

Research on the Food Safety Situation of Online-to-Offline Food Delivery Industry in China

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博 士 論 文

Research on the Food Safety Situation of Online-to-
Offline Food Delivery Industry in China

中国における O2O フードデリバリーの安全性評価

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Abstract

With the rapid growth of economy and fast innovation of internet technology, China has been enjoying a dramatic growth of e-commerce in the past few years. China's e-commerce market size has become the biggest in the world with the total transaction volume of e-commerce reached 34.81 trillion yuan (\$4.98 trillion) in 2019 and over 900 million online shoppers. Since 2012, the Online-to-offline (O2O) food market began to emerge in China, which provides consumers with more diversified choices regarding their everyday catering lives. However, due to the lack of awareness and imperfect regulation, the newly emerging industry has posed inevitable challenges and additional food safety risks to the whole of the food industry has had an asymmetric effect, within the O2O food delivery market, and may occur in all aspects of production, processing, packaging, circulation and consumption due to the virtual nature of network transactions. This research aims to provide us an overall picture of food safety in the O2O industry and to provide a reference for policy makers to regulate food safety in the future.

In addition to review the development of e-commerce in China and explains how the O2O food delivery industry has developed. We then investigated delivery riders' view towards food safety issues in the O2O food delivery industry and their perceptions toward hygiene status, business qualification, distribution processes and packaging materials in the industry. The results show that the main factors affecting food safety in the O2O food delivery industry from the riders' perspective are raw materials and processing, packaging boxes made with inferior materials. Thirdly, we look at consumer's perception of O2O food delivery industry under Covid-19 pandemic as online food service played a critical role for ensuring the food supply under the impact of the pandemic. Food safety issues has the highest concern for consumers.

There is still much room for improvement in the aspect of the strengthening of regulations and supervision by government in the O2O food delivery industry, not only to ensure the food safety, but also for the health and safety purpose of participants of this industry. Efforts such as control of the total number of orders dispatched to riders and explored the approaches by giving riders more choices to select or refuse orders without affecting future order allocation must be taken into considerations. At the same time, increasing investment in conducting more effective safety

education courses for riders and promote industry guidelines are also urgently needed to clarify each participants' rights and obligations. In addition to regulation and supervision from government and food delivery platforms, industry association and consumer association must also take part in ensuring the food safety in O2O food delivery industry.

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Chapter 1

Introduction

1.1 Research Background

With the rapid growth of economy and fast innovation of internet technology, China has been enjoying a dramatic growth of e-commerce in the past few years. China's e-commerce market has overtaken America's market in 2013 and Alibaba has become the world's largest retail platform in 2016, with its total trading volume online surpassing Wal-Mart's annual sales in March 2016(China Daily, 2016). According to the E-Commerce report released by the Ministry of Commerce, China's e-commerce market size has become the biggest in the world with the total transaction volume of e-commerce reached 34.81 trillion yuan (\$4.98 trillion) in 2019, as well as over 900 million online shoppers (E-commerce in China 2019).

One of the impacts of the development of e-commerce on consumer behavior in the food industry is the growth of online-to-offline (O2O) food delivery market. Due to an increasing number of consumers that have started to use online food-ordering platform services, the O2O food delivery market grew explosively in 2014. Although the transformation provides consumers with more diversified choices, especially among the younger generation, the O2O food delivery service has posed inevitable challenges and additional food safety risks to the whole of the food industry as asymmetry, within the O2O food delivery market, may occur in all aspects of production, processing, packaging, circulation and consumption due to the virtual nature of network transactions. This research aims to offer a different perspective in order to grasp the status quo and gain an overall picture of food safety in the O2O industry.

1.2 Literature Review

1.2.1 Definition of Food safety

Traditionally, food safety can be defined both in a narrow sense and a broader sense. According to the food safety definition from “Assuring Food Safety and Quality: Guidelines for strengthening national food control system” published by FAO and WHO in 2003, food safety was defined as to all those hazards, whether chronic or acute, that may make food injurious to the health of the consumer. It is not negotiable. (FAO/WHO, 2003).

1.2.2 Information Asymmetry and Government Regulation Regarding Food Safety

Food safety issues have also long been a public concern that many governments and institutions are proactively supervising and regulating the food industry. According to the survey conducted by FSA in 2019 across England, Wales and Northern Ireland, the top three food safety issues of total concern for respondents were Chemicals from the environment (32%), food hygiene when eating out (31%), and food poisoning (28%). Effective government regulation can promote the healthy development of the industry and there many research that are revolved around the role government regulation has play in the food markets.

However, food markets are characterized by imperfect information that makes food safety management different from the management of general products. Both buyers and seller could face incomplete information in food market. American economist Antle (1995) has classified this into 3 types, perfect information (both seller and buyer have perfect information), asymmetric imperfect information (seller has perfect information but buyer has imperfect information) and symmetric imperfect information (information is imperfect for buyer and seller before and after purchase). He believes that a 100% safe food supply is an unattainable goal and improving the safety of food is costly, he argues that choices must be made between different dimensions of food safety and between a safer food supply and other uses of public and private resources. By looking at the role of government has played in regulating industry, he states that most food safety regulation is based on the view that government can make better food safety choice and these regulations have not been based on efficiency criteria. Antle suggests for an efficient food safety regulation based on

performance criteria and information provision (Antle, 1995).

In addition to regulation from government, private standards have also gaining more and more attention as an important mode of governance in food industry, private food safety and quality standards have changed from being mainly business-to-business requirements to collective standards (Henson, 2008). Wang et al (2015) analyzed the effect of government governance on farmers' pesticide application behaviors in the management of agricultural product safety, and found out that the regulation of government was very limited. Therefore, strengthening food safety and social co-governance is a supplement to make up for the limited government regulation and supervision (Wang et al, 2015).

In terms of the food safety control, several systems and approaches were applied for food safety management procedures, such as HACCP, FSMS. HACCP was first developed by the Pillsbury Company with the aim to assure the safety of food produced for the U.S. space program in 1960s (Karen and Wayne, 2002). It is now developed with the goal of controlling critical points in food handling to prevent food safety problems and the movement to institutionalize the introduction of HACCP is spreading worldwide. For instance, according to the newly amended Food Sanitation Act of Japan, in addition to general hygiene management, all food business operators will be required to implement hygiene management in accordance with HACCP by June 2021 (Annual report on food, agriculture and rural areas in Japan, 2020).

The FSMS was introduced by International Organization for Standardization that is used to direct and control an organization of food safety (ISO, 2018). However, several studies shows that lacking of knowledge, economics resources as well as personnel regarding HACCP and other food safety control system are the main barriers to the implementation in retail and catering sectors ((Jouve, 1994; Mortlock, Peters, & GriYth, 1999). Therefore, it's critical for government to provide periodical training and consultation services regarding the implementation of food safety control system (Ayse et al, 2012)

Martinez et al (2007) has studies food safety governance in different countries and concluded that co-regulation of is becoming acknowledged as an effective method in food safety regulation, driven by both regulatory change of the structure of food supply chains. EU is providing opportunities for closer collaboration between regulatory agencies and the private sector while the US is implementing HACCP in key sectors that shifts the responsibility for the monitoring of food safety to business operators.

1.2.3 Food Safety Regulation in China

Food safety scandals are gaining increased attention from the public in China as many food scandals have been exposed over the past two decades. In 2008, the occurrence of a milk scandal in China led 294,000 infants diagnosed with urinary calculus, with more than 50,000 infants hospitalized (State Council of the People's Republic of China, 2008). The milk and infant formula were adulterated with melamine in order to increase the nitrogen content of diluted milk. Given this situation, the Chinese government released the first Food Safety Law in February 2009 and established the State Council Food Safety Committee and the National Food Safety Risk Assessment Center in 2010 and 2011, respectively (Liu et al, 2019).

Despite the fact that government regulation and consumer awareness regarding food safety issues are constantly increasing, food safety incidents still occasionally occur. Since the milk scandal in 2008, there have been incidents such as the gutter oil scandal, an expired meat scandal, a poisonous ginger scandal and a fake alcohol scandal. These incidents have not only involved the leading domestic food companies in China, but have also involved multinational food companies operating in China (Zhang and Jiang, 2015). Especially during the Consumer Rights Day in 15th of March, China Central Television would also expose food safety incidents discovered over the past year.

Guo and et al argue that two driving powers are important in improving food quality and safety in China, government regulations as the external factor and voluntary certifications as the internal factor. Government regulates the market by using administrative intervention and companies are

trying to gain consumers' acceptance by seeking third-party certification. Reforming food safety system and encouraging small and medium food companies to implement product and system certifications are suggested to ensure the food safety in China (Guo and et al., 2019)

Regarding to the food safety for agricultural products, several pilot project and reforms were gradually to launch by the central government in order to address the safety problem in food systems. One of the representative approach is by launching Nongchaoduijie (Farmer-Supermarket Direct-Purchase) program. It promoted in 2009 in order to encourage supermarket chains to directly purchase from the farmer cooperatives or production base in an effort to ensure the food safety, building a modern distribution system and increasing the benefit for farmers (Gale and Hu, 2011).

1.2.4 Food Safety Issues of O2O Food Delivery Industry

The online-to-offline (O2O) food delivery industry grew in 2014 as increasing numbers of consumers started to use online food-ordering platform services. The new industry provides consumers with more diversified choices regarding their everyday catering lives and has especially attracted a large number of consumers from the younger generation. However, online food ordering services have become a new channel for foodborne disease transmission due to the lack of effective surveillance and supervision (Jiang et al., 2020).

Since 2016, food safety issues related to the online catering industry have begun to arise and were becoming a great concern for the public. Concern has risen especially after the exposure of a series of food safety issues involving businesses on the "Ele.me" platform is suspected of operating without a license and using falsely registered addresses. The Customer Evaluation Center of the Shanghai Association for Quality conducted a survey involving 2,953 consumers and found that 78.7% of consumers worry about hygiene problems in online food, and 29.6% of the respondents encountered food safety problems when they received online orders. Although the National Food and Drug Administration of China promulgated regulations to regulate the food safety of the Internet catering industry in 2017, food safety scandals related to the promotion of unlicensed restaurants by

platforms, the posting of fraudulent information regarding consumers' comments, is still occurring (Zhang and Shi, 2017).

In order to strengthen the supervision and administration of food safety in O2O food delivery industry, the Chinese government enacted the Measures for the Supervision and Administration of Food Safety in Online Catering Services in 2018, which requires O2O food businesses to have physical stores and obtain food operation permits in accordance with the law, and forbid the offline restaurants to operate beyond the business scope (State Administration for Market Regulation, 2017).

The platforms have begun to attach great importance to ensure food safety in different approaches since 2016. Ele.me has been actively improving the supervision of O2O food delivery services so that the public could regain confidence in online platforms. As one of the important measures, Ele.me joined hands with the technology company 360 to launch the “Bright Kitchen and Bright Stove” project. The two parties worked together to show the cleaning and cooking processes of restaurant kitchens through live streaming, to ensure food safety (Huangqiu, 2016). In 2017, Meituan Waimai began to promote “food safety seals” across the country, which aims to reduce the possibility of contamination during the delivery process (Cnfood, 2018).

The “Operational Norms for Food Safety in Catering Services” is a newly revised piece of legislation by the State Administration for Market Regulation that comes into effect on October 1st 2018. This regulation is applicable to the catering service business providers. The regulation requires that third-party platform providers and online catering service providers should publish the name, address, food safety information, and business license, main ingredients and other food safety related information online (People.net, 2018).

In July 2020, Nanjing City issued regulations on the use of food safety seals. Nanjing has formulated uniform standards for the material, location, and use of the seal. It is stipulated that the seal should be made of special material, so that the seal cannot be restored to its original state after it is opened or the outer packaging is damaged (People.net, 2020).

The market supervision department of Zhejiang Province continues to pay close attention to the illegal activities of platforms and catering service providers. Over the past four years, Zhejiang Province has filed a total of 44 cases of illegal food delivery platforms, investigated 2789 cases of catering service providers and banned 573 unlicensed catering service providers. In total, it was found that there were more than 50,000 service providers that did not meet the requirements of online business operation. The investigation and handling of cases are published in the media in order to ensure the food safety of O2O food delivery industry in Zhejiang province (Research Group of Zhejiang Provincial Political Consultative Conference, 2020).

1.2.5 Measures regarding improve the food safety of O2O food delivery industry

Kang et al. (2021) analyzes the business models of food e-commerce in China and difficulties in online food safety governance and their causes. The authors proposed an online food safety co-regulation system considering both regulation and supervision. In order to ensure the food safety of O2O food delivery industry, it is important to establish a system that allows for quality control of food sources, strict management of the transaction process and whole-process supervision as well as emphasizing the necessity of multipartite online food safety co-regulation.

Liu (2021) pointed out that in order to achieve the goal of ensuring the food safety of O2O food delivery industry, forming a framework of the concept of Social Co-governance and the whole industrial chain with a six-in-one governance structure is needed. This includes government supervision, market incentives, consumer and new media supervision, third-party organization testing and accreditation, insider reporting and industry self-discipline. In addition, utilizing the detection technology, electronic traceability and big data technology as well as cold chain packing technology should also be taken into consideration. Zhao et al. (2021) examines the latest transformation and improvements of the O2O market in China and pointed out that the O2O food delivery industry has shifted its priority from quantity to quality and diversity.

Based on the data of 1009 consumer questionnaires in Shanghai and Jinan City, Wang et al. (2019)

investigated how government supervision effects trust and consumers' online food purchasing behavior and found out that consumers' trust in government supervision was not high, government regulatory trust had a significant positive impact on consumers' online food purchasing behavior. In order to achieve the sustainable development of O2O food delivery industry, it is suggested the government should formulate the industry standard for O2O food delivery, especially establishing the traceability system to realize the supervision of the whole industrial chain, as well as to enhance the trust of government regulation.

In addition, these days Big Data technologies are also being developed and implemented to ensure food safety. In a very recent study conducted by Jin and et al. found that the use of Big Data technology could provide predictive insights in food supply chain and design the monitoring strategies. Although, it is still in its infancy phase, it is influencing the entire food supply chain.

1.3 Research Objectives

This study aims to grasp the status quo and gain an overall picture of food safety in the O2O industry and to provide a reference for policy makers to regulate food safety in the future. The following research questions have been formulated to achieve the aim of this study.

- (1) How has O2O food delivery industry developed in the past few years?
- (2) How do delivery riders view food safety issues in the O2O food delivery industry? What are their perceptions toward hygienic status, business qualification, distribution process and packaging materials?
- (3) How did consumers view the O2O food delivery industry under Covid-19 pandemic?

1.4 Methodology

The author conducted a descriptive and case study approach in this research to examine the food safety situation of the O2O food delivery industry and the consumer's perception of O2O food

delivery industry under Covid-19. Secondary data were collected from documents, government and nongovernment reports. Data regarding consumers and suppliers has been gathered mainly from statistical data published in government reports and O2O platforms.

Primary data of the case study was collected via field surveys in Shanghai in July and August 2019. Face-to-face interviews and questionnaire were conducted to investigate delivery riders in Shanghai in order to gain a deeper understanding of the current situation surrounding food safety in China's O2O food industry.

Data of consumer's perception toward O2O food delivery industry under Covid-19 was conducted from February 6 to February 16, 2020 in two selected cities, Beijing and Shanghai in China. The author commissioned Makromir Co., Ltd. to conduct a questionnaire survey of 2080 consumers, among which 1040 consumers in Beijing and Shanghai each to investigate their basic information, consumption habits, preference for food delivery services, and problems that are expected to be improved.

1.5 Outline

The rest of the paper is organized as follows:

Chapter two reviews the development of O2O food delivery industry, the rapid growth of internet and e-commerce have resulted an increasing number of consumers started to use online food-ordering platform services. This chapter provides us with a better understanding of the background of China's e-commerce development and the history of O2O food delivery industry.

Based on a case study in Shanghai, Chapter three attempts to investigate the food safety situation of the O2O food delivery industry from the perspective of delivery riders, including their perceptions regarding hygienic status, business qualification, distribution process and packaging materials. It provides a different perspective to view the food safety issues of O2O food industry

and illustrates the factors that affecting food safety in the O2O food delivery industry from the riders' perspective.

Chapter four illustrates the current situation of the Online-to-offline food delivery industry under the Covid-19 Pandemic and new changes in the industry. Then, the consumer's perception towards online food delivery services were examined based on the 2080 questionnaires conducted in Beijing and Shanghai from February 6 to February 16, 2020. Conclusions and recommendations are given in chapter five.

Chapter 2

Development of Online-to-Offline Food Delivery Industry

2.1 E-commerce of China

2.1.1 E-commerce market of China

The Chinese economy has achieved rapid growth with the introduction of the “Reform and Opening Up” policy since 1978, with an averaged Annual GDP Growth Rate 9.5% in the past 40 years. In recent years, the expansion of e-commerce in China is growing at a rate faster than anywhere else in the world (World economic forum 2021). The total transaction volume of e-commerce reached 34.81 trillion yuan (\$4.98 trillion) in 2019, accounting for over 50% of worldwide retail sales on the internet (E-commerce in China 2019).

As an important part of the e-commerce, online consumption is playing an increasingly important role in promoting the vigorous development of the consumer market. China Singles’ Day shopping festival organized by e-commerce giant Alibaba in 11th November, has become a huge event that has been creating new sales records for the globe’s largest online sales volume every year. It is reported Alibaba posted sales of US\$75.1 billion in Singles’ Day in 2020, compared with US\$38.3 billion in 2019 (Table 2.1). Alibaba’s one day event generates more revenue than the Thanksgiving weekend in the U.S. The e-commerce market that china owns is almost twice as much as the US, UK, Japan, South Korea, Germany in total (Global Ecommerce 2019; Li et al 2020).

Table 2.1 Sales between Singles’ Day of China and Thanksgiving weekend of the U.S.

Sale volume (US\$ billion)	2015	2016	2017	2018		2019
Singles’ Day (Alibaba, China)	14.3	17.8	25.3	30.8		38.4
Thanksgiving weekend:	6.9	8.4	10.7	14.2		17.6
Thanksgiving Day, Black Friday, Cyber Monday (U.S. total)						

Source: Statista, 2020.

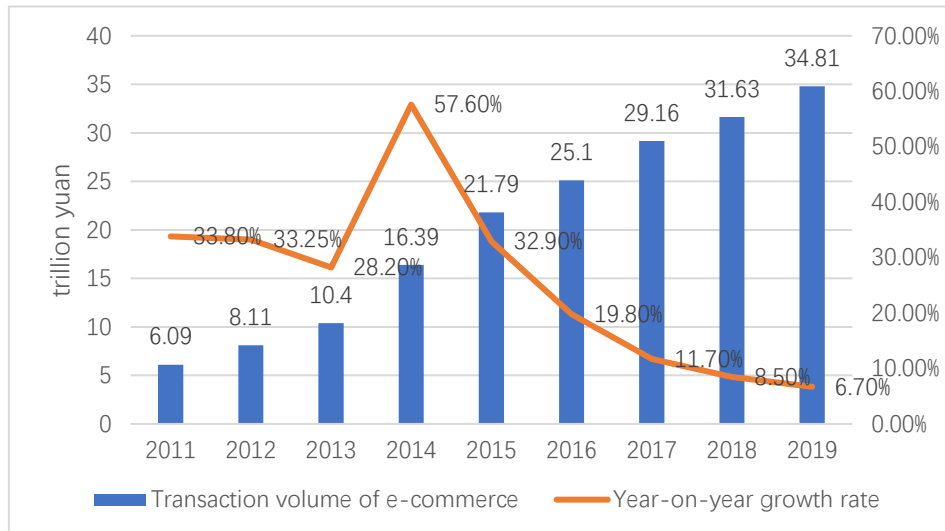


Figure 2.1 Transaction volume of e-commerce in China

Source: E-commerce in China 2019, Ministry of Commerce

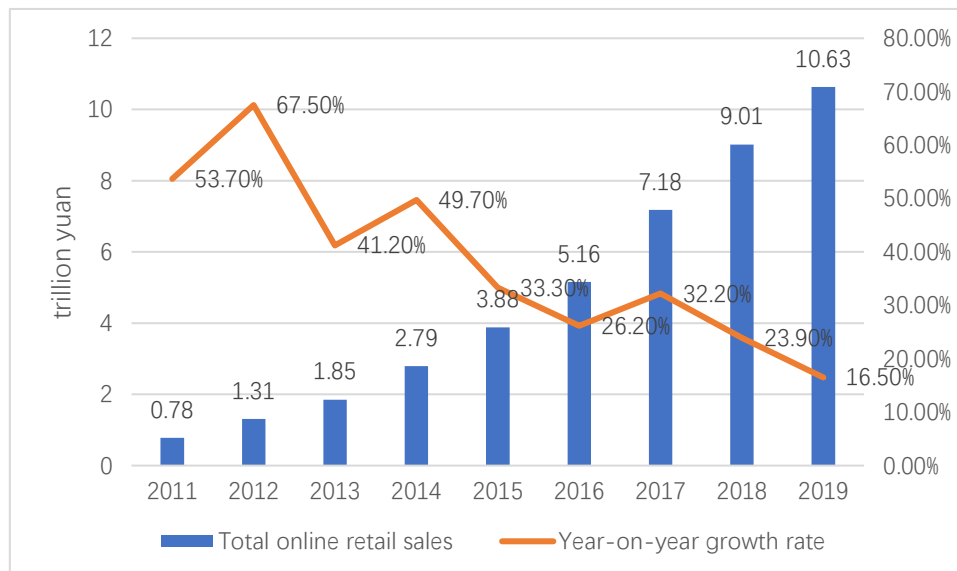


Figure 2.2 Total online retail sales of China in China

Source: E-commerce in China 2019, Ministry of Commerce

China's big success in promoting e-commerce is firstly due to its rapid economic growth that increases people's income, created huge market and upgraded level of consumption. Secondly, the development of the Internet and smart phones satisfied the shopping needs of residents in rural areas, which has stimulated the e-commerce economy. Thirdly, the development of mobile payment systems. Fourthly, the government have implanted supporting policies and created sound environment for startups and innovations, boosting the sharp rising for a batch of e-commerce firms such as Alibaba, JD, and Pinduoduo and etc. (Sun, 2019)

2.1.2 Size of Internet Users

Smartphones have become the basic needs of people’s lives along with the development of infrastructure of increasingly complete Internet services. According to the “Statistical Report on Internet Development in China” released by the China Internet Network Information Center (CNNIC) in 2020, there were 939.84 million people who had access to the internet and the Internet penetration had reached 67.0%. However, compared to its total population, China’s internet penetration rate is lower than in other Asian countries, such as Korea and Japan.

Among the internet users, mobile internet users reached 932.36 million, an increase of 35.46 million over March 2020, resulting the largest online community in the whole world. The proportion of Chinese internet users accessing the Internet via their mobile phones had amounted to 99.2%. According to CNNIC, personal internet applications users increased steadily in the first half of 2020. Rapid growth in user size was found in live streaming e-commerce, video clip and online shopping applications, with growth rates of 16.7%, 5.8% and 5.5% respectively.

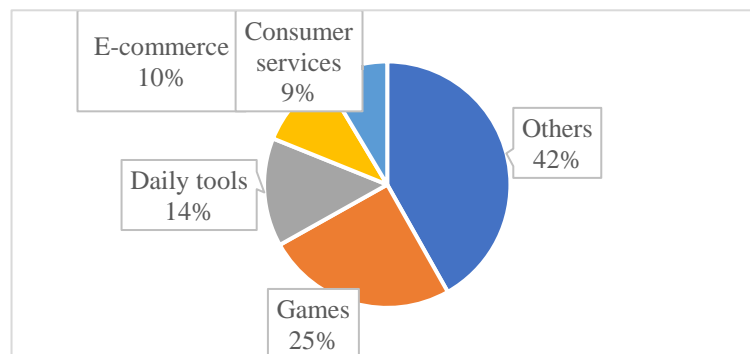


Figure 2.3 Proportion of Apps by Category in China
Source: Ministry of Industry and Information Technology of China

The Apps in the top four categories are games, daily tools, e-commerce, and consumer services, which accounted for 58.6% of the total (Figure 2.3). In 2020, the number of game Apps are 925,000, accounting for 25.8% of all Apps, an increase of 16,000 compared to the end of 2019. The Apps of daily tools and e-commerce ranked second and third place with users of 508,000 and 365,000 and 305,000, respectively. The others include Apps such as social communication, education, music,

news and etc. that made up 41.4% of the total. Table 2.2 shows the user size and percentage of applications users from March to June of 2020. The live streaming e-commerce, video clip and online shopping apps have very rapid growth.

Table 2.2 User size and percentage of applications users from 2020/3 to 2020/6

Applications	June 2020		March 2020		Growth rate
	No. of users (10,000)	% of app users	No. of users (10,000)	% of app users	
Instant messaging	93079	99.0%	89613	99.2%	3.9%
Search engine	76554	81.5%	75015	83.0%	2.1%
Online news	72507	77.1%	73072	80.9%	-0.8%
Telecommuting	19908	21.2%	-	-	-
Online shopping	74939	79.7%	71027	78.6%	5.5%
Online meal ordering	40903	43.5%	39780	44.0%	2.8%
Online payment	80500	85.7%	76798	85.0%	4.8%
Internet wealth management	14938	15.9%	16356	18.1%	-8.7%
Online games	53987	57.4%	53182	58.9%	1.5%
Online video	88821	94.5%	85044	94.1%	4.4%
Video clip	81786	87.0%	77325	85.6%	5.8%
Online music	63855	67.9%	63513	70.3%	0.5%
Online literature	46704	49.7%	45538	50.4%	2.6%
Live streaming*	56230	59.8%	55982	62.0%	0.4%
Online Car-hailing Services	34011	36.2%	36230	40.1%	-6.1%
Online education	38060	40.5%	42296	46.8%	-10.0%
Online medical services	27602	29.4%	-	-	-

*Live streaming includes live-stream e-commerce, live sport broadcasting, host live show, live game streaming, and live concert streaming.

Source: The 46th Statistical Report on Internet Development in China,2020

2.1.3 Business models of E-commerce

E-commerce is the abbreviated form of electronic commerce, which refers to the activity of buying or selling of products and services over the Internet. At present, common e-commerce models mainly include B2B, B2C, C2C, C2B, and O2O.

B2B refers to the sale of goods or services between businesses, such as transactions between manufacturers and wholesalers. This model is aimed to improve the efficiency of a company business by conducting transactions digitally.

B2C refers to the process of selling products and services directly between a business and consumers who are the end-users of its products or services. Most companies that sell directly to consumers can be referred to as B2C companies such as Amazon and Taobao.

C2C refers to the electronically facilitated transactions between consumers through some third party. A common example is an online auction, in which a consumer posts an item for sale and other consumers bid to purchase it; the third party generally charges a flat fee or commission.

C2B is a business model where the end consumers create products and services which are consumed by businesses and organizations. The customers describe the products and services that they want, and then these requirements will be collected and transferred by enterprises or organizations to purchasing and production (Ding, 2016). This business model is a complete reversal of traditional business model where companies offer goods and services to consumers (Vineeta and Akanksha, 2017).

O2O refers the customer enjoys the product or service offline via buying online. This business model is an efficient combination of the online virtual economy and offline real economy, which breaks down territorial barriers and provides consumers with more opportunities to browse and choose preferred online products and information(Wen and Zhang, 2015).

2.2 Online-to-offline (O2O) food delivery industry

People's daily lives have been fundamentally changed by the prosperity of e-commerce industry along with the rapid development of the Internet, smartphones. At the same time, the continuously expanding scale of internet users also provides a user base for O2O industry. Although, internet usage in China is further characterized by a large regional discrepancy, with more internet users in urban area than rural area, the number of internet users in China increased steadily over the previous decade.

Online-to-offline (O2O) food market began to emerge in 2012 and the industry grew explosively in 2014 as increasing numbers of consumers started to use online food-ordering platform services. This new industry provides consumers with more diversified choices regarding their everyday catering lives and has especially attracted a large number of younger generation consumers. Many internet giants such as Baidu, Alibaba, Meituan and traditional catering enterprises entered the industry in 2014 along with rising awareness of the O2O food delivery market.

According to the National Bureau of Statistics, the national catering industry achieved revenue of US\$4672.1 billion in 2019, with a year-on-year increase of 9.4% which exceeding the GDP growth rate (6.1%) in the same period. The proportion of catering industry revenue in total retail sales of consumer goods has increased for five consecutive years, reaching 11.3% in 2019. Food and beverage consumption has become an important driving force for the growth of consumption.

In the past five years, the consumption level of Chinese people has been continuously upgraded and the scale of consumers for dining remotely increased dramatically, which led a rapid growth of transaction volume and transaction value for China's food delivery industry. The market size of China's food delivery industry has also shown a rapid rise in 2019, the scale of China's online-to-offline food delivery industry was 653.6 billion yuan, with an 39.3% increase comparing to 2018.

At the same time, Meituan's 2019 financial report showed that Meituan's food delivery business

continued to maintain a strong growth in 2019. The total number of transactions is 8.7 billion times, with an increase by 36.4% year-on-year; the total transaction value is 392.7 billion yuan, increased by 38.9% year-on-year. The average daily transactions increased by 36.4% to 23.9 million times.

According to Statistical Report on Internet Development in China 2020, the user size of online meal ordering was 409.03 million in June 2020, which accounted for 43.5% of China's total internet users. The number of orders conducted by mobile phone reached 407.20 million. According to China Food Delivery Industry Development Report in 2020, the estimation of food delivery consumers reached 460 million people in China in 2019, an increase of approximately 12.7% compared to 2018. That is to say, more than a quarter of Chinese people have had experienced of ordering food online (China Food Delivery Industry Development Report 2020).

2.3 Business models of online-to-offline (O2O)

2.3.1 Types of business models

There are two types of business models of online-to-offline (O2O) in the food industry, the first type is online food shopping; the second type is online catering services, which are also called online meal ordering and eats-at-home service. Online food shopping is usually operated by traditional retailers such as WalMart, who either open their own online stores or utilize e-marketplaces created by leading platforms such as Alibaba to sell food online. Most of the products are pre-packaged food products and agro-food. In general, the online meal ordering and eats-at-home service is mainly from O2O food delivery platforms that are usually backed by giant tech companies, such Meituan and ele.me. Different from online food shopping, online meal ordering services are closely linked to small local and chain restaurants. In this research, we mainly address the issues regarding the second type of business model, online meal ordering services.

2.3.2 Delivery platforms

Before the digital payment system and delivery platforms were developed, most of the chain restaurants such as KFC and Pizza Hut were providing delivery service with their own delivery riders; some smaller restaurants would also take orders from telephone calls and delivery food to customers. However, in the current stage, online-to-offline food delivery industry is mainly relying on ordering platforms.

Today, delivery industry in China is dominated by two major players Meituan and Ele.me, they are the two largest ordering platforms that are run by tech giants Tencent and Alibaba. According to the “Trust Data”, the total market share of Meituan and Ele.me is close to 95% in the first quarter of 2020, with Meituan taking 67.3% of the market and Ele.me taking a market share of 26.9%, ranking the second in the food delivery industry.

2.3.3 Participants of online-to-offline (O2O)

The operational flow of the O2O mode that involves three parties: an O2O service platform, consumers, and offline business entity (Figure 2.4). The O2O service platform plays a critical role in this business mode that acts as a bridge connecting consumers’ needs and offline business entities. Consumers browse and select appropriate products (meals) that are displayed online via the platform. Payment can be made either on the platform or through third party channels such as Alipay. If the order is placed, the data that contains information on the consumer’s request will be transmitted to an offline business entity (a restaurant) and a delivery rider. Correspondingly, the restaurant prepares the meal while the rider goes to the restaurant to pick up the order with electronic bikes. The rider must deliver the meal to the consumer within the time agreed when the order was placed on the platform. Finally, consumers have opportunities to rate the overall service and provide feedback to the platform after the service is completed.

The advantages of this model can be described as follows: To restaurants, the online to offline channels not only provides a new revenue source without increasing labor cost and expanding business capacity, it can also ensure each customers’ order during peak time. What’s more, compared

with the traditional menu, restaurant owners can have flexible menu management via platforms without worrying too much on updating the information regarding price changes and dishes change of the menu.

To customers, online food ordering service could help customers to save time by placing orders remotely, offering a wide variety of options to customers, as well as remembering consumer's preference each time when the order is placed for better service in the future.

To online platform, in addition to get commission from each order, it could also learn the consumer's preference by collecting their shopping data and monitoring the payment, and then providing products that better meet consumers' taste in next order.

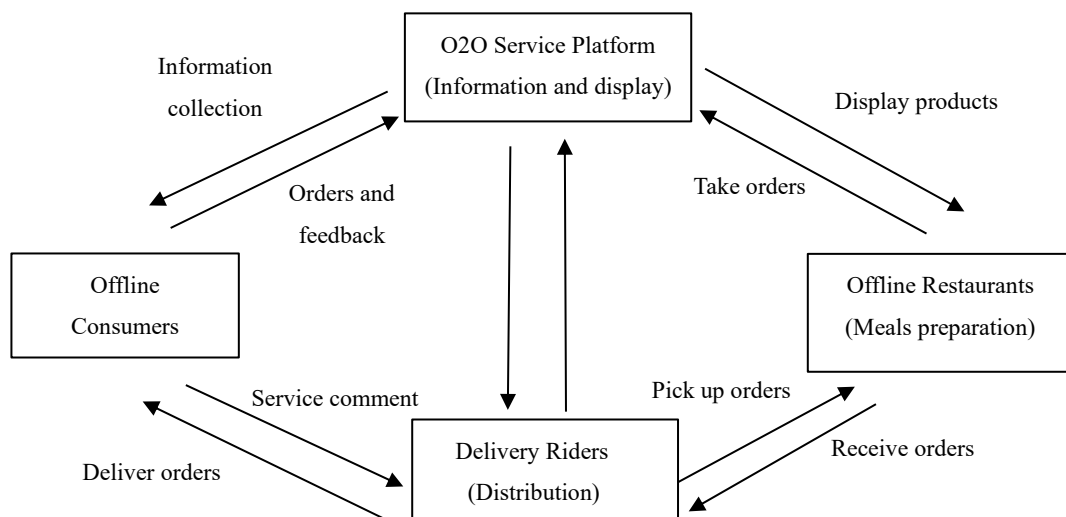


Figure 2.4. Operation of the O2O food industry

Source: Made by author based on previous studies

2.4 Stage of development of the O2O food delivery industry

The stage of development of the O2O food delivery industry can be divided into three stages (Table 2.3): Start-up (2009-2013), expansion (2014-2015) and fast growth (2016-present).

2.4.1 Start-up (2009-2013)

The Internet brought new development opportunities to the catering market between 2009-2013 and the O2O food delivery industry is in its infancy. The O2O catering and food delivery platform Ele.me was founded in 2009, and then it expanded its team to enter universities in Beijing and Hangzhou. Ele.me mainly targeted college students at this time. Meituan was founded in 2010 and launched its O2O food delivery service Meituanwaimai in 2013.

2.4.2 Expansion (2014-2015)

O2O food delivery experienced rapid expansion from 2013 to 2015 which was characterized by Internet giants and traditional catering enterprises entering the industry. From 2014 both Meituan and Ele.me started recruiting a large number of staff and expanding the scope of delivery services to more areas. In the same year, Baidu Waimai joined the food delivery industry with their potential customers targeted to the white-collars. Baidu Waimai accounted for 33% of the white-collar market. However, the online food delivery market slowed down in 2015. Meituan began to shift their consumers from the university students to the white-collars. It established its own delivery team and automatic ordering system in order to improve the efficiency of food delivery. In this period, various platforms were actively expanded and O2O food-related financing reached its peak in 2015. Meituan Waimai was backed by Tencent while Baidu Waimai was supported by Baidu. Ele.me accepted a joint investment of US\$1.25 billion from Alibaba in 2016.

2.4.3 Fast growth (2016-present)

Industry integration and mergers began in this period. In August 2017, Ele.me officially announced the merger of Baidu Waimai and the food delivery market is mainly shared by Ele.me and Meituan Waimai. In 2018, Alibaba acquired Ele.me for US\$9.5 billion while Meituan received investment from Tencent and successfully listed in Hong Kong. Meituan and Ele.me have formed a pattern of confrontation in the O2O food industry since 2018.

The scale of China's food delivery market has reached US\$400 billion. Therefore, more and more

small and medium-size restaurants have entered the food delivery platform and the leading catering companies are focusing on platform operation services at this stage. Over 300 cities were covered by online meal ordering businesses and the transaction scale maintained a steady growth trend.

Table 2.3 Development of the O2O food delivery industry in China

Start-up 2009 - 2013	The Internet brought new development opportunities to the catering market. The O2O catering and food delivery platform Ele.me was founded in 2009 and Meituan was founded in 2010. Meituan launched its O2O food delivery service Meituan Waimai in 2013.
Expansion 2014 - 2015	Internet giants and traditional catering enterprises begin to enter the industry in 2014. Various platforms were actively expanded and O2O food-related financing reached its peak in 2015.
Fast growth 2016 - present	Over 300 cities covered by online meal ordering businesses in 2016 and the transaction scale maintained a steady growth trend. Industry integration and mergers began and Meituan and Ele.me have formed a pattern of confrontation in the O2O food industry since 2018.

Source: iimedia, 2019.

2.5 Consumer Characteristics of the O2O food delivery industry

Ordering food online has become one of important way for dining these days. According to a survey by Meituan and China Hospitality Association at the end of February 2020, 66.9% of the respondents say they choose to order food online because they feel lazy and don't want to go out; 31.7% of the respondents think they could taste the variety of food from online ordering and 29.5% of respondents ordering takeaway due to the fact they want to save cooking time.

According to Meituan data, first-tier cities, new first-tier cities and second-tier cities are the main markets for O2O food delivery consumption in 2019, accounting for 64.7% of the country's total orders. However, the growth rate of orders and value in lower-tier cities is significantly higher than that of high-tier cities, low-tier cities have become the main driving force for the growth of users. In the fourth quarter of 2019, the transaction value of Meituan in low-tier cities increased by 45%. Compared with high-tier cities where the O2O food delivery market is relatively mature, it is

predicted the market in low-tier cities has more potential for development in the future.

In terms of the factor affecting consumers' preference for ordering food online, consumers value user reviews or comment of the offline restaurants the most, followed by food style and food safety, price level brand ranked fourth and fifth.

Table 2.4 Distribution of Riders from Meituan by Province in 2019

Ranking	Provinces where riders work the most	Ranking	Province where the most riders from
1	Guangdong	1	Henan
2	Jiangsu	2	Guangdong
3	Zhejiang	3	Anhui
4	Shanghai	4	Sichuan
5	Beijing	5	Jiangsu
6	Sichuan	6	Hunan
7	Shandong	7	Shandong
8	Henan	8	Guangxi
9	Fujian	9	Hebei
10	Anhui	10	Hubei

Source: Meituan Research Institute and China Hospitality Association, October-December 2019 Food Delivery Rider Survey, 176,000 valid questionnaires

2. 6 Characteristics of delivery riders

2.6.1 Source of origin of delivery riders

It is estimated that there are about 7 million delivery riders in China (Economic Daily, 2021). In 2019, a questionnaire of 189,000 delivery riders conducted by Meituan and China Hospitality Association found out that the delivery riders often migrate from populous provinces (Henann Province, Guangdong Province, Anhui Province, Sichuan Province andJiangsu Province) to economically developed provinces in search of employment opportunities, such as Guangdong Province, Jiangsu Province, Zhejiang Province, Shanghai and Beijing.

Delivery riders are mainly born in the 90s, among whom 87% are male and 13% are female. The majority of delivery riders are in their 20s-30s, accounting for 45.26% of the total. Riders who finished junior high school education accounted for 41.11%, 5.4% have a bachelor's degree or above (Think Tank of Beijing News, 2020).

2.6.2 Types of delivery riders

According to the contract relationships with platforms, delivery riders can be divided into two types, special delivery and crowdsourcing.

(1) Special delivery

Special delivery is a full-time job. The rider signs a contract with the platform and then becomes an exclusive delivery rider for the platform. The rider's working hours and salary settlement are in accordance with the provisions in the contract. The delivery range is usually within three kilometers and the commission fee per delivery is relatively high. Riders work mainly with chain restaurants and fast-food restaurants.

(2) Crowdsourcing

Crowdsourcing is a form of a part-time work; riders have no contractual obligation to the company but simply sign up to the platform. The delivery rider receives orders from the delivery information released by the platform. Their working hours and salary settlement are flexible. The scope of crowdsourcing is within five kilometers and riders work mainly with small-scale restaurants.

Research conducted by Think Tank of Beijing News in 2020 shows that 60.61% of delivery riders are special delivery riders and 39.39% were crowdsourced riders. Most of them earn 4,000-8,000 yuan per month depending on their work hours.

2.6.3 Reason for choosing the work

In addition to make a living, flexibility of working time is the most significant feature of delivery riders' work. Flexibility of working time is also the most important reason to attract riders. The survey from Meituan and China Hospitality Association shows that 64.0% of riders value time flexibility the most when they apply for the job, ranking highest among other factors. 58.8% of riders have an average daily delivery time of less than 4 hours.

Moreover, this profession plays an important role in absorbing a large number of people from the secondary and third industries, of which the catering industry accounts for the highest proportion. From the perspective of the working time, 31.07% of the riders have been engaged in this profession for more than two years and 51.82% of riders have been working as riders for more than one year. In addition, 33.94% of riders resigned from their previous job due to the low income and lack of income guarantee (Think Tank of Beijing, 2020).

The distribution efficiency of delivery riders has been improved with the development of Technology and innovation, which includes the internet, big data, artificial intelligence. The rider survey shows that the average daily delivery mileage of riders has increased in 2019, an increase of 5.5% compared to 2018. The percentage of riders with an average daily delivery mileage of more than 50 kilometers increased from 13.8% in 2018 to 18.2% in 2019 (Meituan Research Institute and China Hospitality Association).

Chapter 3

Food Safety Situation from the Perspective of Delivery Riders

3.1 Introduction

3.1.1 Research background

Food safety scandals are gaining increased attention from the public in China as many food scandals have been exposed in the past two decades (Table 3.1). Since 2016, food safety issues related to the online catering industry have begun to arise and are becoming a great concern for the public. With the fast development of the online-to-offline (O2O) food delivery industry grew explosively in 2014 as increasing numbers of consumers started to use online food-ordering platform services. This new industry provides consumers with more diversified choices regarding their everyday catering lives and has especially attracted a large number of younger generation consumers. However, this change has also posed inevitable challenges to the whole food industry as asymmetry may occur in all aspects of production, processing, packaging, circulation and consumption due to the virtual nature of network transactions.

Table 3.1 Food scandals concerning contamination and the illegal use of prohibited ingredients since 2009

2009	Melamine scandal: Milk tainted with the industrial additive melamine
2010	Gutter oil scandal: Oil recycled from waste oil
2011	Recycling expired steamed buns (Mantou)
2013	Cadmium rice scandal: Rice laced with levels of the metal cadmium exceeding national safety standards
2015	Zombie meat scandal: Smuggled meat that had been frozen for a very long time
2016*	Unlicensed restaurants running online meal ordering businesses online
2017*	Illegal marketing and fraudulent sales used for online food
2018*	Restaurants running online meal ordering business with low-quality pre-packaged ingredients

* Media reports on food scandals regarding to online meal ordering food began to increase since 2016

The Customer Evaluation Center of the Shanghai Association for Quality conducted a survey involving 2,953 consumers found that 78.7% of consumers worry about hygiene problems in online food, and 29.6% of the respondents encountered food safety problems when they received online orders. Although the National Food and Drug Administration of China promulgated regulations to regulate the food safety of the Internet catering industry in 2017, food safety scandals related to the promotion of unlicensed restaurants by platforms, the posting of fraudulent information regarding consumers' comments is still occurring (Zhang and Shi, 2017).

3.1.2 Research objective

By reviewing the literature at home and abroad, we found that studies regarding O2O food delivery industry focus mainly on the following three aspects: First, consumers' trust and behavior regarding the safety of online food (Gefen and Straub; Wang, Liu and Guan); second, the supervision and administration of online food safety issues (Fang et al., 2019; Guan et al., 2019); third, investigations into the responsibility among online food ordering platforms, suppliers and consumers (He et al., 2019). However, research that views online food safety issues from the perspective of delivery riders is currently non-existent. Delivery riders play an indispensable role in this industry as a bridge connecting food suppliers and consumers. They have an intuitive understanding and a clear grasp of the production environment, hygiene and operational status of offline restaurants, and are also familiar with the geographical location, personal characteristics and consumption preferences of consumers. In addition, many delivery riders have had working experience in the restaurants and have a certain knowledge about the catering industry. It is believed that delivery riders could provide information that usually cannot be obtained by directly surveying offline restaurants.

Therefore, to fill the research gap, this chapter investigates the food safety situation of the O2O food delivery industry from the perspective of delivery riders, including their perceptions regarding

hygienic status, business qualification, distribution process and packaging materials, in order to grasp the status quo and gain an overall picture of food safety in the O2O industry, as well as to provide references for policy makers.

Table 3.2 Demographic Characteristics of Respondents

Number		%	Number		%
Age			Tenure		
20's	16	44.4	Less than 1 year	20	55.6
30's	18	50	1-2 years	11	30.6
40's	2	5.6	3-4 years	5	13.8
Gender			Deliveries/day		
male	29	80.6	1-10	1	2.8
female	7	19.4	11-20	4	11.1
Household Register			21-30	16	44.4
Shanghai	3	8.3	31-40	11	30.6
Outside Shanghai	33	91.7	More than 40	4	11.1
Education			Working hours/day		
Middle School	18	50	Less than 4 hours	1	2.8
High School	16	44.4	4-6 hours	3	8.3
Vocational School	2	5.6	5-8 hours	4	11.1
Monthly Salary (yuan*)			9-10 hours	11	30.6
3000-6000	15	41.7	11-12 hours	9	25
6001-8000	16	44.4	More than 12 hours	8	22.2
above 8001	5	13.9	Type		
Platform			Special	13	36.1
Meituan	21	58.3	Crowdsourcing	23	63.9
Ele.me	15	41.7			

Source: Based on field survey conducted in 2019.

*1 CNY is equal to 0.14 USD.

3.2 Research methodology

3.2.1 Research Area

The author conducted a case study approach and selected Shanghai as research target for the following reasons: Firstly, ordering meals online in China firstly emerged in megacities such as Shanghai, Beijing and Shenzhen, of which the volume of orders in Shanghai ranked top in 2019 (Candao, 2019). Secondly, Shanghai is an international metropolis that has the largest number of takeout restaurants in China, with over than 100,000 restaurants in the city. Of these 93,301 restaurants are running online businesses. Thirdly, as Shanghai has a strong business atmosphere and a large number of consumers and a rich and diverse culinary culture, many restaurants and entrepreneurs who are interested in this industry usually regard Shanghai as the initial location for pilot schemes that diversify Shanghai's environment of restaurants and services.

Face-to-face interviews and questionnaire were conducted to investigate delivery riders in Shanghai in order to gain a deeper understanding of the current situation surrounding food safety in China's O2O food industry. Secondary data were collected from documents, government and nongovernment reports.

Primary data were collected via field surveys in Shanghai in July and August 2019. We interviewed 36 riders for 30 minutes each, and then asked them to fill out questionnaires that investigated food safety awareness, risks in the distribution process, supplier hygiene conditions, and their impressions of online food, etc. We asked the riders to make judgments based on the information they mastered and experiences in the work, rather than considering themselves being consumers or in other roles. Data regarding consumers and suppliers has been gathered mainly from statistical data published in government reports and O2O platforms.

3.2.2 Participants

Table 3 shows the demographic characteristics for the delivery riders we interviewed, ages mainly ranged from 20 to 40 years, and the group included 29 males and 7 females, most of whom were from locations outside Shanghai. The respondents generally show the characteristics of a low education level; only two riders out of 36 had finished vocation school, the remainder being middle school and high school graduates. Each rider was able make 20 to 50 deliveries per day; half of the

respondent’s monthly income was between 6001 yuan to 8000 yuan. The industry has rapid personnel turnover, with a large number of delivery riders working in the industry for less than two years, and 77.8% of the respondents worked more than eight hours a day. Special delivery riders work under a relatively sound management system and fixed working hours, while crowdsourcing is similar to part-time work. In addition, riders have to obtain a health certificate before signing up on the platform; the company then provides training for the newly registered delivery rider. However, according to our interviews, most of the training sessions consist of familiarizing riders with the rules and regulations of the company.

Table 3.3 Evaluation of O2O Food Safety from the Perspective of Delivery Riders

Food safety issues respondents were most concerned about in O2O	Answers
Raw materials: Use of expired materials Low-quality pre-packaged ingredients	16
Processing: Excessive use of additives Improper preservation Unhygienic kitchen at restaurant	11
Packaging: Inferior packaging materials Poor container sealing	9
Distribution risks respondents were most concerned about	Answers (multiple)
Food deterioration in transport due to long waiting time	15
Delivery box not disinfected daily and becoming unhygienic	13
Food mixing with foreign matter during transport	12
Damage to containers during transport or traffic accidents	11
Whether or not order meals online	Answers
Yes	3
No	33

Source: Based on field survey conducted in 2019.

3.3 Results

3.3.1 Food safety evaluation by delivery riders

Food safety issues refers to judgments made by riders according to their own understanding about food safety, the distribution risks refer to the food safety issues that riders can directly observe in their daily work. Although most of the respondents believed that they pay considerable attention to food safety, they still consider that the safety of O2O food is low. We were very surprised to find that 33 of the 36 interviewees said they had never ordered meals online as they perceive these meals to unhygienic. Two riders used online food-ordering services, and one further rider only purchased fresh produce such as fruits and vegetables.

(1) Raw materials, processing and Packaging

The results of the survey show that the special delivery riders have a positive attitude towards food safety while crowdsourcing riders have a lower degree of trust. Although there are risks in the distribution process, half of the respondents perceive raw materials and excessive use of additives during processing to be the main sources of risk in the O2O food industry, followed by packaging boxes made of inferior packaging materials (Table 4). As temperature control is critical to the Chinese cooking style, low quality packing boxes might melt at a high temperature and poorly sealed packaging increases the possibility of the growth of detrimental bacteria, which pose a threat to consumer health.

Another issue is improper preservation and hygiene of restaurant kitchen, as many restaurants cook meals in advance to speed up serving. If there is insufficient space in the refrigerator, the ingredients are simply placed somewhere outside the refrigerator, which might lead to problems of deterioration, especially in the summer season. In addition, small-scale family restaurants have a high proportion of food safety problems according to our interview with riders.

(2) Risks in distribution

In the process of distribution, the main problem is food deterioration caused by long waiting time, especially during the extreme weather conditions and traffic. Followed by the delivery box being not disinfected properly and food mixing with foreign matter during transport. Long waiting time is very frustrating to delivery riders as it will lead to changes in the taste of the food and O2O platforms

also have strict requirements on delivery time (mostly within 45 minutes). Riders sometimes find it hard to balance delivery speed and traffic safety due to time pressure, which tends to result in traffic accidents, especially at rush hour. In addition, there are 17 respondents in our interview said that sometimes the ordering address is different from the delivery address, which causes the rider to spend much time confirming the location with the customers, resulting in a long waiting time as well.

(3) Operation

We found that the O2O food industry lacks robust supervision and service standards, and that offline suppliers without a business license still exist in the market, according to the interviews with the delivery riders. In addition, a business license for food delivery is not required for the restaurants that are shown on O2O platforms, which results in cases such as suppliers running a business without physical entities offline. The platforms recruit delivery riders through a very simple process online; Mayila's research also notices that applicants need only fill in simple forms and answer several questions online before being qualified as delivery riders (Mayila et al., 2018).

3.3.2 Problems encountered at work and suggestions to the industry via interview

(1) Safety problems encountered at work

In the interviews, 16 riders said they had encountered safety problems at work, of which traffic accidents were the most common ones. 14 respondents had all encountered traffic accidents during their delivery, such as colliding into pedestrian or the riders hit by other vehicle. Secondly, weather conditions also a cause for concern for riders. In relation to the effect of weather, four interviewees have experienced heatstroke and frostbite. Regarding violence, an additional three riders said they had physical conflicts with customers at work.

(2) Difficulties encountered at work

Trying to be punctual or pursuing a faster delivery time is an important reason why online food delivery service is so popular. However, the strict time limit is one of the biggest difficulties

encountered in this line of work. Among the riders interviewed, 15 respondents said that they find that it is difficult to make the delivery on time. Riders will be punished by the platform for not being punctual. Moreover, a delay in delivery will usually result in negative comments from consumers which makes the situation even worse for delivery riders.

Another 18 people said that delayed delivery were often caused by the rider not being able to contact the consumers. There are 18 riders who have encountered the problem of delivery address being different than the pick-up address, which will also cause delivery delays. 9 interviewees encountered difficulties in communicating with consumers, sometimes it caused conflicts and wasted riders' time pointing to communication being a difficulty at work. Consumer evaluations directly affect the credit rating of the delivery riders, 10 interviewees were affected due to negative consumer reviews after the delivery.

Table 3.4 Safety status

16 people said they were injured during work that include:
14 traffic accidents
4 heatstroke
4 frostbite
3 injuries due to disputes

Source: Based on our field survey

Table 3.5 Difficulties faced at work:

15 difficult to arrive on time, riders will be punished for not being punctual
18 delay of delivery caused by unable to contact with customers
9 difficulties in communication lead to disputes, which causes time waste and complaints
18 inaccurate customers' address cause delay of deliver
10 negative comments from customers affect credit evaluation

Source: Based on our field survey

(3) Riders' suggestions for the industry

In our interview, we asked the riders to write down their suggestions to improve the food safety issues for the industry. Among them, 18 riders pointed out the aspects that the food delivery industry should be improved in the future, mainly revolve around the following aspects.

Table 3.6 Suggestion from the riders to the industry

No.	
1	The hygiene of the restaurant should be checked more often
2	Do not use plastic packing boxes
3	Strengthen the supervision of offline restaurant
4	Packaging materials should be unified
5	Use environmentally friendly packaging materials and ban business operators without license
6	Use fresh ingredients
9	Supervision on crowdsourcing riders
15	Delivery problems caused by bad weather should not be blamed on riders
16	Use qualified packing box
18	Restaurants should pay more attention to hygiene
20	Packing boxes should be disinfected and managed
21	Pay attention to the preservation of vegetables and do not store the prepared dishes outside the refrigerator
22	Government should check the offline restaurants more often
24	Food packaging needs to be improved
26	Raw materials are difficult to be guaranteed
27	Working hours are too long and lack of rest time
29	Income does not match the intensity of work
32	Riders' safety during delivery should be ensured

Source: Based on our field survey

Firstly, packaging box. Interviewees No.2, 4, 5, 16 and No.24 agree that packaging boxes are still a big problem that should be improved. Suggestions includes not using plastic packaging, the quality of packaging boxes should have uniform standards, and the use of environmentally friendly packaging boxes. Secondly, strengthening supervision. Four riders, No. 1, 3, 5, 9 and No.22 believe that the supervision of restaurant hygiene, business licenses and the crowdsourcing of delivery staff should be strengthened. Thirdly, raw materials and hygiene. There are 4 delivery staff who said that the freshness of raw materials, the preservation of prepared dishes, the sanitary condition of the restaurant and the kitchen, and the source of raw materials are difficult to be guaranteed. Management in the above aspects should be strengthened. Fourthly, working environment. Four interviewees, No.15, 27, 29 and No.32 felt that the food delivery industry should pay attention to

their working environment. For example, the delivery riders should not be held responsible for various problems caused by the extreme weather conditions, and they can choose to stop delivery services when encounter bad weather condition. Other comments on working condition includes long working hours and lack of time to rest, most of them believed that income from their job does not match the intensity of work.

3.4. Discussion

The operational model of O2O is consisted service platform, consumers, and offline restaurants. The O2O service platform collects information of consumers' needs, and then transmits the information to offline restaurants and delivery riders. Finally, delivery riders pick up the order in offline restaurants and deliver the meal to the consumer within the time agreed when the order was placed on the platform. Delivery riders act as a bridge connecting offline restaurants, consumers and service platforms with an intuitive understanding of the production environment, operational status of offline restaurants, as well as consumption preferences of consumers.

Considering the main risks are inherent in the stage of raw materials and processing, we learned that in order to reduce the cost, it was not unusual for offline restaurants to use “ready meals” and food cooked with low-quality pre-packaged ingredients, which they then sold to consumers as fresh cooked meals. Due to the fact that platform do not provide packaging boxes with unified standard, but leave restaurants to prepare packaging boxes, which results, according to riders, in a great possibility for poor quality packaging boxes to come onto the market, as well as high risk of counterfeiting and expiration due to the unclear origin of the products.

Although the government has stipulated the safety standards for food packaging, due to the lack of supervision, many packaging materials used do not meet the safety standards. According to Shanghai Food and Drug Administration in 2017, the qualifying rate of online delivery packaging boxes in Shanghai is less than 90%, while the qualifying rate is even lower in areas outside Shanghai. For instance, the inspection data of Jiangsu Province in 2015 showed that more than 30% of the

boxes were below the quality standard.

The platform stipulated that the delivery containers should be disinfected daily, due to the heavy workload of the delivery riders and the lack of supervision; some riders do not disinfect the delivery container in accordance with the regulations. There are also cases in which riders use the delivery container to transport goods other than food purchased by customers, which is very likely to lead foreign matter becoming mixed in with the meal. If the delivery riders receive negative comments or a low evaluation from consumers for their services during distribution, riders will be fined, which also affects future orders as platforms usually dispatch orders to riders with reference to the evaluation received by customers.

The riders considered the supervision of the offline restaurants by the platform is not as strict as for the delivery riders. There have been issues with the online platforms failing to adequately check restaurant business licenses due to competition for market share, demonstrating loopholes in the current regulation (Liu, 2020). In addition, the industry's pursuit of timeliness has placed severe work pressure on the delivery riders. Some of the riders ignore traffic safety in the rush to comply with the prescribed delivery time, and this results in an increase in traffic accidents.

The changes in consumers' preferences bring new challenges to food safety that makes delivery riders an important part of this industry. However, our studies show that food safety problems caused by lack of supervision still exist. Understanding of the current situation of food safety from delivery riders' perspective is important to promote the healthy development of the industry in the future.

3.5 Conclusions and implications

As online-to-offline food delivery is a rapidly developing industry with many emerging problems, by investigating online food safety issues from the perspective of delivery riders, our finding in this research provides a different perspective to view the food safety issues of O2O food, as well as to fill the research gap.

We can draw the following conclusions from the above investigation and analysis: The main factors affecting food safety in the O2O food delivery industry from the riders' perspective are raw materials and processing, followed by packaging boxes made with inferior materials. Especially the "ready meals" and food cooked used low-quality pre-packaged ingredients with unclear origin are considered as unique safety problem in this industry. Food safety issues respondents most concerned about in distribution are food deterioration in transport due to long waiting time, delivery box not disinfected daily and become unhygienic, food mixing with foreign matter, as well as damage to containers during transport or traffic accidents.

For reasons of business efficiency and in order to comply with delivery times, the following issues pertinent to each subject will affect food safety: The platform partners with unlicensed restaurants, the rider fails to completely disinfect the distribution container, and the rider is involved in a traffic accident. Although platform formulates management and distribution regulations for offline suppliers and delivery riders, imperfect supervision leading to violations of regulations, especially among small-scale family restaurants is an important factor affecting food safety.

Therefore, there is still much room for improvement in the aspect of the strengthening of regulations and supervision by government in the O2O food delivery industry. Efforts such as control of the number of orders received by riders and increasing investment in safety education must also be taken to raise awareness of the safety of delivery riders.

Chapter 4

Consumer's perception of O2O Food Delivery Industry under Covid-19 Pandemic

4.1 Introduction

4.1.1 The rapid development of Online-to-offline (O2O) food Delivery Industry

As the pace of people's lives continue to accelerate, ordering food online has increasingly become an indispensable part of people's lives. The sustained and rapid growth of the O2O food delivery market has become a highlight of China's catering industry. The development of food delivery has not only provided convenience to people's everyday lives, but also promoted the integration of online and offline development within the catering industry, broadened consumption application scenarios, created a large number of employment opportunities, and disrupted the entire catering industry. According to the survey data of iResearch, the scale of China's food delivery industry in 2019 was 653.6 billion yuan, an increase of 39.3% compared to 2018.

The user size of online food ordering is 409.03 million in June 2020, accounting for 43.5% of China's total internet users (Statistical Report on Internet Development in China 2020). Among which, the number of orders conducted by mobile phone users reached 407.20 million. According to the China Food Delivery Industry Development Report in 2020, the estimation of overall food delivery consumers reached 460 million in 2019, which means more than a quarter of Chinese people have had experience of ordering food online (China Food Delivery Industry Development Report 2020).

Since China has a population of 1.4 billion and the internet penetration rate is only about 67%, it is expected the order volume and transaction value of O2O food delivery will maintain a rapid growth rate. In addition, with the increase of consumers' health awareness, the continuous expansion

of boundaries of online food delivery industry and the continuous enhancement of distribution capabilities, the distribution of more types of food with better preserved flavors have become a reality. Therefore, many consumers have long surpassed the simple need of saving time and filling their stomach by ordering food online, they expect that food ordered from online could be the same as in restaurants, with more varieties and more nutritious.

Table 4.1 Social situation in Wuhan, Shanghai and Beijing during Covid-19

Wuhan	<p>1.23 – 4.8: Lockdown.</p> <p>No gatherings and refrain from unnecessarily outing are advocated by the government.</p> <p>Extending Spring Festival holiday, working from home, travel control, online teaching.</p>
Shanghai	<p>Key industries resumed to work from 2.10, most people still work from home and students have online classes.</p> <p>All residential areas carry out entry and exit management based on the community.</p> <p>The community provides the distribution of daily necessities, contactless delivery such as online food delivery.</p> <p>Online services were also provided for people who were dealing with paper works with government departments.</p> <p>The requirements of each district are slightly different, and travel restrictions will basically end at the end of February.</p>
Beijing	<p>People mainly work from home and students have online classes.</p> <p>Residential areas carry out entry and exit management and strict temperature measurement.</p> <p>Daily necessities are mostly purchased by online delivery.</p>

Source: Made by author

4.1.2 Online-to-offline (O2O) food delivery Industry under Covid-19 Pandemic

The outbreak of Covid-19 pandemic not only has had extensive impacts on the world public health, but also presents severe challenges to our food systems. A lot of countries in the world imposed the “community lockdown method” to slow the spread of the virus (Shi et al. 2020). Measures were taken by China in the fight against the pandemic including the suspension of intra-

city public transport, closure of entertainment venues, and banning of public gatherings (Table 4.1). As a result, to most people this has reduced the frequency of eating out and led more and more people choosing to stay at home and cook their own food (Tian et al. 2020).

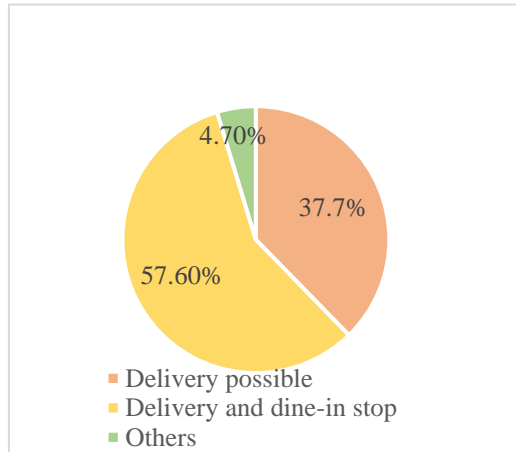


Figure 4.1 Situation of Catering industry of 2020.2

Source: China Food Delivery Industry Development Analysis Report

The catering industry was severely affected by the epidemic. According to China Food Delivery Industry Development Analysis Report, 57.6% of catering businesses had stopped operations in February 2020, and 37.7% of catering businesses have launched online delivery services (Figure 4.1). According to the survey of restaurant revenue, 53.6% of revenue comes from food delivery, and online business has become an important channel to help catering businesses survive the crisis.

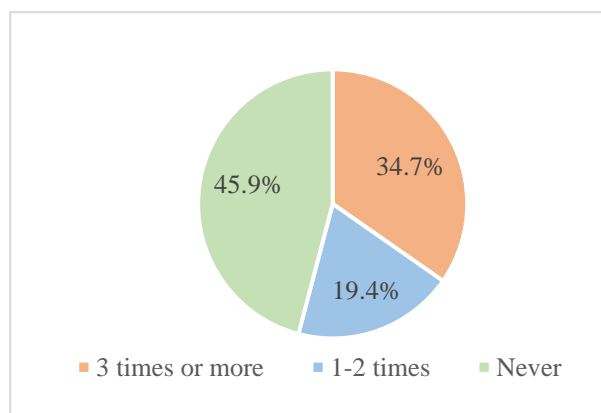


Figure 4.2 Times of delivery riders to hospitals in Wuhan

Source: China Food Delivery Industry Development Analysis Report

However, this is also a period in which the food delivery industry has had rapid growth and it has played a critical role for ensuring the food supply under the impact of the epidemic. During the lockdown of Wuhan, Meituan’s delivery riders delivered 3.96 million orders, including 102,000 hospital orders. According to the data released by the Meituan platform, 34.7% of the delivery staff delivered more than three hospital orders, 19.4% of delivery riders have delivered 1-2 times (Figure 4.2). Delivery riders have become an important city link during the epidemic.

In addition, the delivery service of vegetables and fresh produce has become another choice of many families. Food distribution is also undergoing significant change as the online grocery deliveries expanded during the pandemic (Jill 2020). Even for the consumers who did not have the habit of ordering food online before began to try to register on platforms to purchase online. At this stage, the ability to provide consumers with better quality products and more timely delivery became the new challenge of the industry. The new trends of “exquisite and healthy” presented by the food delivery industry are the latest response to consumer demand.

During the epidemic, Ele.me and Meituan provide support to both supplier and delivery riders (Table 4.2), ele.me provided financial support and commission reduction and annual fee extension while Meituan provided insurance and online courses, and preferential interest rate loans. According to The Meituan Riders Employment Report released by the Meituan Research Institute, the total number of riders earning income through Meituan platform reached 3.98 million during the years 2019 and 2020. After the outbreak of Covid-19 pandemic, the Meituan platform has recruited an additional 336,000 riders from January 20 to March 18, 2020.

Table 4.2 Policy of the food delivery platform during the epidemic

Ele.me	Commission reduction and annual fee extension
	Financial support to delivery service
	Providing insurance and contactless delivery
Meituan	commission reduction, annual fee extension
	providing insurance and online courses, preferential interest rate loans
	financial support, contactless delivery

Source: Made by author based on previous studies

Table 4.3 Companies launched online service during the pandemic

Company	Activities
Shangri-La Hotels	The dinner menu was innovatively optimized for online customers, products such as one-person meal, 2-3 business meal, and group meal for 6-8 people were launched. Shangri-La Hotel in Suzhou has established a online business strategy with the same quality of service as in-store dining, with monthly sales of more than 1,600 orders.
Quanjude	On February 18 Quanjude Group officially launched Ele.me platform. The first batch of restaurants that provided online service included 13 Quanjude stores and 15 stores under brands including Fengzeyuan Restaurant and Sichuan Restaurant.
Lou Wai Lou	On February 18, Hangzhou Louwailou, a century-old store, launched online service in Ele.me platform for the first time.
Tai Er	On February 22, the well-known pickled fish brand Tai Er announced that some restaurants in Guangzhou and Shenzhen will launch Meituan platform to provide online service for one month starting from February 24.
Grandma's Home	On February 13, the Grandma's Home of Jiahang Newspaper branch launched online service with Meituan. Other branches of Grandma's Home across the country will gradually launch online services.
Luyu	On February 16, Luyu Hangzhou Chengxi Yintai branch's online service was officially launched, supported by Meituan Waimai and Ele.me platforms.
Xiaolongkan Hotpot	Xiaolongkan has opened online food delivery business in Meituan and Ele.me platform, and the variety of hot pot delivery has increased.
Haidilao Hotpot	Since February 15, Haidilao's delivery service have resumed At the same time, Haidilao stated that it will comprehensively upgrade the two services of "safe delivery" and "contactless delivery".

Source: Arranged by Industrial Securities, Institute of Forward Business and Intelligence 2020

4.1.3 New Changes of the Industry

There are several new changes that have taken place in the food delivery industry after the outbreak of the epidemic. First, the "Stay at home economy" represented by the online-to-offline food delivery industry has accelerated at a rapid pace. The epidemic has severely affected the

catering industry, most especially because the restaurants stopped dine-in service. This has let restaurants and food supplier look for new channels to increase revenue such as launching online services (Table 4.3).

Second, the concept of “delivering everything to your home” emerged. In the past, food and beverage products were mainly products for delivery. During the epidemic, the products that can be delivered has become more diversified, including items such as household necessities for everyday usage in addition to medicines to prevent the virus from spreading, through which the term “delivery without contact” become popular. The delivery riders, offline suppliers and consumers are negotiating a delivery method where the product is placed at the consumers’ designated picking place, and then consumers pick up the products by himself after the delivery finished. The process finishes without person-to-person contact.

According to the “Contactless Delivery Report” released by Meituan, it showed that more than 80% of the total orders were using “contactless delivery”, and the proportion of users who used the “contactless delivery” service for each order exceeded 60%. The Commercial Industry Committee of the China Council for the Promotion of International Trade issued the “delivery “Service Specification”, which provides specific operating specifications for the industry (Xinhua Net 2020).

4.2 Previous studies

In addition to cooking and dine-in restaurants, online food ordering has become a new way of eating. According to a research report called “Establishing an online food delivery safety guarantee mechanism” from Shanghai Municipal Government, in a survey conducted among the 1018 consumers in 2018, when asked “Where do you usually eat and eat?”, 46.8% of the respondents replied that they usually eat at home, 22.4% of respondents chose to eat at a restaurant, 22.3% of the respondents chose to eat in the canteen at their work place, 17.78% of the respondents chose to eat food ordered from online. Regarding the proportion of online food consumption in daily food expenditure, 28.98% of the respondents said they spend less than 10%, 33.89% of the respondents

said they spent 10%-29% of their daily expenditure on ordering food online, 20.63% of the respondents chose 30%-49%, and only 16.50% of respondents choose 50% and above (Figure 4.3).

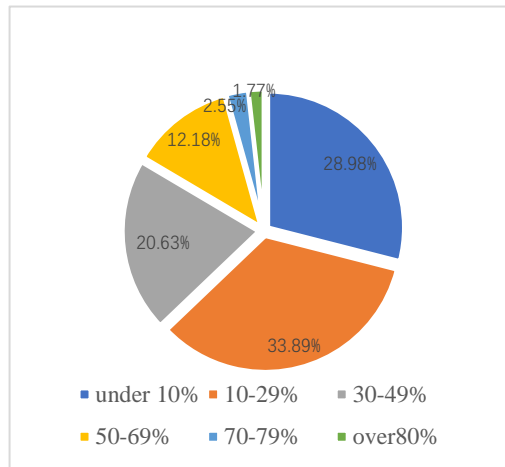


Figure 4.3 Proportion of online food consumption

Source: China Food Delivery Industry Development Analysis Report

In terms of the amount of money consumers spend on online food delivery, 45.78% of the respondents spent an average of less than 300 yuan per month on online food delivery, 43.81% of the respondents had an average monthly expenditure of 300-999 yuan, and 10.41% of the respondents spent 1000 yuan and above. In addition, 9.53% of respondents ordered online food delivery every day, more than 75% of respondents order online food delivery once a week, and only 7.66% of respondents order online food delivery less than once on a monthly basis (Figure 4.4).

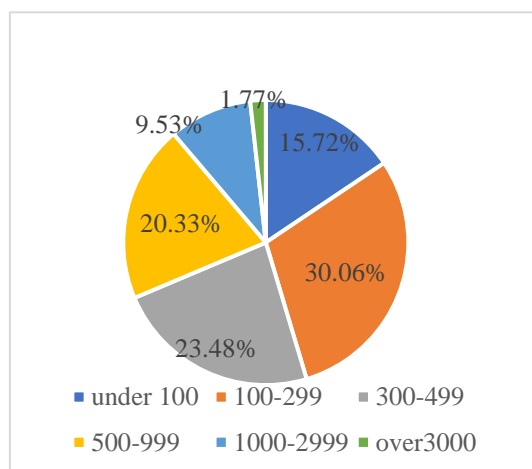


Figure 4.4 Expenditure of consumer spending on online food delivery

Source: China Food Delivery Industry Development Analysis Report

According to the consumer survey in July 2018, 2.95% of the respondents said they had “trust” about the quality and safety of online food delivery while 22.10% of the respondents chose “partly trust”. The respondents who chose “fair”, “not quite” and “not at all” accounted for 57.47%, 15.13% and 2.36% respectively. According to the results of a consumer survey from May to June 2017, 1.37% of the respondents said they “trust” the quality and safety of online food delivery while 17.58% said they “partly trust”. In addition, 35.67%, 34.47%, 10.92% of the respondents chose “fair”, “not quite” and “not at all” in the survey conducted in 2017 (Table 4.4).

The online food delivery industry can better meet people’s increasingly faster pace of life. The survey found that when asked “what is the main reason for ordering food online”, 86.15% of respondents choose “convenience and fast”, 21.12% of them chose “taste of food”, 17.88% of the respondents chose “low prices” and 10.61% of the respondents chose “quality and safety”.

Due to the convenience and various options, the food delivery industry experienced rapid growth in China, especially during the outbreak of COVID-19 there has been an acceleration in the transformation of people’s dining habits. Offline consumers and online platforms become more closely connected. However, consumers still don’t have a high degree of trust in food ordered from online according to previous studies. Therefore, this paper aims to examine the safety and processing of online food delivery industry, the working environment, and environmental packaging, certification in order to clarify the further needs of consumers for online food delivery industry.

Table 4.4 Comparison of consumers’ trust in the safety of online food delivery service in 2017 and 2018

Item	N (2017)	%	N (2018)	%
Trust	8	1.37%	30	2.95%
Partly trust	103	17.58%	225	22.10%
Fair	209	35.67%	585	57.47%
Not quite	202	34.47%	154	15.13%
Not at all	64	10.92%	24	2.36%
Total	586	100.00%	1018	100.00%

Source: Research project report of Shanghai Municipal Government 2018

Table 4.5 Comparison of consumers' trust in government supervision of online food delivery service in 2017 and 2018

Item	N (2017)	%	N (2018)	%
Trust	8	1.37%	40	3.93%
Partly trust	88	15.02%	299	29.37%
Fair	236	40.27%	517	50.79%
Not quite	214	36.52%	142	13.95%
Not at all	40	6.83%	20	1.96%
Total	586	100.00%	1018	100.00%

Source: Research project report of Shanghai Municipal Government 2018

4.3 Data collection

Our survey was conducted from February 6 to February 16, 2020, in the cities of Beijing and Shanghai in China. We commissioned Makromir Co., Ltd. to conduct a questionnaire survey of 2,080 consumers. We selected 1,040 consumers in both Beijing and Shanghai, in order to ascertain their basic information, consumption habits, preference for food delivery services, and problems that are expected to be improved.

Figure 4.5 shows the gender and age of the respondent, and the age and gender of selected respondents are equally proportioned. The distribution of income and occupation is shown in Figure 4.6 and Figure 4.7. In addition, the questionnaire also contains information about the consumer's cohabiting members and marital status.

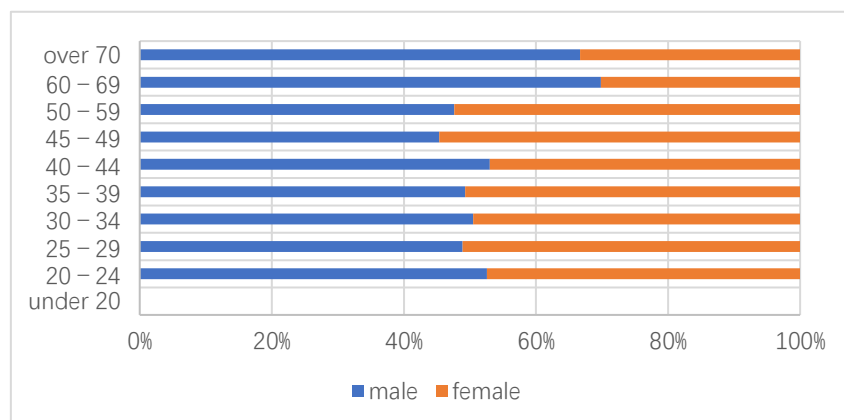


Figure 4.5 Distribution of sample by age group and sex

Source: Based on our survey

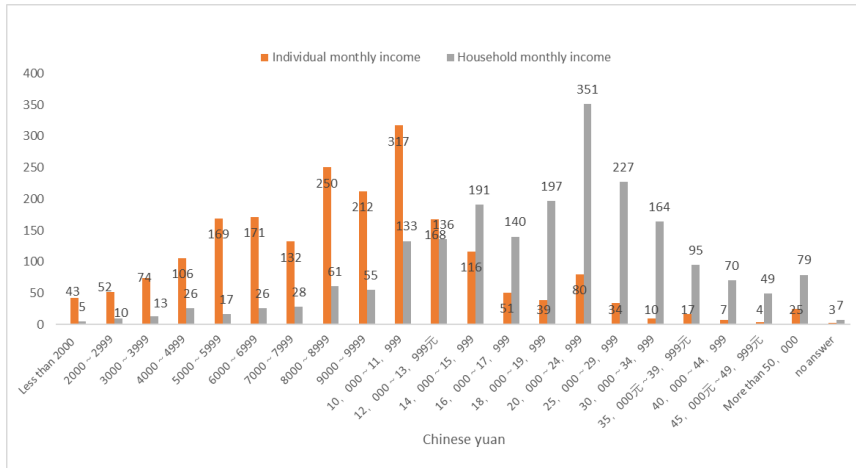


Figure 4.6 Distribution of sample by income
Source: Based on our survey

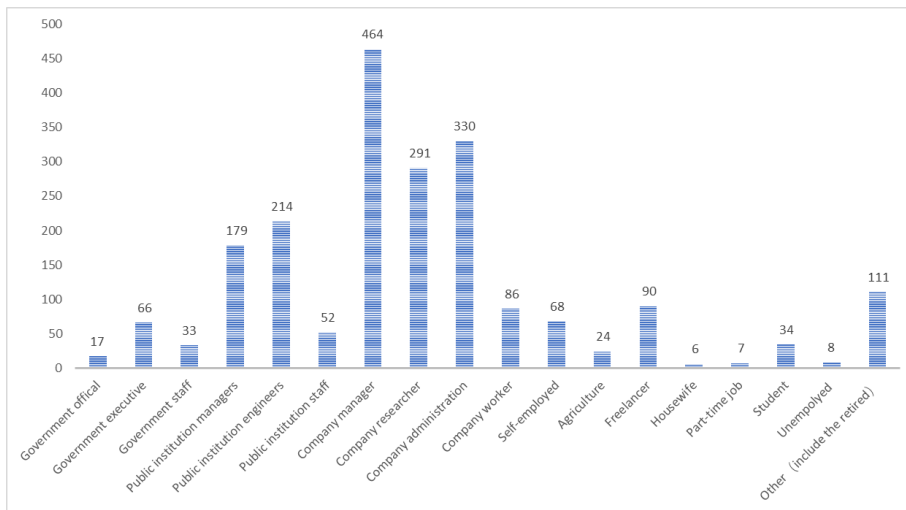


Figure 4.7 Distribution of sample by occupation
Source: Based on our survey

4.4 Results

In the survey of consumption habits, we mainly investigated the daily use scenarios, frequency, and expense on online delivery. From Table 4.6 it can be seen that 70.9% of consumers use online delivery services about three times a week. In terms of the platform, 41.3% of consumers chose Meituan platform while 5.7% of consumers chose the Ele.me platform, and 22% of consumers use multiple platforms.

Table 4.6 Consumers' habits of online food delivery service

Item	N	%	Item	N	%
Whether to use online food service			Platform used		
Yes	1474	70.9%	No platform	435	20.9%
Frequency/week	3.01 times		Meituan	860	41.3%
No	606	29.1%	Ele.me	326	15.7%
			More than one	458	22.0%
Amount of expense (including delivery fee, packaging fee, etc.) Yuan/order			Scenarios of using online food service		
	N	%		N	%
Under10	35	2.1%	Lunch	1109	67.4%
10 ~ 20	147	8.9%	Dinner	889	54.0%
20 ~ 30	426	25.9%	Night meal	587	35.7%
30 ~ 40	439	26.7%	Breakfast	160	9.7%
40 ~ 50	248	15.1%	Beverages	495	30.1%
50 ~ 60	160	9.7%	Party and Banquet	151	9.2%
60 ~ 70	55	3.3%	Others	1	0.1%
70 ~ 80	61	3.7%	Total	1645	100
80 ~ 90	21	1.3%			
90 ~ 100	16	1.0%			
Over100	37	2.35%			

Source: Based on our survey

When it comes to the time of using online delivery services, 67.4% of the consumers buy lunch through online ordering, then dinner and night meal, accounting for 54% and 35.7%, respectively. Drinks (including coffee, milk tea, etc.) are also popular products that are often purchased through online services, accounting for 30.1% of the total. The purchase of breakfast and food for the preparation of parties accounted for a relatively small proportion of 9.7% and 9.2% respectively. The expenses per order from online delivery is mainly in 20-yuan to 50-yuan range, accounting for 67.7% of the total. According to the research report from bigdata research, more than 64% of consumers spend a 31-50 yuan range per order in the third quarter of 2019, which was used as a reference point for the price setting standard of our questionnaire as well.

Table 4.7 shows the issues that consumers are concerned with regarding ordering food online. Food safety accounts for 69.5%, which is the highest concern for consumers. Secondly, delivery time, distribution hygiene are also factors that consumers pay attention to. Food prices and distribution costs accounted for 54.3% and 49.8% respectively, which shows that over 50% of consumers still consider price as the basis for their choice when using delivery services. Although the appearance of food, the working conditions of the delivery riders, and the sanitation status of the delivery riders accounted relatively small, they are also issues of concern (Table 4.7).

Table 4.7 Most concerned issue when using online food delivery services (Multiple choice)

	N	%
Price	893	54.3
Delivery fee	820	49.8
Delivery time	969	58.9
Appearance of food	449	27.3
Hygienic management of the distribution process	930	56.5
Food safety	1143	69.5
Hygiene of the packaging box	573	34.8
Working conditions of delivery riders	405	24.6
Hygiene condition of delivery riders	578	35.1
Other	6	0.4
Total	1645	100.0

Source: Based on our survey

In the previous research, it can be seen that consumers have a low degree of trust in government supervision. Therefore, we have included a survey of preference for authority certification (Table 4.8). The following question was asked in the survey, “In order to ensure the food safe of online food delivery service, do you think the offline physical food providers need to be certified by a third-party agency? If necessary, which certification of organization is the most credible? Please select 3 items.” We found out that the vast majority of consumers believe that it is necessary to introduce certification agencies and strengthen the information disclosure of offline restaurants. Certifications from food delivery platforms and certifications from domestic consumer groups or third-party organizations are considered the most trustworthy, accounting for 53.8% and 54.7%, respectively. Secondly, the disclosure of information in offline physical stores can also increase

consumer trust to a certain extent. 34.8% of consumers believe that disclosure of information is very necessary. International organizations and third-party certifications, government certifications, and local government certifications accounted for 25.9%, 29.7%, and 24.1%, respectively. In addition, the previous experience and evaluation from consumers were not widely trusted according to our survey, accounting for 20.9%.

Table 4.8 Consumers preference for certification of online food delivery services

Items	N	%
Maintain the status quo, no certification required	81	3.9
Certification from the platform required	1120	53.8
Domestic consumer groups or third-party certification required	1137	54.7
International consumer groups or third-party certification required	539	25.9
Government certification required	618	29.7
Need certification from local governments	502	24.1
Need to disclose information on the shop itself	724	34.8
Experience and evaluation of actual consumers	435	20.9
Other	0	0.0

Source: Based on our survey

4.5 Conclusions

The outbreak of Covid-19 at the end of 2019 not only presented severe challenges to food systems around the world, but also severely affected the catering industry. However, food delivery services have been playing a critical role for ensuring the food supply during the lockdown period. At the same time, more and more consumers began to switch to online purchasing during the pandemic.

During the period that most people were highly dependent on online delivery services, we conducted a consumer survey in Beijing and Shanghai to investigate consumer's perception of O2O food delivery industry under the Covid-19 pandemic in order to ascertain their consumption habits, preference for food delivery services, and problems that are expected to be improved.

Among 2080 respondents, we found out that 70.9% of respondents use online delivery services three times a week. Most of them purchase lunch, accounting 67.4% of total orders. Food safety issues has the highest concern for consumers. Secondly, delivery time, distribution hygiene is also a factor that consumers pay attention to. Followed by food prices and distribution costs. Regarding the areas that need to be improved in this industry, consumers believe that the introduction of a certification system and strengthening the information disclosure is necessary. One approach is to explore and launch electronical traceability system where consumers can scan the QR code to obtain the information of the food, which is expected to play an important role to ensure the food safety.

In addition to regulation and supervision from government and food delivery platforms, industry association and consumer association must also take part in ensuring the food safety in O2O food delivery industry. Industry association could form partnership with government to make and promote industry guidance to help participants to understand and meet food safety standards. Consumer associations need try to provide platforms to facilitate the communication between consumers and other operators of O2O food delivery industry regarding food safety they concerns as well as how to eat in a healthy way.

Chapter 5

Conclusions and Implications

Food safety has always been an issue in China especially due to the rapid evolution of food industry, which continues to pose public health risks. Since 2012, the Online-to-offline (O2O) food market began to emerge in China, internet giants such as Baidu, Alibaba, Meituan have poured huge investments into the industry that has contributed to the prosperity of the food delivery market. This new industry provides consumers with more diversified choices regarding their everyday catering lives and has especially attracted a large number of younger generation consumers to use online food-ordering platform services.

However, due to the lack of awareness and imperfect regulation, the newly emerging industry has posed inevitable challenges and additional food safety risks to the whole of the food industry has had an asymmetric effect, within the O2O food delivery market, and may occur in all aspects of production, processing, packaging, circulation and consumption due to the virtual nature of network transactions. This research examines the food safety situation of Online-to-Offline food delivery industry in China, it aims to provide us an overall picture of food safety in the O2O industry and to provide a reference for policy makers to regulate food safety in the future.

Chapter 2 firstly introduces the development of e-commerce in China and explains how the O2O food delivery industry has developed in the past few years. Then, the characteristics of three parties involved in the O2O model (an O2O service platform, consumers, and offline business entity) and its operational system was illustrated.

In chapter 3, we investigated delivery riders' view towards food safety issues in the O2O food delivery industry and tried to find out their perceptions toward hygiene status, business qualification, distribution processes and packaging materials in the industry. This chapter is also regarded as an original contribution to the research as previous research that views online food safety issues from the perspective of delivery riders is currently non-existent. We learned that the main factors

affecting food safety in the O2O food delivery industry from the riders' perspective are raw materials and processing, packaging boxes made with inferior materials. Delivery riders hope their companies can pay more attention to their working environment.

In chapter 4, we look at consumer's perception of O2O food delivery industry under Covid-19 pandemic. Online food service played a critical role for ensuring the food supply under the impact of the pandemic as most of the offline restaurants closed or stopped dine-in service to fight against the pandemic. Under this background, the consumer's perception towards online food delivery services were examined based on the 2080 questionnaires conducted in Beijing and Shanghai in 2020. Results show that over 70 percent of people use online delivery services three times a week and food safety issues have the highest concern for consumers. Regarding the areas that need to be improved in this industry, consumers believe that the introduction of a certification system and strengthening the information disclosure is necessary.

There is still much room for improvement in the aspect of the strengthening of regulations and supervision by government in the O2O food delivery industry, not only to ensure the food safety, but also for the health and safety purpose of participants of this industry. Both regulators and delivery platforms have to pay close attention to address the concerns encountered by delivery riders, such as road safety and working environment.

Efforts such as control of the total number of orders dispatched to riders and explored the approaches by giving riders more choices to select or refuse orders without affecting future order allocation must be taken into considerations. At the same time, increasing investment in conducting more effective safety education courses for riders and promote industry guidelines are also urgently needed to clarify each participants' rights and obligations.

In addition to regulation and supervision from government and food delivery platforms, industry association and consumer association must also take part in ensuring the food safety in O2O food delivery industry. Industry association could form partnership with government to make

and promote industry guidance to help participants to understand and meet food safety standards. Consumer associations need try to provide platforms to facilitate the communication between consumers and other operators of O2O food delivery industry regarding food safety they concerns as well as how to eat in a healthy way.

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