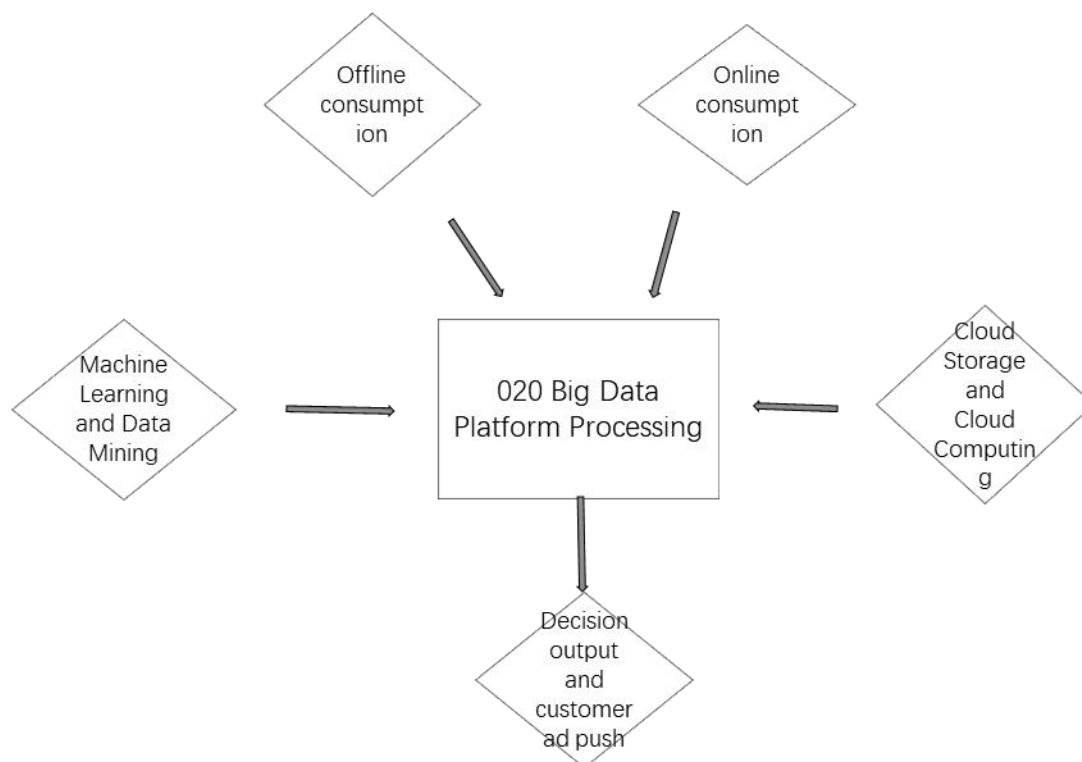

Figure 3. Big Data platform architecture

(2) Closed-Loop Structure

On the other hand, the addition of Big Data makes the online and offline form an effective closed-loop structure. Online marketing, promotion and advertising can accelerate customers to go offline to experience consumption, and then return to online feedback experience, give evaluation and even online communication between customers. Merchants and platforms again from this closed loop to complete the task of consumption, and access to more data, you can further optimize the service. This is the reason why many attractions and restaurant

scoring apps appear today. To China's takeout platform Ele.me for example, it's 020 closed-loop implementation of the first through the online app and web page publicity and major social media platforms advertising delivery to customers through online promotion led to the line to spend to trade. After Ele.me then through their own payment structure to allow users to order and pay online, the restaurant also in this system for settlement, the offline behavior re-directed back online, to achieve a closed loop. And in this closed loop of Big Data, data circulation, data storage, data analysis and reuse is the key to the closed loop can operate in harmony.

Alibaba establishes an e-commerce platform through Taobao and completes offline logistics and distribution through Cainiao. Tencent uses QQ and WeChat to form a huge social media network to obtain massive amounts of user information, and then has a built-in public website and other features to form one of the largest online promotional platforms in China. China's leading Internet companies are working hard to expand their online platforms, collect information and then achieve a more complete 020 closed loop. This is because only a closed loop based on consumer data can provide a more accurate understanding of consumer needs and generate stronger consumer stickiness. Their aim is undoubtedly to create a perfect 020 closed loop through the addition of Big Data and the integration of online and offline, so that every indicator in the data can maximize the value of goods.

3.1.2 Optimal Route

The most important function of Big Data for take-out is reflected in the intelligent scheduling of take-out logistics. Simply put, Big Data is based on a large amount of historical data, according to the data to complete the optimal allocation of resources, reduce costs and improve customer experience. But in the actual scenario this process is very complex. At present, the main delivery modes are self-delivery mode, O2O delivery platform delivery mode and third-party delivery platform delivery mode. Most of them are 020 takeout platform delivery mode. Thanks to the support behind Big Data, the 020 takeout platform delivery has a unified delivery strategy and a strictly controlled delivery time frame, low-cost time fast making it fast to have a large number of customers.

Takeout delivery is simply a path planning problem: how to achieve the goal of the shortest path in the shortest time based on the completion of the delivery route. Unlike most European and American delivery people, they generally deliver one order at a time. Chinese delivery is more complex. Due to the large volume of orders, Chinese deliverers will take multiple orders at the same time and then deliver them sequentially according to the optimal solution developed by the system. This kind of route planning can be seen as the Traveling salesman problem: the problem of how to travel to multiple vertices in the shortest possible time. First, the salesman starts from a fixed point, goes to the restaurant to pick up the food and then arrives at the customer's location to complete the order. The departure point is fixed, and there are many stopping points, and there is a certain sequence requirement for passing through the location. In the actual delivery process, the maximum delivery capacity of each delivery person is also considered because the delivery capacity of one delivery person is limited. The platform also has a time limit for each order, and the delivery person needs to deliver the delivery within the time limit. This is a problem similar to the traveler problem but with more constraints. Genetic algorithm, as a heuristic intelligent algorithm that translates the traveler problem by coding and simulates the natural selection process of biological evolution in the genetic space, is a classical algorithm to solve TSP[42]. The logic of this algorithm is to set the merchant location, customer location and the shortest distance between the two as d_{ij}, the distribution cost per unit distance as c, the number of deliverers as m, the current location of the deliverer as the origin 0, and the merchant and customer locations as 1, 2, ..., n, define the variables X_{ijk}. It is mathematically modeled as Figure 4.

$$\min \left(w_i * \sum_i \sum_k x_{ijk} c_i + w_2 * \sum_i \sum_j \sum_k x_{ijk} d_{ij} + w_3 * \sum_i \sum_k x_{ijk}(E_i - S_I) \right)$$
$$s.t. \quad \sum_{k=0}^{m} S_{ik} = 1, \qquad i = 1,2,\cdots\cdots,n$$
$$\sum_{i=0}^{n} \sum_{k=1}^{m} x_{ijk} = 1, \quad j = 1,2,\cdots\cdots,n$$
$$\sum_{j=1}^{n} \sum_{k=1}^{m} x_{ijk} = 1, \quad i = 1,2,\cdots\cdots,n$$
$$T_i \geq S_i + \frac{d_{ij}}{v}$$

Figure 4.

Based on scientific algorithms and massive amounts of historical information, large take-out platforms have built their own automated intelligent order dispatch systems through Big Data. Unlike early Chinese take-out delivery, which basically relied on the experience of delivery staff for manual order delivery. This subjective routing is no

longer reliable once you encounter peak meal times or locations beyond your experience. The addition of Big Data has changed this inefficient situation. From the merchant's point of view, although each merchant's dishes, the number of chefs is not the same but Big Data based on the historical data of the waiting time for the delivery staff to arrive at the merchant to reasonably plan the arrival time of the food delivery staff to reduce unnecessary waiting. From the customer's point of view, according to the historical evaluation of each customer, Big Data monitors and infers the patience level of different customers. Customers with high patience levels often get longer wait times, while those with low patience levels get shorter wait times. This is also the phenomenon of "Big Data discriminatory pricing (BDDP)" which is currently criticized by customers. From the point of view of the delivery staff, the delivery capacity, delivery speed and map familiarity of each delivery staff are different. The delivery person with high delivery capacity and fast delivery speed tends to be favored by the order delivery system and gets more orders delivered. At the same time, Big Data also possesses a simulation system, i.e., external factors such as traffic conditions and weather conditions at the time of order occurrence will also affect the overall delivery route selection. Combining historical order data, establishing simulation models, and using simulation systems to simulate the real delivery process and order distribution process can provide a more intuitive understanding of the rationality of the current delivery strategy for take-out orders, and can identify various problems that exist in it[43].

At the same time, as the take-out industry mainly relies on manual services, a large amount of data comes from the food delivery workers. This means that Big Data in the take-out industry can incorporate manual flexibility in a timely manner. As an example, building A has two doors B C, due to staff diversion and other reasons B door does not allow takeouts to enter, then the platform delivery system will automatically default to door C as the distance calculation point. But when the deliveryman enters the actual scene, he finds a short platform next to door B, where the customer can pick up the food, which is more convenient and fast. So, the deliverers will deliver the takeout at the small platform next to door B. When this data enters the backend system many times, Big Data will soon monitor this convenient location and update the data in time. This platform then becomes the new fixed point for the next distance calculation. Even if this small platform cannot be displayed on the map, it will become a new delivery point in the automatic dispatch system.

3.1.3 Evaluation Systems

When online platforms emerge, customers can order a variety of products without leaving home. But at the same time, it brings the information difference between online and offline that is not equal. Customers cannot perceive and fully understand the quality of products from online, let alone evaluate the merits of products. This is why the rating system was created. A large number of online users evaluate the platform products through their own experience, which results in a final overall rating. The rating of take-out merchants is a quantitative evaluation of the products and services provided by take-out merchants, helping customers and the platform to achieve superiority and reduce the cost of choice for consumers. User reviews are textual descriptions of users' real experiences after purchasing and using merchants' products or services. Fully mining and utilizing users' review information is of great practical significance for merchants to improve the quality of their products or services, for management organizations to manage merchants and for consumers to make purchasing decisions[44].

Such a scoring system is a treasure trove of information for Big Data. The characteristic price method theory assumes that diverse goods have multiple different characteristics or qualities. Then the consumer buys actually each different characteristic of the goods. As the number of online users continues to increase, consumers leave a huge number of product reviews on the platform is the evaluation of the different characteristics of the product. Using such reviews, Big Data can easily extract information about consumers' purchasing preferences and the advantages and disadvantages of products. Meituan Takeout, as one of the largest take-out platforms in China, has made a clear classification of all user reviews: good, bad and medium. By analyzing users' bad reviews, using TF-IDF method to mine the key words in users' bad reviews, and then using Word2vec method to cluster the key words, merchants can easily discover the impact factors of users' bad reviews and improve their services[45]. Based on these bad review data, merchants can clearly understand the strengths and problems of their own products in terms of taste, appearance, hygiene conditions, freshness of ingredients, etc. The role of positive reviews is even more obvious, it increases the exposure of the merchant in the platform, to improve the consumer's desire to buy.

3.2 Take Meituan as an Example

3.2.1 Introduction

Meituan Delivery is an online food ordering platform of Meituan, officially launched in November 2013 and headquartered in Beijing. It has 250 million users, more than 2 million merchants, more than 500,000 active delivery works, covering more than 1,300 cities and completing 21 million orders daily. In 2017, the total transaction volume of Meituan Delivery reached 171 billion, and on January 26, 2020, Meituan Delivery took the lead in launching "contactless delivery" and quickly achieved nationwide coverage. Meituan Delivery

categories include nearby food, fruits, vegetables, supermarkets, flowers, cakes, etc., whether it is breakfast, lunch, dinner, afternoon tea, snack, Chinese food, Western food, home-cooked food, snacks, fast food, seafood, hot pot, Sichuan cuisine, cakes, grilled meat, fruits, drinks, desserts, etc.; multiple brands such as Pizza Hut, KFC, McDonald's, Burger King, Starbucks, COCO Duke, U Ding risotto, Real Kung Fu, Daily Youxiang, Gourmet World, etc. Daily Fresh, Gourmet World, etc. Meituan Delivery also provides a variety of services such as home delivery of medicine, Meituan special delivery, errands and shopping on behalf of others. Computer, mobile APP and WeChat can place orders, and support various payment methods such as Meituan payment, WeChat payment and Apple pay.

3.2.2 Take-out Delivery Process

(1) Distribution Method Classification

At this stage, there are mainly self-managed distribution mode, common distribution mode, crowdsourcing distribution mode and third-party logistics distribution mode in China under 020 mode. There are two delivery modes for the merchants stationed in Meituan Delivery, namely merchant delivery and platform delivery. The platform delivery is divided into two ways: Meituan special delivery and crowd-sourcing delivery. The merchant delivery is the merchant receives the order from the system and then the merchant's own staff completes the delivery personally. Meituan special delivery is the main delivery method of Meituan takeout platform, which is completed by the professional delivery team of Meituan. Crowdsourcing delivery is a way for individuals to participate in delivery based on the sharing economy by using their free time, which effectively relieves the pressure of professional delivery during peak periods.

Meituan Delivery is an LBS-based online ordering platform, which is a fusion of 020 and take-out industry. Meituan Delivery is also the first to realize the combination of Big Data and artificial intelligence data to build a set of can repeatedly replay, deduce and predict the entire take-out process simulation system. This allows merchants and deliverers entering Meituan Delivery to have the support of intelligent order taking, delivery and payment systems, prompting continuous optimization and upgrading of the entire take-out business and process. As for the logistics and distribution, Meituan Delivery is based on an intelligent delivery system that changes the order system of the take-out deliverer from grabbing orders to dispatching orders. That is, from the delivery staff to compete for orders changed to the backstage system according to real-time simulation data to send the best orders. The advanced intelligent delivery system can automatically match each take-out to the most suitable deliverer and plan the optimal path.

In the whole service process food and beverage delivery is undoubtedly the core business of Meituan Delivery, the process is as follows: The customer places an order and pays on the platform, and the platform gets an estimated time of receipt based on the calculation of Big Data. The order is then sent by the platform to the merchant, who confirms the order and prepares it according to the customer's individual requirements. While the merchant prepares the meal, the platform will assign take-out deliverers to complete the delivery task. After receiving and confirming the task, the delivery person will go to the merchant to pick up the meal and travel to the user's location. The progress is as Figure 5.
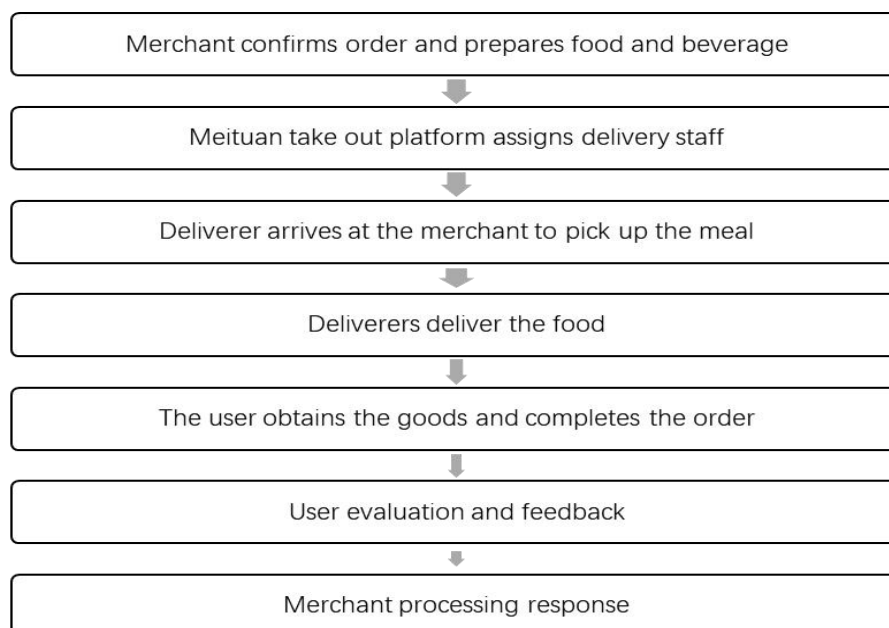
Figure 5. Meituan takeout progress

(2) Drone Delivery

Another aspect of Big Data control is deep learning with machines. Meituan started to experiment with digital restaurants and other intelligent services in 2018. Among them, drones and drone delivery vehicles were put into use one after another. Meituan believes that this kind of artificial + machine cooperation may become the new mode of the future delivery industry. Based on the needs of delivery scenarios, Meituan independently developed a new generation of unmanned delivery vehicle - Magic Bag 20, which integrates high-precision map positioning, obstacle detection positioning, obstacle detection and vehicle attitude dynamic control and path planning, etc., for outdoor the vehicle integrates high-precision map positioning, obstacle detection, vehicle posture dynamic control and path planning, and is open road for outdoor scenarios. The vehicle has been upgraded and iterated on the basis of the previous generation. The vehicle has been upgraded and iterated on the basis of the previous generation. Capacity of 150kg, volume of nearly 540L. The maximum speed is 20km/h[46]. In addition to unmanned delivery vehicles, Meituan released its self-researched drone products last year and disclosed its self-developed urban low-altitude logistics model, which plans to create a low-altitude logistics network for delivery within 3 km and 15 minutes. The new drone delivery on the one hand solves the problem of insufficient manpower of delivery staff and poor service experience in special places, and on the other hand optimizes the manpower cost of Meituan takeout. However, this drone delivery has many restrictions and the development is not perfect. There is still a big distance from the large-scale commercial use.

(3) Special Cases

Inevitably, unforeseen conditions will arise during the distribution process, such as bad weather, traffic accidents, etc. If such unexpected situations are not anticipated and handled in a timely manner, they can cause a large backlog of orders. To avoid this situation, Meituan will develop corresponding response plans according to the unexpected situation, collectively called "supply and demand balance system". Firstly, the real-time monitoring and short-term prediction of Big Data can accurately estimate the order size and capacity in the next N minutes. Once there is an imbalance of orders, special plans are activated in time. Secondly, the core dispatching strategy is adaptively adjusted. According to the results of Big Data processing, the backend will automatically extend the estimated delivery time, improve the probability of combining orders and reduce the driving distance of delivery works. The platform will then react to the predictions by appropriately raising prices during peak periods, allowing users to stagger their orders through a dynamic pricing strategy, while also incentivizing more delivery works to start work and ensuring an overall balance between supply and demand. Such extraction forecasts and background reactions enable Meituan takeout to achieve a basic balance between supply and demand.

3.2.3 Establishment of Big Data Platform

(1) O2O Real-Time Logistics and Delivery Intelligent Scheduling System

By using Big Data, artificial intelligence, and machine learning technology, Meituan's delivery "super brain"—"O2O real-time logistics and delivery intelligent scheduling system"—can reduce the average delivery time to 28 minutes. Using a variety of algorithms to deal with different delivery scenarios, the average delivery time has been shortened to an average of 28 minutes. When a new order is generated, Meituan's intelligent dispatching system will take into account the rider's location, the order in transit, the rider's ability, the merchant's meal delivery, delivery difficulty, weather, geographic road conditions, future order volume and other factors to assign the order to the most suitable rider at the right time, and to anticipate the order timeout situation and dynamically trigger the reassignment operation at any time during the rider's execution to achieve dynamic and optimal matching of orders and delivery works.

Meituan intelligent delivery system allows the whole business process of instant delivery to run efficiently. The system is divided into two aspects: basic platform construction and vertical business optimization. In the basic platform construction, Meituan has developed a machine learning platform, a simulation platform and a Big Data platform for just-in-time delivery. Among them, the machine learning platform provides some data pre-processing, machine learning algorithm toolkit, etc., and completes the interface between the underlying Big Data platform and the online system to improve the efficiency of machine learning model iteration; the delivery simulation platform realizes the accurate simulation of the whole delivery process and can effectively carry out offline evaluation and what-if analysis of various delivery strategies, while the algorithm support platform mainly includes offline/online feature management platform, online strategy management platform, and online strategy management platform. The algorithm support platform mainly includes offline/online feature management platform, online strategy management platform and A/B experiment tools, etc. In terms of vertical business optimization, Meituan has developed a delivery network optimization system, a real-time scheduling

system and a pricing system. The distribution network optimization system provides intelligent tools to support the distribution area to divide the merchant's distribution range and help establish a reasonable underlying distribution network structure. The real-time scheduling system realizes the dynamic and optimal matching of orders and delivery works, which greatly improves the efficiency of delivery; meanwhile, the pricing system realizes reasonable pricing for users, delivery works and merchants, and establishes a good ecosystem for all parties involved in instant delivery, realizing the goal of win-win situation for all parties. The following table shows the overall artificial intelligence technology system of Meituan delivery (Figure 6):
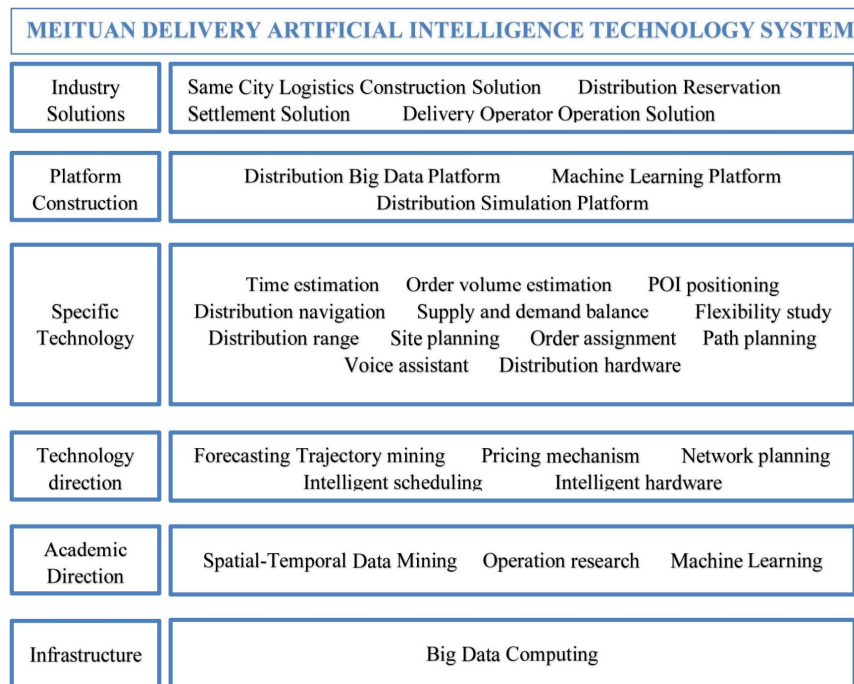

Figure 6. Meituan delivrery artificial intelligence technology system

(2) Meituan Intelligent Delivery System Architecture

Meituan delivery business scenario is complex, and the scale of single volume is large. In the large-scale business scenario, delivery intelligence becomes very important, and the core of intelligent delivery is to do the optimal allocation of resources. Takeout delivery is divided into online business and offline operation. The key to intelligent delivery is to connect order demand and capacity supply. In order to achieve a balance between demand and supply, it is necessary not only to operate the offline operator and the operational deliverer, but also to make a reasonable allocation of these demands and capacity supply online, with the aim of improving the overall efficiency. Only by maximizing the efficiency of delivery can we bring good customer experience and achieve lower delivery costs. The process of optimal allocation of resources is actually layered. In Meituan it can be divided into three layers. The basic layer is structural optimization, which directly determines the upper limit nd low frequency, including distribution network planning, capacity structure planning, etc. The middle layer is market regulation, which is relatively short- to medium-term, mainly through pricing or marketing means, so that supply and demand can reach a relatively ideal balance state. The upper layer is real-time matching, which is the optimal matching of resources in real time through scheduling. The frequency of real-time matching is the highest, and the decision-making cycle is the shortest.
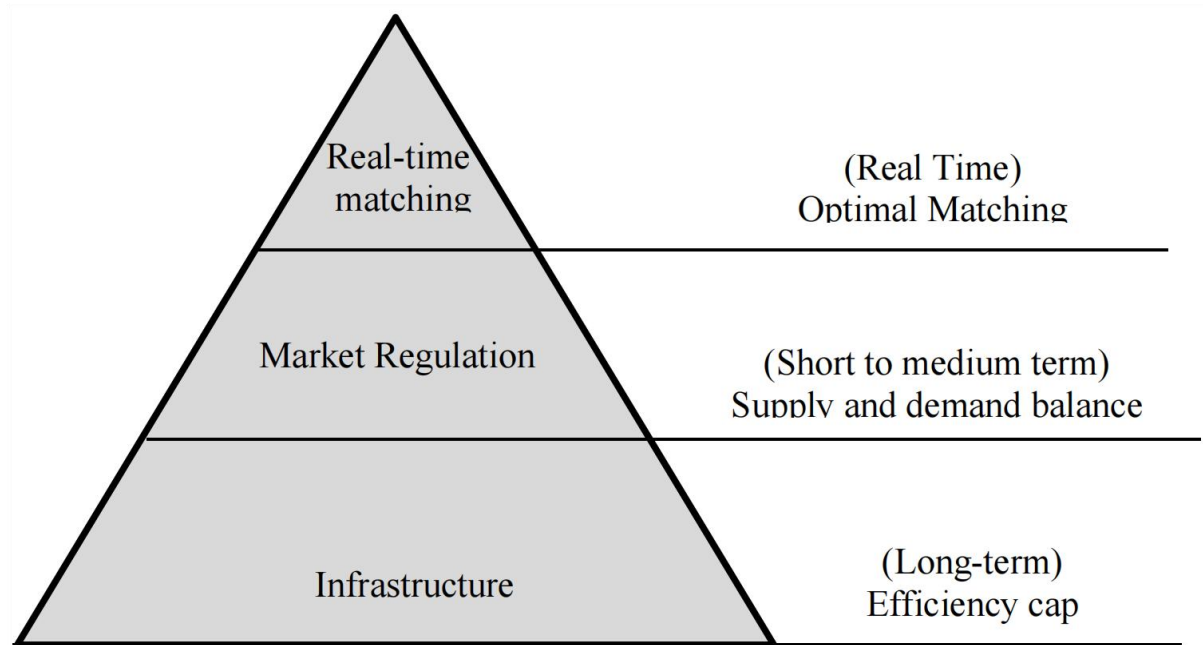
Figure 7. Three subsystems

As shown above (Figure 7), the three subsystems on the right correspond to these three layers of the system. The bottom layer is the planning system, such as adjusting capacity, which has a longer period and lower frequency, and more factors need to be considered for capacity adjustment. The middle layer is the pricing system, dynamic pricing, marketing activities, etc., which can predict the single volume and capacity within a certain time frame in advance, and make capacity scheduling or dynamic pricing in advance. The top layer is the scheduling system, real-time scheduling of delivery works, real-time order allocation. The ultimate goal of the scheduling system (allocation of delivery works based on orders), pricing system (dynamic pricing based on time, weather, and capacity), planning system (administrative area division can be used and adjusted on top of that), LBS system (route planning), and machine learning system (ETA prediction) is to coordinate and optimize.

3.3 SWOT Analysis

3.3.1 Strength

Meituan takeout is the online ordering platform of Meituan, which is backed by Meituan, which itself brings a big traffic entrance and low cost of obtaining customers. It also has a strong user base and a strong capital chain. 2018 Meituan takeout is already the first takeout platform in China's takeout market share, with more than 600 million users and 5 million merchants, forming a huge O2O platform resource. At the same time, Meituan takeout already has its own brand effect, which brings it a lot of convenience to expand the market. Meituan.com emerged as a group-buying site with an extremely wide range of involvement. The product scene involves a wide range: Meituan Dianping's O2O business scope seeks to involve all aspects of life services, the original main line of eating, drinking and playing now extends to the field of travel, eating with Meituan takeout, palm fish fresh food and so on, playing with Meituan travel, cat eye movie and so on, travel originally had Meituan taxi, and in the acquisition of Mobai, the O2O-business scene about people's lives is constantly updated[47].

Secondly, Meituan has its own professional delivery service team, which provides logistics guarantee for its own platform. Meituan takeout is also the first to introduce new technologies such as Big Data, and continue to develop, and now has begun the attempt of drone delivery. The Meituan delivery team has more deliverers, i.e., more capacity. Therefore, Meituan is also the first company to solve the problem of "last mile" instant delivery. This has attracted more branded merchants to move in, increasing their competitive advantage. At the same time, Meituan's delivery model is a trinity of self-operated, special delivery and crowdsourcing, providing a diverse range of delivery methods and solving the problem of insufficient capacity in delivery.

Third, Meituan takeout has a lot of tripartite support, it has received financial support from Tencent and even has entrance services from sites such as WeChat.

3.3.2 Weakness

External competition is fierce, Ele.me as the largest competitor to Meituan Delivery has gradually occupied a

larger market share. In order to maintain a significant market share, Meituan Delivery vigorously attract merchants to reside, but the quality of the merchants of varying quality also brings food safety issues. This in turn brings the difficulty of offline management. Restaurants and merchants are stationed on the platform, and the platform's supervision and testing cannot be accurate to the household frequently to every day. This has given rise to many problems, small workshops in the take-out industry, black workshops operating without a license and so on. Food safety and food hygiene and other issues are exposed one by one. As an O2O platform, Meituan Delivery provides information to both parties and facilitates transactions. If frequent food safety problems occur, it will make consumers doubt Meituan's access threshold and qualification review and reduce consumer stickiness.

Meituan Delivery has been positive and profitable until 2019. As the oligarch of the Chinese take-out industry, it is not very profitable. Its main profit models are delivery fees, commission on delivery, service fees from some merchants, time difference in payment, and a small amount of advertising. These profit models are not profitable enough, resulting in a weak financial position for Meituan.

The advertising delivery of Meituan Delivery is also a major problem, with narrow publicity channels and a small number of physical and online advertisements. There are few new users brought through the Meituan network and third-party diversions, but a more powerful way to attract new users is lacking subsequently. Publicity activities and marketing methods are lacking in highlights.

Lack of third-party payment. the core aspect of O2O field is online payment. The largest online payment platforms in China are Alipay and WeChat Pay. Meituan Delivery currently offers WeChat payment, Alipay, Apple Pay and Meituan payment. The so-called Meituan payment is basically equivalent to binding bank card payment, and there is no more professional means of payment. The use of Meituan payment scene is also very little, the user utilization rate is low.

3.3.3 Opportunity

The delivery market is huge. China's take-out market is basically saturated in first- and second-tier cities, but the market demand in third- and fourth-tier and even more non-urban places has not been fully developed. Affected by the new crown pneumonia epidemic, China's control is so strong that people's lifestyles and consumption habits are changing dramatically, either actively or passively. By continuously deepening the delivery categories of the take-out industry and refining the original market, we can find higher growth points.

5G network era is coming: 4G network tide makes it very convenient for people to place orders on their cell phones anytime and anywhere, and 5G technology, which aims to achieve the Internet of everything, will provide a more favorable development environment for Meituan Dianping, and faster network speed support brings great opportunities for the future development of 020.

The popularity of smart mobile terminals and the development of mobile payment technology provide technical support for the development of the take-out industry. With the prevalence of the "healthy eating" concept, consumers are demanding more from take-out restaurants, not only to be fed, but also to be tasty, healthy and hygienic, which gives take-out platforms new room for growth.

With the further development of China's food and beverage take-out 020 market, the market for students in Koran schools is becoming increasingly saturated, and the business white collar market is characterized by high density, high frequency, off-price consumption, high stickiness, and insensitivity to price. The white-collar market will be the main source of profit in the future take-out 020 market, especially in the untapped fourth-tier cities with huge potential. Whoever has the advantage in the white-collar market will have the biggest leverage to win the take-out market crown.

3.3.4 Threat

Competitive pressure is high, Ele.me is the largest competitor of Meituan Delivery, and gradually occupy more market share. The competitive landscape of Meituan Delivery has had a strong development trend in recent years with a large proportion of the market (see Figure 8).
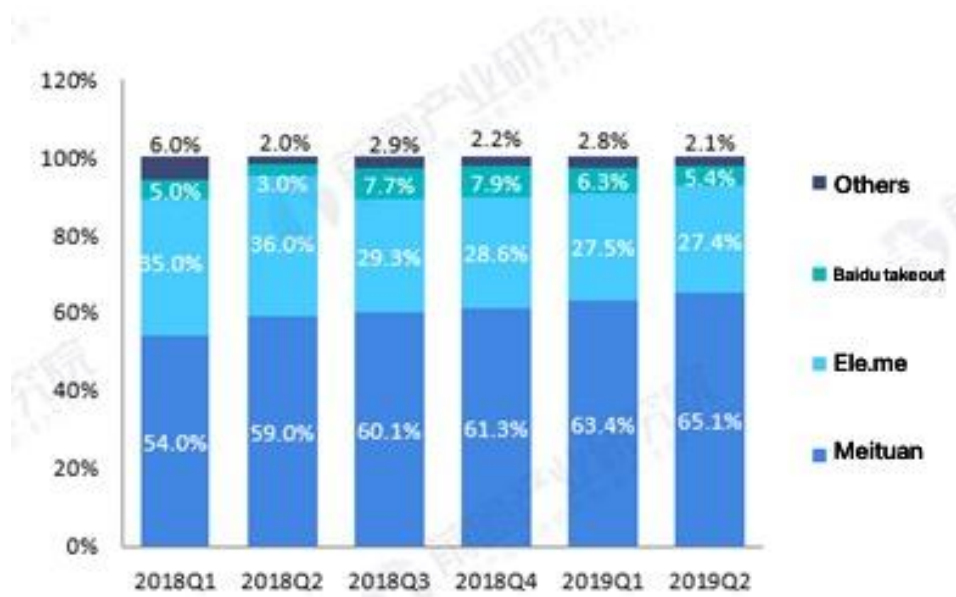
Figure 8. Competitive landscape of China's takeout market 2018-2019[48]

But because of the price of hungry and other advantages, hungry market share has been and Meituan is not comparable (see Figure 9). It has a 020 platform first-mover advantage and technological advantage, and is grabbing more user resources. Ele.me for more than Meituan earlier into the take-out market, with the advantage of new entrants. At the same time, Ele.me is backed by Alibaba's parent company and has a more than adequate source of funds.
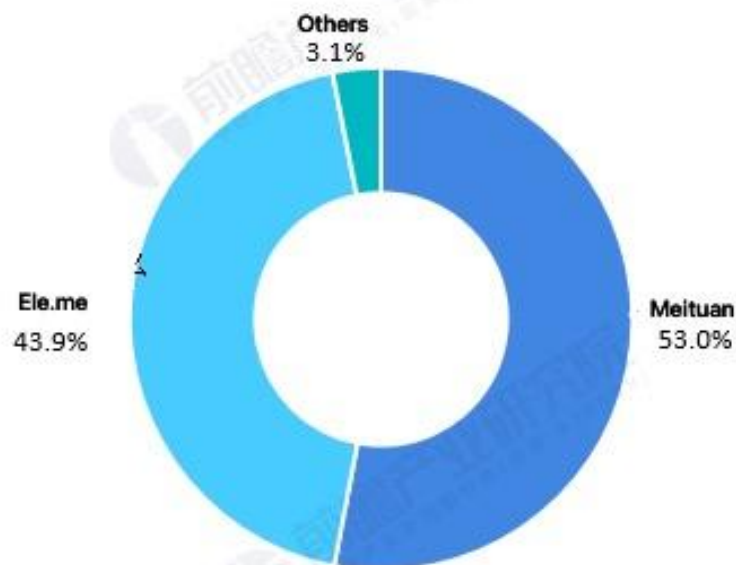

Figure 9. Market share of Meituan Delivery and Ele.me for Sale in the third quarter of 2019[49]

At the same time the take-out market user loyalty is low, both the merchant and the platform are not very sticky. Users often have 2-3 platforms to choose from, constantly comparing prices, delivery times and other factors before finally deciding to consume.

Serious food hygiene problems. Due to lax monitoring and imperfect regulations, the take-out industry is full of muddled businesses. Many small and medium-sized merchants have serious problems with the quality of hygiene, and users will point their conflicts at the platform.

4. Blueprint of Chinese Takeout Market

4.1 PEST Analysis

The development of China's domestic take-out industry and the external environment of Big Data on the development of the industry are described below by using PEST analysis to analyze and elaborate on each of the four perspectives: political, economic, social, and technological.

4.1.1 Political

China has been strongly supporting and encouraging the development of the food and beverage takeout industry in recent years, and more actively advocating the realization of the online 020 industry. In recent years, the Chinese government has continued to introduce relevant policies and improve market rules to pave the way for the development of the industry.

In terms of food safety and restaurant hygiene, China's Ministry of Commerce, in the National Planning Outline for the Development of the Restaurant Industry (2009-2013), requires restaurant enterprises to accelerate modernization, vigorously promote modern management models, actively use modern scientific and technological means, and provide quality modern services in areas such as restaurant databases and e-commerce. In March 2015, the newly revised Food Safety Law increased the regulatory requirements for food production and operation and for online food transactions. At the third session of the 12th National People's Congress in 2015, the modern logistics industry was included in China's top ten revitalized industries. 2017 CCPIT Commercial Industry Sub-Council refined the requirements of five aspects of take-out delivery in the "Specification for Take-out Delivery Services". November 2017 the Chinese Food and Drug Administration promulgated the "Food Safety Supervision and Administration Measures for Online Food Service" to further In September 2018, the General Administration of Market Supervision of China (GAMSC) issued a notice on the special inspection of food safety in online catering services, which requires that the division of responsibilities among employees must be precise. With the outbreak of the new crown epidemic, in July 2020 the Chinese Central Bureau of Disease Control and Prevention issued a Notice on the Issuance of Health Protection Guidelines for Take-out Delivery and Express Delivery Practitioners for the New Crown Pneumonia Epidemic to optimize takeout delivery and express delivery services. In February 2021, the General Administration of Market Regulation of China issued the "Information Description Specification for Take-out Meals" to regulate the information description of take-out meals.

The combination of the market and information industry in the Internet environment is one of the industry development directions that the Chinese government has been vigorously developing in recent years. Premier Li Keqiang put forward the concept of "Internet +" at the 2015 National People's Congress, and "Internet +" soon caught fire across the country. Traditional and non-traditional industries are all catching up with the "Internet +" express, trying to quickly connect with the Internet. On September 29, 2015, the General Office of the State Council of China announced the "Opinions on Promoting Online/Offline Interaction to Accelerate the Innovation, Development, and Transformation and Upgrading of Trade Circulation" (hereinafter referred to as the Opinions). This opinion is also the first official document issued by the State Council on O2O, online and offline interaction and consumer upgrading. The document clearly indicates that the Chinese government supports business model innovation, encourages technology application innovation and promotes product service innovation, hoping to accelerate the implementation of core technologies such as mobile Internet, Big Data, Internet of Things cloud computing and other business applications in authentication, buying and selling, payment, logistics and other business links.

4.1.2 Economic

With the popularity of the Internet, the booming development of e-commerce and O2O industry, the increase of residents' consumption level and ability, the significant increase of consumption ability in catering, the diversification of demand for catering services, prompting the development of the new economic situation of at-home consumption, bringing huge traffic to take-out logistics and distribution, while also prompting the diversity and the speed of simultaneous rapid development of logistics and distribution services.

China's economic development trend has been steady in the last decade, with the global economic recession and the impact of the new crown pneumonia epidemic in the last two years, the growth rate has decreased, but the overall trend is still up. As Figure 10 shows the GDP in China has an upward trend.
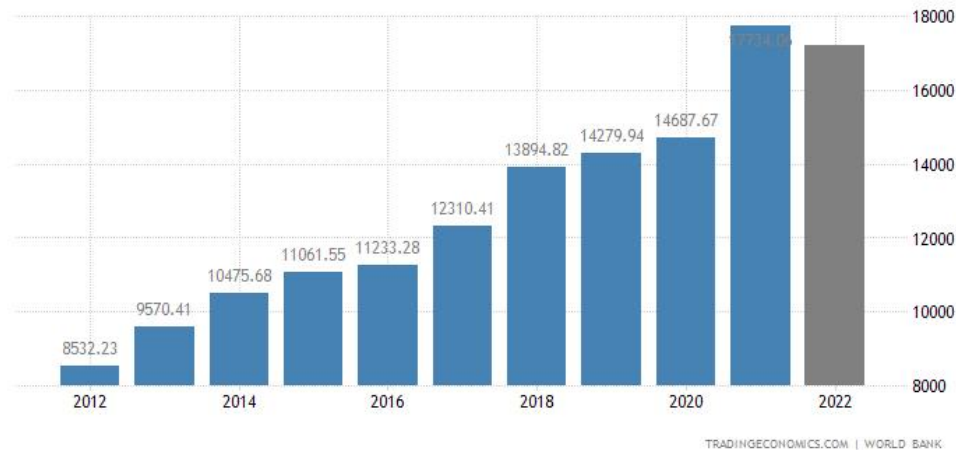
Figure 10. [50]

Meanwhile, in recent years, with the continuous development of China's economy and Internet technology, the sharing economy has been expanding and the transaction scale of the shared living service market has been expanding. 2021, the transaction scale of China's shared living service market reached 1,711.8 billion yuan, an increase of 94.3 billion yuan compared with the previous year. Take-out, a major component of shared living services, has also developed rapidly. China Internet Network Information Center (CNNIC) data show that as of December 2020, the size of the national Internet users reached 989 million, an increase of 85.4 million from March 2020, and the Internet penetration rate reached 70.4%, of which the size of online shopping users reached 782 million, and the proportion of online shopping users has reached 79.1% of all Internet users.

The new generation of Chinese youths are beginning to have certain economic power and different consumption concepts and habits, giving rise to new economic trends, namely the "house economy" and the "lazy man economy", which have changed the way of consumption. They prefer online home delivery service rather than offline store experience. At the same time, with the emergence of the new pneumonia epidemic, China's offline restaurant industry has fallen off a cliff, but at the same time, there has been a sharp rise in online services (Figure 11).
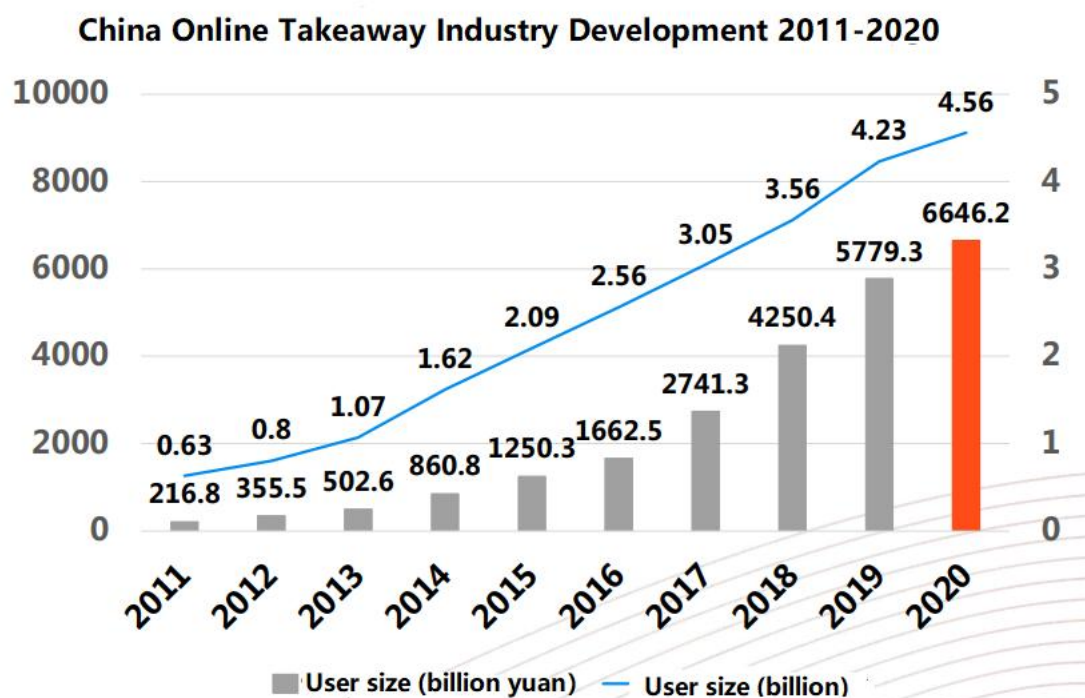
Figure 11. China online takeaway industry development[51]

4.1.3 Social

From the age distribution of take-out consumers, 18–30-year-olds are the largest consumer group in the take-out industry, with 36.10% of 18–25-year-olds and 22.50% of 26–30-year-olds, accounting for nearly 60% of the total. 18–30-year-olds are the main force of take-out consumption, they are seamlessly connected to the information network era at birth and adapt to new things on the Internet relatively quickly. From the demographic point of view, with the growth of the post-90s and post-00s, these Internet natives have a deeper understanding of the Internet, and they have become accustomed to life on the Internet, so they are more inclined to seek corresponding services through the Internet in the field of local living services. From the perspective of user habit cultivation, with the huge subsidies of BAT and other Internet giants in the field of 020, users have formed a certain habit of 020 consumption.

In 2014, China's urban population was 767.38 million, while the rural population was 609.08 million, or 158.3 million more than the rural population. 2021, China's urban population will grow to 914.25 million, while the rural population will decrease year by year to 498.35 million in 2021. The urban population is nearly twice as large as the rural population. With a wide range and variety of stores in cities, consumers have more choices. At the same time, the convenience of urban road transport and the high efficiency of take-out transportation will help the development of the take-out industry.
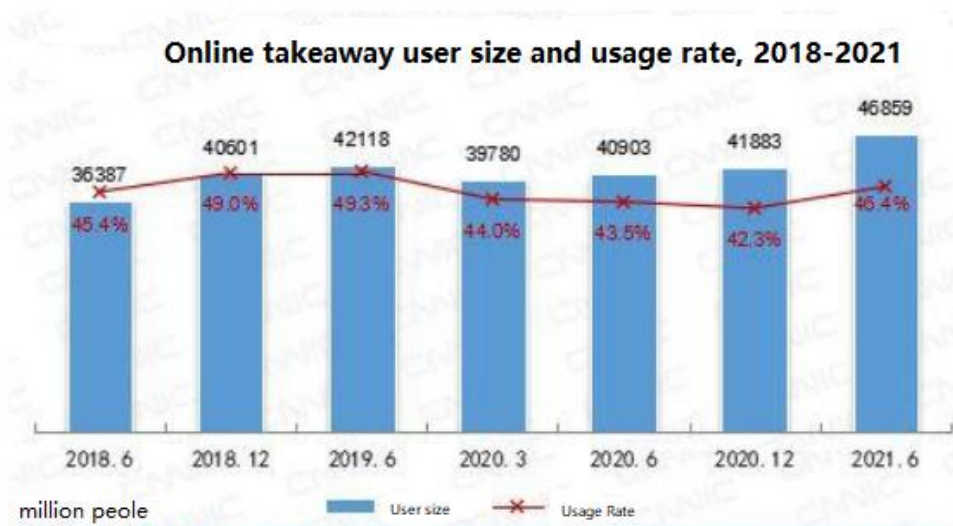

Figure 12. Online takeaway user size and usage rate[52]

With the continuous development of China's takeout industry, the user scale of the industry continues to rise. 2016-2021 (Figure 12), the overall user scale of China's take-out industry is on an upward trend, and as of December 2021, the number of online takeout users in China reached 544 million, an increase of 125 million compared to the previous year, providing sufficient user groups for the development of the takeout industry.

4.1.4 Technological

High-speed development of Internet technology provides support for local life service 020. The popularity of mobile Internet technology and the rapid development of smart terminals have completely changed people's lives and consumption habits, and LBS services and map technology have turned local lifestyle services 020 into a reality. The use of Big Data enables businesses to understand their consumption habits better than they do, bringing an incredible user experience to users. The rapid development of technology has also provided China's O2O model provides advantages in the channel: comprehensive data analysis technology can make O2O enterprises to make better use of information; and the increasingly complete unmanned equipment technology allows O2O. The growing availability of unmanned equipment technology allows O2O to integrate online and offline more closely; web technology development can give O2O companies a broader platform The development of web technology can give O2O companies a broader platform.

The booming development of the take-out industry cannot be separated from the support of Internet technology. cloud computing greatly shortens the delivery time by analyzing delivery data and planning the delivery path,

and also can assign tasks for delivery personnel more efficiently through an intelligent scheduling system to meet the delivery efficiency needs of take-out, etc. The market size of cloud computing in China has been expanding from 2015-2021, and the market size of public cloud is also increasing year by year. In 2021, the market size of China's cloud computing is 322.9 billion yuan, of which the market size of public cloud is 218.1 billion yuan, compared with the previous year, the market size of cloud computing has increased by 113.8 billion yuan, and the market size of public cloud has increased by 90.4 billion yuan. The development of the take-out industry, many companies began some new attempts, such as exploring unmanned delivery scenarios, exploring the construction of urban low-altitude delivery network, etc., to further reduce the burden of take-out deliverers and improve delivery efficiency. 2017-2021 China's take-out industry-related patent authorization number increased year by year, the number of authorized patents reached 692 in 2021, the number of patent applications and the number of authorizations in that year converge, related enterprises are becoming more and more mature in this field of research. The take-out delivery market is large, and more and more companies will participate in the R&D application of new delivery technologies in the future, which will promote the development of the industry.

4.2 Remaining Issues

4.2.1 The Phenomenon of "BDDP" on the Internet

Today, in the 21st century, people are becoming familiar with Internet life and are actively or passively entering into a fully information-based life. All kinds of traces of people on the Internet have been turned into information for sale by businesses. People as human symbols are gradually weakened and turned into a string of Internet data. Big Data technology has brought great convenience to people's production life, but at the same time there are also some problems. The so-called "Big Data BDDP" is defined by some scholars as the use of user data by Internet companies. The so-called "Big Data BDDP" is defined by some scholars as the act of price discrimination against old users by Internet companies using the user data they have. This is an act of price discrimination against old users by using the data they have[53]. In short, when users use the take-out platform to order food, the same goods, the same delivery service, but with different prices depending on the frequency of use or frequency of browsing. The higher the frequency of use, the higher the price.

According to different consumers, the Big Data of the take-out industry is mainly focused on several aspects: (1) the difference of mobile devices. The take-out platform will set different prices because of the different mobile devices used by consumers. The difference in the brand and version of the device used by the consumer is used to infer the consumer's consumer ability and thus achieve price differentiation. For example, the price of the same product using iPhone 13 may be higher than that of iPhone 12. (2) Frequency of use and time of use. The take-out platform determines the degree of consumer demand for take-out based on the frequency of users ordering take-out and the time of use by users. For users with low frequency of use, the platform system will default to low demand and set a cheaper price to attract consumers to spend. (3) Location. The location of the take-out app is a necessary tool, and the platform will determine the consumer's spending power in the city or even the region based on the consumer's geographic location to differentiate pricing. Users who live in high-end residential areas tend to get higher prices. (4) Membership. The membership system has been introduced by Meituan, Ele.me, and other take-out platforms, and users who have membership can enjoy more bonus benefits to reduce delivery fees. But many users soon found the same goods, members and non-members of the crowd will get different delivery prices.

The realization conditions for this phenomenon are inseparable from Big Data technology. On the one hand, the number of take-out platforms in China is relatively small, and Meituan Delivery and Ele.me Meow are basically at the top of the take-out market. China's huge consumer market is highly concentrated in a few top companies. It stands to reason that these companies have a huge amount of data and information about the Chinese market. The more information there is, the more accurate the platform can be in terms of analysis. As technology has become more sophisticated in recent years, algorithms have become more refined. Merchants can collect data to accurately profile consumers, save costs, and improve margins through price discrimination[54]. This "BDDP" begins when the user logs in for the first time and leaves a lot of personal information on the platform. The user registers with the platform and enters personal information, and then performs consumption behavior on the platform. These Internet traces are recorded in the background. The e-commerce platform uses Big Data analysis technology and other means to seize the entire surplus of consumers in order to maximize the interests of the platform. The consumer's rights are only the appearance and result of Big Data "BDDP", and the abuse of algorithmic rights by operators is the essence and root cause of Big Data "BDDP"[55].

There are three reasons for the emergence of the phenomenon of "BDDP" in take-out Big Data. The first is the excessive pursuit of profit maximization by merchants and the destruction of the fairness of the transaction. Merchants hope to attract more consumers through technical means, to seize the consumer market and pursue the maximum profit. Secondly, information asymmetry. In the general environment of the Internet, on the one hand,

users have more consumer choices and have an endless bombardment of information. But then comes the transparency of users in the era of Big Data. Platforms use Big Data to monitor and obtain consumer information and precisely control consumer preferences without the user's knowledge. Finally, there is the imperfection of legal regulation. As the means of Big Data is not easy to detect and regulate, governments do not have a relatively perfect and comprehensive law to regulate and manage this phenomenon, which has led to the intensification of this phenomenon.

4.2.2 Artificial Squeeze Caused by Big Data

(1) Labor Control

The entry of Big Data into the take-out industry has undoubtedly contributed to the modernization of organizational management efficiency throughout the industry. When each person enters Big Data, his attributes as a natural person is fading away, replaced by the existence of people as data. In all labor work is a combination between labor order and people. There is autonomy under the rules in any organization. But the emergence of Big Data is eating up the space for this autonomy step by step. The platform system makes labor order possible by subliminally collecting and analyzing rider data and reacting the results back to the delivery works. Digital control not only weakens delivery works' willingness to resist and eats away at their space to exercise autonomy, but also unwittingly involves them in the process of managing themselves. Digital control also suggests that the means of capital control are shifting not only from authoritarian to hegemonic, but also from physical to virtual[56].

The data analysis result of Big Data is actually the ideal state after a lot of collection, simulation, and prediction. But the presence of data implies the existence of reality bias. In most scenarios this scenario is compensated by manual energetics. For example, the most important aspect in the take-out industry is the delivery time. In China, the time between the customer placing an order and finally getting it is typically 35 minutes. This means that the delivery person must complete the order within 35 minutes or face the penalty of deduction of money. But in the actual scenario chef delays, traffic jams, rain, traffic lights, etc. can occur. Big Data intelligence makes an average estimate for the scenario, and this estimate is subject to error. The cost of the error is borne by the food delivery staff. So, most of the delivery staff in order to avoid penalties will continue to improve the speed of delivery. This data is re-entered into the Big Data system, and the Big Data will think that the delivery time should be shorter, then the next delivery estimate will be shorter, forming a kind of cycle. The delivery workers are unknowingly compressed by the system.

On the other hand, the real-time monitoring of Big Data is constantly eating away at the autonomy of the industry's practitioners. No matter what kind of system or how accurate the algorithm is, there are loopholes, and such bugs will be revealed in practice, and then manually tinkered with and compensated. In the early days of China, the delivery staff could "report" the delivery. That is, in the delivery if the restaurant is very slow to deliver meals may cause delays in the case of "report" to use to extend the time. In the actual work scenario, many delivery staffs use "reporting" to extend the delivery time to get more orders, so that they can maximize the value of their labor. However, as more and more "reports" appear, the system will detect this vulnerability and optimize it. This data anomaly will eventually lead the platform system to detect its own "vulnerability", and the result is a system "vulnerability". Which in turn means that the control over the rider is strengthened, because the rider's autonomy is further eroded. The result is that system "vulnerabilities" are fixed and the platform system is optimized (Chen, L, 2020).

(2) Overwork

From the emergence of take-out platforms to the present, the management has become more and more perfect and the services provided have become more and more perfect. Meituan has improved its delivery time three times from 2016-2019. The time limit for 3 km was 1 hour in 2016, this time was reduced to 45 minutes in 2017, and in 2018 it became 38 minutes. Now it is even shorter on average at around 30 minutes. The industry's increasing efficiency is backed by the overworked and dangerous work of take-out delivery workers. On the one hand, delivery workers can decide their own working hours, and there are no strict commuting hours. But due to the massive volume of delivery orders and the lack of delivery capacity, working more than eight hours is very common for delivery workers (see Figure 13).
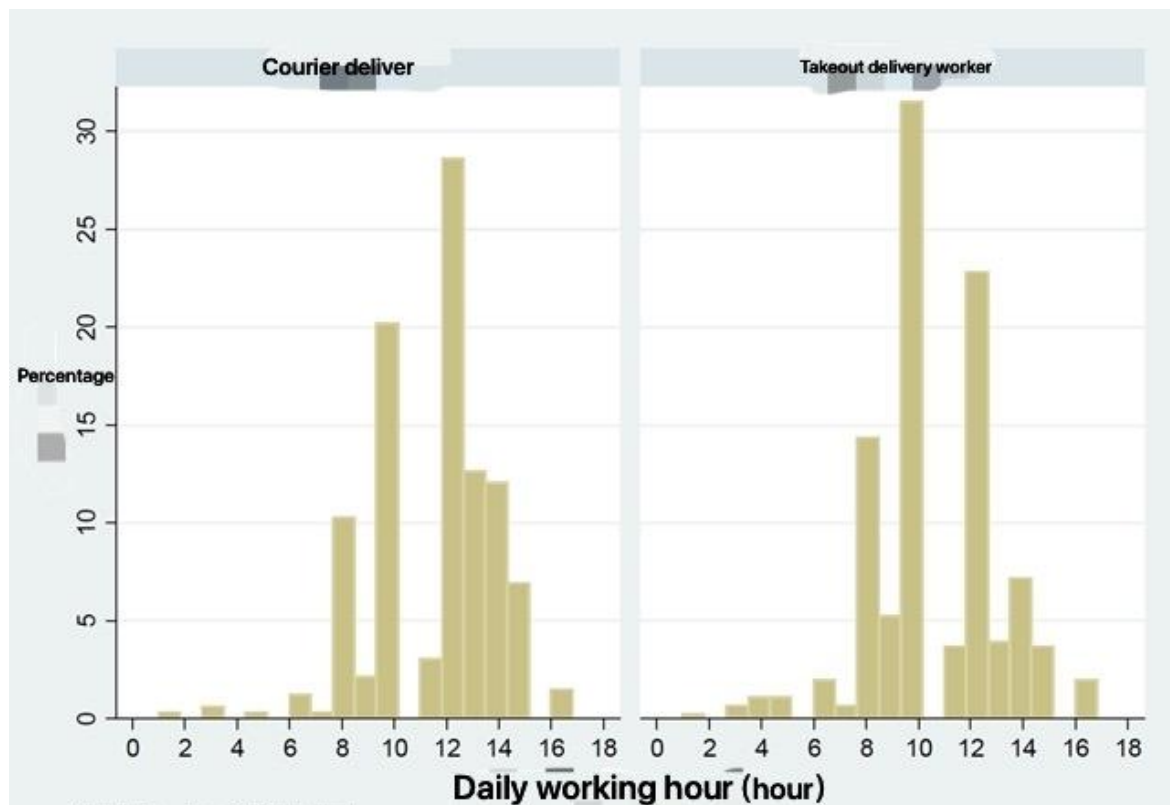
Figure 13. Daily working hours of takeaway platform workers[57]

And on the other hand, is the risk of the delivery staff. The first half of 2017, the Shanghai Municipal Public Security Bureau Traffic Police Headquarters data show that in Shanghai, an average of every 2.5 days there is a take-away delivery staff casualties. 2018, Chengdu traffic police 7 months during the investigation of the delivery staff illegal nearly 10,000 times, 196 accidents, casualties 155 people, an average of 1 delivery staff casualties every day due to illegal. In September 2018, the Guangzhou traffic police investigated and dealt with nearly 2,000 traffic violations by take-away food delivery workers, with Meituan accounting for half of the cases and Ele.me ranking second. In order to constantly avoid the penalty of delivery delays, some delivery workers inevitably increase their delivery speed by violating speeding regulations and so on. Behind this is the platform's extremely harsh time control and reward and punishment system. The platform controls the potential experience, thoughts and feelings of delivery works through the work mechanism of grabbing and waiting for orders, shaping the sense of "on-time" and "fast" labor time, and guiding delivery works to be willing to become "all-weather workers The rider is guided to become a "24/7 worker" and to work actively during labor hours. Ultimately, delivery works are bound by the platform in the pursuit of freedom, and cooperate with the time control reluctantly and actively[58].

4.3 Future Development

4.3.1 Standardize Related Systems

(1) Overseeing the Process of Using Big Data

First of all, the government or organizations establish a Big Data supervision platform to regulate and restrain the negative effects that Big Data may bring, and at the same time make a corresponding punishment system for enterprises that are bent on using Big Data to pursue profit maximization. In order to avoid the phenomenon of "BDDP" of Big Data and labor force suppression. The so-called Big Data supervision platform can also make use of the data analysis function of Big Data to determine whether there are problems in enterprises, and then feedback the analysis results to users. Secondly, a national Big Data information development department integrating review, supervision and governance should be established to strengthen the control of Big Data development, improve control efficiency, enhance targeting and coordination, shorten the problem processing cycle, and provide citizens with reporting channels. Again, a blacklist system should be established. The national network supervision department and the media networking, with reference to the practice of the defaulted executor, the businessmen who have made illegal acts more than twice should be notified of the whole network and announced to the society by the media, in order to play a warning role to the platform businessmen.

Strengthen industry self-regulation, accelerate the development of relevant codes of conduct and standards at the level of industry associations, and use the supervision mechanism among peers to jointly promote the standardization of corporate behavior in the platform economy.

(2) Sound Laws and Regulations

The construction of laws and regulations has been delayed in the development of affairs, and it needs time and experience to improve constantly. E-commerce is a new thing, its rapid development has brought a lot of problems, but the corresponding laws and regulations are not perfect, resulting in a lot of regulatory issues and users can not defend their rights even if they find problems, and there is no way to make strong punishment according to the relevant laws. Both the operational strength of the Ele.me, Meituan, there are varying degrees of food hygiene problems, platform management issues. For example, the online evaluation of the store and the physical store experience is very different, individual bad stores intentionally hired online water army to pull up the evaluation and other acts. User reviews on takeout platforms play a verbal marketing role, influencing consumers' consumption decisions at all times, and also these problems will limit the development of take-out platforms if they are not solved.

The Chinese government needs to deepen its theoretical understanding and combine the realities of online platform development to develop laws and regulations that are in line with the actual development of the O2O model in the food service industry, so that users can be protected when defending their rights and can use them with confidence.

At the legal level, the government needs to speed up the establishment and improvement of relevant laws and regulations, such as the popularity of regulations related to e-commerce and pricing, so that people understand the national regulations on the operation of commercial activities and protect their own rights and interests.

The government should speed up the establishment and improvement of relevant laws and regulations, such as those on e-commerce and pricing, so that people can understand the national regulations on commercial activities and protect their rights. Second, to provide clear legal characterization and regulation of illegal acts, set huge fines, increase the cost of violations, and require the network platform should be publicized its platform service agreement and payment rules. Third, reverse the burden of proof for violations of the law, as proof by merchants is not effective in curbing violations. But if the user to prove will be effective control and limit the illegal behavior. Fourth, simplify the legal rights procedures, strengthen the rights of publicity and education. With the help of mass media, community outreach and other ways to inform the public of the ways and procedures to protect their rights. Fifth, give citizens the right to be forgotten, the right to timely notice and other rights, so that citizens can more effectively defend their own interests. Sixth, with the introduction of the E-Commerce Law, before it takes effect. The Supreme Court will send it to the lower courts before it comes into effect, and the political departments of the courts at all levels will organize studies to improve the supervision of law enforcement. The political divisions of the courts at all levels will organize studies to improve the capacity of law enforcement and supervision.

4.3.2 Clarify Rights and Responsibilities

Conflicts between consumers and delivery workers have always been evident in China's take-out industry. Consumers place orders on the platform and the delivery staff deliver the food and beverage to provide delivery services, originally there should not be obvious conflicts. Consumers have the right to evaluate the service, and merchants are thus given feedback data. But when the platform to the identity of the online hidden entity, and will be linked to the consumer evaluation and delivery staff wages, consumers seem to get the supervision and evaluation of the "absolute power", but unknowingly and the platform system to play the role of "manager" has become the "scapegoat" for labor-management conflicts. What is even more ironic is that when consumers and food delivery workers complain about each other, the take-out platform company becomes the "mediator" of their conflicts, because consumers will complain to the company about the food delivery workers through the platform system, and the food delivery workers can only complain to the company through the platform system (Chen, L, 2020). At the same time delivery workers, because there is no offline entity managers, seem to have a free commute, flexible working hours and free workplace, but all the time under the monitoring of Big Data passively squeezed labor value. The piece-rate wage system has forced food delivery workers to actively work longer hours, logically accepting the 24/7 labor schedule. The piece-rate wage system makes riders work longer hours of their own accord, and it is logical for them to accept a 24/7 labor schedule, even working day and night. The freedom of choice of working hours is reduced to the selfishness of workers. The freedom of choice of working hours is reduced to a tool for the workers to impose their own limits[59].

4.3.3 Deliverers and Big Data

In order to solve the relationship between the Big Data platform and the delivery staff, the most direct approach is to set aside a tolerance rate within the platform, while strengthening the delivery staff's complaint mechanism

for special cases, so that the delivery staff is exempt from punishment in special cases. For example, in special scenarios (rain, snow, fog, traffic jams, etc.), the platform moderately extends delivery time or reduces the requirements for on-time delivery.

The more fundamental approach is to add the rights of the delivery staff to the rules of the Big Data algorithm. This requires the intervention of relevant organizations or governments. When Big Data infinite squeeze workers' labor time and labor value, the root cause is the platform or business in order to pursue profit maximization and give up the respect and protection of workers' rights. Big Data should not become a bottomless profit-making tool for businessmen, when the data algorithm monitoring workers at the same time should reasonably join the "care model" for workers.

4.3.4 Deliverers and Users

The take-out platform redistributes control with the help of Internet technology, with the platform system responsible for guiding, rewarding and punishing riders, and consumers responsible for monitoring and evaluating them. The redistribution of control is largely supported by the data, algorithms and models behind the platform system. And because the data, algorithms and models are invisible, the redistribution of control further increases the difficulty of determining the employment relationship[60]. The take-out workers and consumers should not have had obvious conflicts and disputes, and the contradictory transformation of the platform made the labor relations tense.

The immediate solution to these problems is to abolish the direct relationship between consumer evaluation and the wages of the delivery staff, but to use other work indicators as the basis for judging the merits of their work to reward and punish. At the same time, the take-out industry needs a fair and self-reliant industry system to solve the problem and establish an Internet take-out industry association and industry standards. A sound industry system should have an industry authority, and an industry association should be established under the leadership of the authority to promote the common governance of all parties.

4.3.5 Improving Facilities

(1) The Establishment of Intelligent Take-out Cabinets

The smart delivery cabinet is the earliest take-out storage launched by Meituan Delivery for colleges and universities. The take-out platform lays takeout cabinets under college dormitory buildings, so that even if you can directly realize the real contactless delivery. At the same time for some off-campus takeout cannot enter the school, the school canteen take-out can be sent directly to the students under the dormitory building. Off-campus take-out is also allowed to enter the school to store the take-out in the courier locker under the circumstances permitted by the regulations. Its process is as follows (Figure 14):
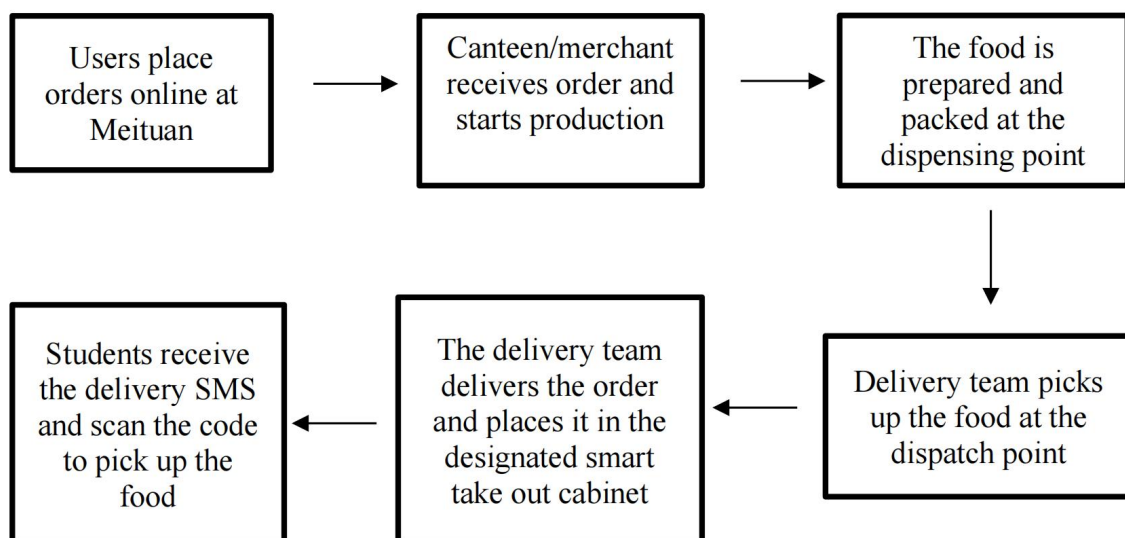

Figure 14. Takeout cabinets using process

The functions of the smart takeout cabinets currently on the market mainly include temperature regulation, disinfection, lighting and information interaction. The main role of temperature regulation is to maintain the

temperature and taste of food. The disinfection function refers to the process of food safety through ultraviolet sterilization or pasteurization technology to eliminate pathogens. The most basic lighting system is built into the take-out cabinet.

The basic lighting system facilitates the identification of information inside the cabinet. These basic functions ensure safe and sanitary conditions for take-out storage, while addressing the requirement for contact-free take-out delivery during the COVID-19 outbreak. The existence of take-out counters can to greatly improve the delivery efficiency of the take-out staff, ease the pressure of delivery, increase the number of the existence of take-out cabinets can greatly improve the efficiency of delivery, relieve the pressure of delivery, increase the number of orders and speed up the market operation. For consumers, the appearance of take-out cabinets guarantees the quality and safety of meals and saves consumers' time, thus achieving a win-win situation[61]. The emergence of intelligent take-out cabinets can effectively alleviate the pressure of take-out delivery during peak periods, while later if you can combine with WeChat mini-programs and more can attract more consumers.

5. Conclusion

With the development of the times and the continued expansion of the Internet, when there is one cell phone per capita, consumption has shifted from offline one-to-one to online diversified consumption. The restaurant industry is even more from the store consumption to online ordering, by in addition to the sale industry was born. China's takeout industry is clearly at the forefront of the world. The Chinese take-out industry has many strict standards, with precise restrictions on delivery times, routes, and personnel. All of this is done by the Big Data of the take-out platforms. The larger take-out companies have their own Big Data systems to complete backend items such as order taking, order distribution, delivery driver route planning, etc. It has greatly improved the efficiency of the organization, making the original organizational management structure a comprehensive upgrade and optimization. On the one hand, the addition of Big Data makes the management of the organization digital and transparent, and there is almost no manual waste of resources, and the maximum use of resources is accomplished through digital. On the other hand, strong technological advantages bring technological barriers, so that companies with Big Data systems can take the leading position in the industry and complete user control with accurate advertising. But at the same time, it brings a lot of problems, such as humanized management of enterprises (humanized care of delivery staff), information security of users, etc. So, in the future, the application of Big Data in the enterprise is more in the rules, legal constraints, and at the same time in the enterprise to carry out a clear responsibility system, so as to complete the reasonable and legitimate application of Big Data.

References

Chang, Y.-W., Hsu, P.-Y., & Yang, Q.-M., (2018). Integration of online and offline channels: a view of O2O commerce. *Internet Research, 28*(4), 926–945. doi:10.1108/intr-01-2017-0023.

Breur, Tom, (July 2016). Statistical Power Analysis and the contemporary crisis in social sciences. *Journal of Marketing Analytics.* London, England: Palgrave Macmillan. *4*(2–3), 61–65. doi:10.1057/s41270-016-0001-3. ISSN 2050-3318.

Lee, I. (2017). Big Data: Dimensions, evolution, impacts, and challenges. *Business Horizons, 60*(3), 293–303.

Dabbawala, (2022, February 24). Wikipedia. Retrieved March 07, 2022, from https://en.wikipedia.org/wiki/Dabbawala.

History of food delivery and how its changed, (2021, November 18). Thistle thoughts. Retrieved March 07, 2022, from https://www.thistle.co/learn/thistle-thoughts/history-of-food-delivery-and-how-its-changed.

Laney D., 3D data management: controlling data volume, velocity and variety. META Group Res Note 2001; 6: 70.

Philip Chen, C., & Zhang, C.-Y., (2014). Data-intensive applications, challenges, techniques and technologies: A survey on Big Data. *Information Sciences, 275,* 314–347.

Weiss, S.M. and N. Indurkhya, (1998). *Predictive Data Mining: A Practical Guide,* Morgan Kaufmann Publishers, Inc.

Hilbert, M., (2013). *Big Data for development: From information-to knowledge societies.* Available at SSRN 2205145.

Kim, H. S., & Kim, J., (2019). Exploratory study on food delivery through using social network analysis: Focused on the Google web and Google news. *Culinary Science & Hospitality Research, 25*(2), 1-10.

Singh, R. K., & Verma, H. K. (2020). Influence of social media analytics on online food delivery systems. *International Journal of Information System Modeling and Design (IJISMD), 11*(3), 1-21.

Sadiku, M. N., Ashaolu, T. J., Ajayi-Majebi, A., & Musa, S. M, (2020). Big Data in Food Industry.

Madani, B., & Alshraideh, H., (2021). Predicting Consumer Purchasing Decision in The Online Food Delivery Industry. arXiv preprint arXiv:2110.00502.

Shi, C., Li, D., & Wu, T., (2021). Influencing Factors of Catering O2O Customer Experience: An Approach Integrating Big Data Analytics with Grounded Theory. *Tehnički vjesnik, 28*(3), 862-872.

Dhiman, K., & Phansikar, M., (2021). Online Food Ordering Management System. *International Journal for Research in Applied Science and Engineering Technology, 9*, 2096-2107.

ŞAHİN, H., & Duygu, İ. Ç. E. N., (n.d.). Application of Random Forest Algorithm for the Prediction of Online Food Delivery Service Delay. *Turkish Journal of Forecasting, 5*(1), 1-11.

McAfee, A., Brynjolfsson, E., Davenport, T. H., Patil, D. J., & Barton, D., (2012). Big Data: the management revolution. *Harvard business review, 90*(10), 60-68.

Galbraith, J. R., (2014). Organizational design challenges resulting from Big Data. *Journal of Organization Design, 3*(1), 2-13.

Korhonen, J., (2014). Big Data–Big Deal for Organization Design? *Journal of Organization Design, 3*(1), 31-36.

Almeida, F. L., (2017). Benefits, challenges and tools of Big Data management. *Journal of Systems Integration (1804-2724), 8*(4).

George, G., Haas, M. R., & Pentland, A., (2014). Big Data and management. *Academy of management Journal, 57*(2), 321-326.

Etzion, D., & Aragon-Correa, J. A., (2016). Big Data, management, and sustainability: Strategic opportunities ahead. *Organization & Environment, 29*(2), 147-155.

Janssen, M., van der Voort, H., & Wahyudi, A., (2017). Factors influencing Big Data decision-making quality. *Journal of business research, 70*, 338-345.

D.J. Teece, G. Pisano, A. Shuen, (1997). Dynamic capabilities and strategic management, Strateg. *Manage. J. 18*(7), 509–533.

Shamim, S., Zeng, J., Shariq, S. M., & Khan, Z., (2019). Role of Big Data management in enhancing Big Data decision-making capability and quality among Chinese firms: A dynamic capabilities view. *Information & Management, 56*(6), 103135.

Zhang Shanshan, Zhang Yucheng & Xu Shan, (2011). A new species of the genus Phyllostachys (Hymenoptera, Braconidae) from China. (2021). New game, new rules: The application of Big Data in organizational management research. *China Human Resource Development,* (11), 41-57.

Fan, Meng-Meng & Fan, Ji-Wei, (2020). Research on the management mode of take-out platform under the background of "Internet+". *Industry and Technology Forum*, (21), 224-225.

Jiang F, Xu MQ & Cui DYR, (2017). A scheduling system based on Big Data for take-out logistics delivery. *Big Data*, (01), 104-110.

Xu Qian, Xiong Jun, Yang Zhenhua & Jin Zhihong, (2021). Path optimization of delivery vehicles based on adaptive large neighborhood search algorithm. *Industrial Engineering and Management,* (03), 115-122.

Cheng R., (2017). Genetic algorithm for solving travel quotient problem. *Science and Technology Wind, 16*(37), 40-51.

Wang, Tsuen-Fei, (2017). Research on fast food delivery path scheme. Beijing: Beijing Jiaotong University (Master's thesis).

Ma Jiangtao, (2010). Medical delivery path planning based on genetic algorithm. *Computer Knowledge and Technology, 6*(11), 2717-2718.

Qin Zhengyu, (2016). Research on third-party logistics distribution of campus take-out in colleges and universities. *Business Story, 2016*(26), 98-99.

Fan, L.N. & Lu, P., (2021). Campus delivery path planning based on improved genetic algorithm. *Logistics Science and Technology,* (01), 14-19.

Wu, H., (2015). Investigation of college students' consumption intention under the influence of Big Data - an example of take-out consumption in six universities in Guizhou Province. *Business,* (19), 298.

Cao QP & Pan YC., (2021). A Big Data-based approach to raw material procurement and management in the restaurant take-out industry. *Science and Technology Perspectives,* (17), 145-149.

Li, Qin & Cui, Xianqing, (2017). Research on the mechanism of online take-out food safety supervision from the perspective of Big Data. *Taxation,* (09), 80.

Chen Xianyu, (2013). The business value of Big Data. *Business Management, 2013*(3), 108-110.

Qiu, Yuan-Yuan, (2016). Research on precise marketing strategy of O2O platform based on Big Data. *Journal of Qiqihar University (Philosophy and Social Science Edition)*, (12), 60-62. doi:10.13971/j.cnki.cn23-1435/c.2016.12.017.

Feng, Zhi-Meng, (2021). Take-out delivery strategy based on Big Data analysis (Master's thesis, Dalian University of Technology).

Jin Jiahua, Wu Langtao, Zhang Tingting & Yan Xiangbin, (2020). A study of takeout merchant ratings based on sentiment analysis. *Journal of Management*, (02), 66-75.

Cao, Jun & Wang, Hu, (2017). Research on factors influencing poor reviews of takeout users - based on text reviews and Word2vec. *Modern Trade Industry*, (02), 55-56. doi:10.19311/j.cnki.1672-3198.2017.02.027.

Wen, Xin, (2021). Unmanned delivery: a technology flow for e-commerce platforms. *Intelligent Networked Vehicles*, (05), 36-38.

He Fengdan, (2018). O2O business model evaluation study (Master's thesis, Hunan University). https://kns.cnki.net/KCMS/detail/detail.aspx?dbname=CMFD201901&filename=1018102998.nh.

Yan Xu, Qianqian Wang, R. Dong, Xinyi Wang & L. Wu, (2019). Analysis of the current situation, problems and countermeasures of "Big Data BDDP". *Reform and Openness*, (01), 15-20. doi:10.16653/j.cnki.32-1034/f.2019.01.005.

Wu, Shujun, (2019). Research on the "BDDP" behavior of e-commerce under weak regulation (Master's thesis, Hunan University). https://kns.cnki.net/KCMS/detail/detail.aspx?dbname=CMFD202002&filename=1020704336.nh.

Lu Fangwei, (2020). Research on the regulation of Big Data "BDDP" in B2C e-commerce platform (Master's thesis, Xiangtan University). https://kns.cnki.net/KCMS/detail/detail.aspx?dbname=CMFD202101&filename=1020408458.nh.

Chen, L., (2020). Labor order under "digital control"-a study on labor control of take-out delivery works. *Sociological Research*, (06), 113-135+244.

Li, S.L. & Jiang, L.H., (2020). Novel labor time control and false freedom - A study of the labor process of take-out delivery works. *Sociological Research*, (06), 91-112+243-244.

Ding, Chuheng, Deng, Tianwen, Wang, Zhao-Yu & Hu, Yiting, (2021). Research on the status and development mode of take-out industry and intelligent take-out counter based on Big Data. *Hebei Enterprise*, (06), 52-54. doi:10.19885/j.cnki.hbqy.2021.06.016.

---

[1] Chang, Y.-W., Hsu, P.-Y., & Yang, Q.-M. (2018). Integration of online and offline channels: a view of O2O commerce. *Internet Research, 28*(4), 926–945.

[2] Breur, Tom, (July 2016). Statistical Power Analysis and the contemporary crisis in social sciences. *Journal of Marketing Analytics.* London, England: Palgrave Macmillan. *4*(2–3), 61–65.

[3] Dabbawala. (2022, February 24). Wikipedia. Retrieved March 07, 2022, from https://en.wikipedia.org/wiki/Dabbawala.

[4]History of food delivery and how its changed. (2021, November 18). Thistle thoughts. Retrieved March 07, 2022, from https://www.thistle.co/learn/thistle-thoughts/history-of-food-delivery-and-how-its-changed.

[5] Adapted from More than a year after the epidemic, our food, clothing, housing and transport have undergone these changes: a surge in demand for take-out Food industry has changed dramatically. (2021, February). QQ.com. Retrieved May 07, 2022, from https://new.qq.com/omn/20210212/20210212A043P100.html.

[6] Adapted from Online Food Delivery - Worldwide. (2022, June). Statista. Retrieved May 07, 2022, from https://www.statista.com/outlook/dmo/eservices/online-food-delivery/worldwide#revenue.

[7] Lee, I. (2017). Big data: Dimensions, evolution, impacts, and challenges. *Business Horizons, 60*(3), 293–303.

[8] Laney D. 3D data management: controlling data volume, velocity and variety. META Group Res Note 2001; 6, 70.

[9] Philip Chen, C., & Zhang, C.-Y. (2014). Data-intensive applications, challenges, techniques and technologies: A survey on Big Data. *Information Sciences*, 275, 314–347.

[10] Weiss, S.M. and N. Indurkhya. (1998), Predictive Data Mining: A Practical Guide, Morgan. Kaufmann Publishers, Inc.

[11] Hilbert, M. (2013). Big data for development: From information-to knowledge societies. Available at SSRN 2205145.

12 Kim, H. S., & Kim, J. (2019). Exploratory study on food delivery through using social network analysis: Focused on the Google web and Google news. *Culinary Science & Hospitality Research, 25*(2), 1-10.

13 Singh, R. K., & Verma, H. K. (2020). Influence of social media analytics on online food delivery systems. *International Journal of Information System Modeling and Design (IJISMD), 11*(3), 1-21.

14 Sadiku, M. N., Ashaolu, T. J., Ajayi-Majebi, A., & Musa, S. M (2020). Big Data in Food Industry.

15 Madani, B., & Alshraideh, H. (2021). Predicting Consumer Purchasing Decision in The Online Food Delivery Industry. arXiv preprint arXiv:2110.00502.

16 Shi, C., Li, D., & Wu, T. (2021). Influencing Factors of Catering O2O Customer Experience: An Approach Integrating Big Data Analytics with Grounded Theory. *Tehnički vjesnik, 28*(3), 862-872.

17 Dhiman, K., & Phansikar, M. (2021). Online Food Ordering Management System. International Journal for Research in Applied Science and Engineering Technology, 9, 2096-2107.

18 ŞAHİN, H., & Duygu, İ. Ç. E. N. Application of Random Forest Algorithm for the Prediction of Online Food Delivery Service Delay. Turkish Journal of Forecasting, 5(1), 1-11.

19 McAfee, A., Brynjolfsson, E., Davenport, T. H., Patil, D. J., & Barton, D. (2012). Big data: the management revolution. *Harvard business review, 90*(10), 60-68.

20 Galbraith, J. R. (2014). Organizational design challenges resulting from big data. *Journal of Organization Design, 3*(1), 2-13.

21 Korhonen, J. (2014). BIg Data–BIg Deal fOr OrganIzatIOn DesIgn?. *Journal of Organization Design, 3*(1), 31-36.

22 Almeida, F. L. (2017). Benefits, challenges and tools of big data management. *Journal of Systems Integration (1804-2724), 8*(4).

23 George, G., Haas, M. R., & Pentland, A. (2014). Big data and management. *Academy of management Journal, 57*(2), 321-326.

24 Etzion, D., & Aragon-Correa, J. A. (2016). Big data, management, and sustainability: Strategic opportunities ahead. *Organization & Environment, 29*(2), 147-155.

25 Janssen, M., van der Voort, H., & Wahyudi, A. (2017). Factors influencing big data decision-making quality. *Journal of business research, 70*, 338-345.

26 D.J. Teece, G. Pisano, A. (1997). Shuen, Dynamic capabilities and strategic management, Strateg. *Manage. J. 18*(7), 509–533.

27 Shamim, S., Zeng, J., Shariq, S. M., & Khan, Z. (2019). Role of big data management in enhancing big data decision-making capability and quality among Chinese firms: A dynamic capabilities view. *Information & Management, 56*(6), 103135.

28 Zhang Shanshan, Zhang Yucheng & Xu Shan. 2011 A new species of the genus Phyllostachys (Hymenoptera, Braconidae) from China. (2021). New game, new rules: The application of big data in organizational management research. *China Human Resource Development*, (11), 41-57.

29 Fan, Meng-Meng & Fan, Ji-Wei. (2020). Research on the management mode of take-out platform under the background of "Internet+". *Industry and Technology Forum*, (21), 224-225.

30 Jiang F, Xu MQ & Cui DYR. (2017). A scheduling system based on big data for take-out logistics delivery. *Big Data*, (01), 104-110.

31 Xu Qian, Xiong Jun, Yang Zhenhua & Jin Zhihong. (2021). Path optimization of delivery vehicles based on adaptive large neighborhood search algorithm. *Industrial Engineering and Management*, (03), 115-122.

32 Cheng R. (2017). Genetic algorithm for solving travel quotient problem. *Science and Technology Wind, 16*(37):40-51.

33 Wang, Tsuen-Fei. (2017). Research on fast food delivery path scheme. Beijing: Beijing Jiaotong University (Master's thesis).

34 Ma Jiangtao. (2010). Medical delivery path planning based on genetic algorithm. *Computer Knowledge and Technology, 6*(11):2717-2718.

35 Qin Zhengyu. (2016). Research on third-party logistics distribution of campus take-out in colleges and universities. *Business Story, 2016*(26), 98-99.

36 Fan, L.N. & Lu, P., (2021). Campus delivery path planning based on improved genetic algorithm. *Logistics Science and Technology,* (01), 14-19.

37 Wu, H., (2015). Investigation of college students' consumption intention under the influence of big data - an example of take-out consumption in six universities in Guizhou Province. *Business*, (19), 298.

38 Cao QP & Pan YC. (2021). A big data-based approach to raw material procurement and management in the restaurant take-out industry. *Science and Technology Perspectives*, (17), 145-149.

39 Li, Qin & Cui, Xianqing. (2017). Research on the mechanism of online take-out food safety supervision from the perspective of big data. *Taxation,* (09), 80.

40 Chen Xianyu. (2013). The business value of big data. B*usiness Management, 2013*(3), 108-110.

41 Qiu, Yuan-Yuan. (2016). Research on precise marketing strategy of O2O platform based on big data. *Journal of Qiqihar University (Philosophy and Social Science Edition)*, (12), 60-62.

42 Feng, Zhi-Meng. (2021). Take-out delivery strategy based on big data analysis (Master's thesis, Dalian University of Technology).

43 Feng, Zhi-Meng. (2021). Take-out delivery strategy based on big data analysis (Master's thesis, Dalian University of Technology).

44 Jin Jiahua, Wu Langtao, Zhang Tingting & Yan Xiangbin. (2020). A study of takeout merchant ratings based on sentiment analysis. *Journal of Management,* (02), 66-75.

45 Cao, Jun & Wang, Hu. (2017). Research on factors influencing poor reviews of takeout users - based on text reviews and Word2vec. *Modern Trade Industry,* (02), 55-56.

46 Wen, Xin. (2021). Unmanned delivery: a technology flow for e-commerce platforms. *Intelligent Networked Vehicles,* (05), 36-38.

47 He Fengdan. (2018). O2O business model evaluation study (Master's thesis, Hunan University).

48 Adapted from Meituan vs. Hungry Who is the king of take-out in China? (2019, October). Forward-The economist. Retrieved June 13, 2022, from https://www.qianzhan.com/analyst/detail/220/191011-9912b290.html.

49 Adapted from Meituan vs. Hungry Who is the king of take-out in China? (2019, October). Forward-The economist. Retrieved June 13, 2022, from https://www.qianzhan.com/analyst/detail/220/191011-9912b290.html.

50 Adapted from China GDP, (September 2022). Trade Economics. Retrieved September 4, 2022, from https://tradingeconomics.com/china/gdp.

51 Adapted from China Hotel Association (May 2021). The epidemic reshapes the takeout landscape: new consumption - new brand - new role. http://www.globalhha.com/doclib/data/upload/editor/620f73e866aee.pdf.

52 Adapted CNAW (August 27, 2021). The latest data! The size of China's Internet users broke 1 billion! Takeout users reached 469 million. https://baijiahao.baidu.com/s?id=1709207042576096017&wfr=spider&for=pc.

53 Yan Xu, Qianqian Wang, R. Dong, Xinyi Wang & L. Wu. (2019). Analysis of the current situation, problems and countermeasures of "big data BDDP". *Reform and Openness,* (01), 15-20.

54 Wu, Shujun. (2019). Research on the "BDDP" behavior of e-commerce under weak regulation (Master's thesis, Hunan University).

55 Lu Fangwei. (2020). Research on the regulation of big data "BDDP" in B2C e-commerce platform (Master's thesis, Xiangtan University).

56 Chen, L., (2020). Labor order under "digital control"-a study on labor control of take-out delivery works. *Sociological Research*, (06), 113-135+244.

57 Adapted Zhou Xiang, Meituan data is not credible, the real income of take-away riders is lower than the city base salary (September 16, 2022). Observer. https://www.guancha.cn/zhouxiang/2020_09_16_565266.

58 Li, S.L. & Jiang, L.H.. (2020). Novel labor time control and false freedom - A study of the labor process of take-out delivery works. *Sociological Research*, (06), 91-112+243-244.

59 Li, S.L. & Jiang, L.H.. (2020). Novel labor time control and false freedom - A study of the labor process of take-out delivery works. *Sociological Research*, (06), 91-112+243-244.

60 Chen, L. (2020). Labor order under "digital control"-a study on labor control of take-out delivery works. *Sociological Research*, (06), 113-135+244.

61 Ding, Chuheng, Deng, Tianwen, Wang, Zhao-Yu & Hu, Yiting. (2021). Research on the status and development mode of take-out industry and intelligent take-out counter based on big data. *Hebei Enterprise,* (06), 52-54.

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