



A Review of the Environmental Impact of Online Food Delivery Platforms on Sustainability

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Abstract: The benefits of online food delivery (FD) were extremely popular during the global COVID-19 pandemic in 2020 because it allowed consumers to receive prepared food. This platform has grown very popular, not only in the younger generation, but also in the older generation, due to the convenience of ordering food online, the speed with which it is delivered, and the diversity of cuisine available to suit everyone's budget and taste. Plastic waste generation, food waste, and a high carbon footprint are the main issues related to online food delivery systems. Both the massive amount of waste created and the huge carbon footprint have affected the environment. The rising demand for this form of food service is expected to drastically alter restaurant consumers' consumption patterns, ultimately accelerating the use of single-use plastics. The issues of sustainability-related to plastic usage linked with online food delivery services are discussed in this study, along with suggestions for how to address them.

Keywords – Online food delivery; Sustainability; Environmental impact; Plastic pollution; COVID-19

I. INTRODUCTION

Food is an important aspect of life since it provides us with the nutrition we need to survive, but the pandemic of COVID-19 has made it difficult to follow a regular diet plan. Consumers are adopting online services as their income grows, electronic payments become more reliable, and therefore the number of food providers and hence the scope of their delivery networks expands with the increase in the internet service. even though there are numerous implications that online food delivery doesn't appear to possess, at this point of worldwide violence, the increase of online food delivery has transformed the habits of many consumers and food providers.

The restaurant business has been struck particularly severely by the outbreak of COVID-19. Numerous restaurants and food enterprises have faced difficulties as a result of extended closures and reduced patronage caused by neighborhood lockdowns. Demand for online food delivery services has increased as individuals have been compelled to stay indoors to prevent the spreading of the virus. The rising demand for this form of food service is expected to drastically alter restaurant guests' consumption patterns, perhaps speeding up the use of single-use plastics.

II. OVERVIEW OF THE ONLINE FOOD DELIVERY SYSTEM

Online FD is the process of preparing and distributing food that has been ordered online. Online FD platforms like Uber Eats, Zomato, Swiggy, Deliveroo, and Meituan increased online FD. Payment monitoring, food delivery organization and tracking capabilities, offering a large range of food alternatives to clients, receiving orders, and transferring these orders to the producer of the food for consistency are all advantages of online FD platforms.

The two forms of food delivery services are restaurant-to-consumer delivery and platform-to-consumer delivery [1]. KFC, McDonald's, and Dominos are examples of restaurant-to-consumer delivery companies that prepare and serve meals to clients. The

restaurant's website or a third-party website can be used to place orders. Uber Eats in the United States, Eleme in China, Just Eat in the United Kingdom, and Swiggy in India are examples of third-party platforms. Platform-to-Consumer Delivery is a method of providing internet delivery services from restaurants that don't always provide delivery services [2].

Growth Of the Online Food Delivery Market Size

Worldwide: In 2019, the globally online food delivery market size was valued at 107.44 billion U.S. dollars. In 2020, this value is predicted to rise to 111.32 billion USD. The poor growth in 2020 was primarily due to a global economic slowdown caused by the coronavirus pandemic and the steps taken to combat it. However, the market was predicted to increase at a Compound Annual Growth Rate (CAGR) of 11.51% to 154.34 billion US dollars by 2023 [3].

India According to the Statista research department the Indian online food delivery market was estimated to be valued at 4.35 billion USD in 2020. This was a significant gain over the previous year when the market was estimated to be worth nearly 2.9 billion U.S. dollars. The food delivery sector was predicted to reach about 13 billion USD in value by 2025 [4].

III. METHODOLOGY

An integrative study of recent literature was required to understand the environmental sustainability consequences of online FD. The documents were located using the research tools Scopus, Web of Science, Google Scholar, and China National Knowledge Infrastructure (CNKI) based on 'online food delivery environmental impacts.' We used source material that was available in either English or Chinese (language) from 2010 to 2021. We decided to include papers in both Chinese and English in our study since China's online FD market is the most developed, and as a result, China's online FD has garnered the most academic attention so far. The majority of the literature on online FD, according to our search, focuses on FD in a Chinese context.

IV. ENVIRONMENTAL IMPACT OF ONLINE FOOD DELIVERY

The major environmental concerns that can be noted as an outcome of the great development in Online Food Delivery are the massive volumes of plastic waste generated and how to manage it. The efficiency with which different countries deal with the plastic waste generated by their online food delivery is governed by their recycling infrastructure and the growth of their online Food Delivery.

As a result of the COVID-19 outbreak, disposable food packaging will become increasingly popular in many regions of the world by 2020, as many customers believe disposable packaging is safer and more hygienic. Food waste is frequently linked to online food delivery services that have a "minimum price" requirement, forcing customers to buy more food than they need or share food with roommates to meet the "minimum price" for free delivery. Customers don't want to stock up on leftovers because they don't want to eat the same meals twice, they can't take them home from work, or they can't store them since they live in a dorm, therefore incentives to buy more lead to leftovers being removed.

The most significant environmental effect of this growing sector is solid waste pollution, which is joined by water pollution, resource consumption, and air pollution. The online food delivery industry is striving to enhance its reputation in a variety of ways, including the usage of electric bicycles and drones to transport food. This helps to lessen road traffic safety concerns while also reducing delivery's environmental impact. Few transportation service providers currently employ motors or motorbikes, which create exhaust fumes and contribute to air pollution.

Total packaging waste in China climbed from 0.2 million metric tonnes in 2015 to 1.5 million metric tonnes in 2017 due to a rise in online FD [5]. In 2016, China's waste generated through online FD was estimated to be 1.68 million tonnes, with 1.33 million tonnes of plastic waste and 0.35 million tonnes of wooden chopsticks [6]. In the same study, the wasted batteries from food delivery riders' electric bikes generate significantly less trash than online FD. In 2016, 19,507 batteries were thrown including 17,285 lead-acid batteries. In 2016, China's electricity used to charge vehicles and dispose of the waste was expected to have produced 73.89 Gt CO₂eq in indirect GHG emissions [6].

Food waste as a result of online FD is frequently linked to manufacturers enforcing a minimum price requirement, which leads to consumers ordering more food than they need or ordering food with roommates to meet the minimum price' for free delivery services. Customers are hesitant or unable to store leftovers because they do not want to eat the same meals again, or because they live in dorms and are not allowed to have refrigerators in their rooms, resulting in uneaten food being thrown away [7].

Apart from plastic and food waste, another environmental problem that must be addressed is the high carbon footprint that online FD generates. A study in China specialized in the lifestyles cycle effect evaluation of packaging from online FD employed 334 units of restaurant packaging samples, including boxes, bags, chopsticks, glasses, and straws, to examine data from 35.61 million orders from one online FD platform across eight locations in 2019. The authors of the Beijing study found that each order generates 0.1185kg of solid waste and 0.68kg CO₂ eq/kg global warming Potential (GWP), with packaging production and disposal accounting for 45% and 50% of the total environmental impact, respectively, making them the most critical environmental effects in the industry. The delivery phase was responsible for only 5% of the environmental impact (which included distribution from the manufacturer to the restaurant, delivery persons to the consumer, and the consumer to the disposal unit) [8].

Food delivery firms should utilize cargo bikes, according to experts, because they are quiet, emission-free, and less annoying to residents. Because drones use batteries, drone food delivery is also less polluting [9]. Despite the drawbacks of using drones for food delivery, like time, performance, and psychological problems [9]. Researchers believe that drone-based delivery could reduce CO₂ emissions in the delivery business, making the risks worthwhile [10]. any food delivery companies, including Yogiyo in Korea and Domino pizza in New Zealand, are already planning to commercialize drone food delivery services, as these low-carbon modes of transportation can assist to reduce greenhouse gas emissions [11].

V. CHALLENGES TO SUSTAINABLE CONSUMPTION

Restaurants have been a top producer of single-use plastics like food containers, cutlery, beverage cups, and straws since the pandemic started [12]. The pandemic has boosted the usage of single-use plastics in the restaurant business, owing to the rising popularity of food delivery services and concerns about safety and cleanliness. Another factor encouraging the usage of Online Food Delivery Services (OFDS) is the concern of catching COVID-19, which has resulted in a preference for disposable utensils and food containers. While experiments have shown that the coronavirus may survive for days on a variety of surfaces, including plastics [13], the chance of catching COVID-19 via this route is negligible [14].

Plastic consumption related to food delivery such as bottles, cups, containers, and plastic bags results in 600,000 tonnes of disposed plastics in South Korea, according to a material flow study [15]. In Australia, the cost of greenhouse gas emissions connected with a single order of takeout containers from OFDS was calculated to be between 0.15 and 0.29 CO₂e [16]. According to the same research, the projected expansion of this business model is expected to raise greenhouse gas emissions for food containers connected with OFDS by 132% by 2024. While these studies offered an overview of the consequences of OFDS as a result of increased plastic consumption, they were carried out in highly developed countries. As a result, further research is needed to measure and examine how the rising demand for OFDS, as well as the resultant increase in plastic usage, would harm the environment, especially in densely populated places. Because OFDS are becoming more prevalent in cities and the rate of urbanization continues to rise, this problem will only worsen, necessitating immediate action [17].

VI. PROPOSED SOLUTION

Various levels of society can provide potential ideas to reduce the inflow of plastic waste from the restaurant industry are shown in Table 1.

Table 1: Action taken by the different stakeholders to promote the cleaner and more responsible use of plastic obtained from online food delivery services.

Level	Action
Personal	<ul style="list-style-type: none"> Choose restaurants within the vicinity and bring your own containers for takeout
Restaurant	<ul style="list-style-type: none"> Increase the options for takeout containers and packaging to include sustainable materials.
Online food delivery system	<ul style="list-style-type: none"> Provide incentives for restaurants that utilize sustainable packaging materials. Negotiate with manufacturers of sustainable packaging materials on behalf of restaurants within their network, which may drastically decrease the procurement cost of sustainable packaging materials. Devise an innovative operational framework that will lead to the circular use of food containers within their restaurant network
Government	<ul style="list-style-type: none"> Infrastructure investment for recycling facilities Review the relevance and ability to exist laws to respond to the dynamic nature of plastic waste management Review the relevance and ability to exist laws to respond to the dynamic nature of plastic waste management

Source: [18]

On a personal level, customers may choose to eat at restaurants in their close vicinity rather than ordering food online. They are welcome to bring their food containers and take their meals home with them. Customers can also choose to purchase environmentally concerned establishments. This may express itself through the restaurants' packaging materials of choice, as well as discounts for reusing containers, among other things.

Restaurants may find it challenging to pursue sustainable principles because the immediate and most pressing need is to survive and avoid losses incurred by the pandemic and community quarantine. Giving customers more alternatives for how their food is packaged and delivered is one technique that restaurants may take to help minimize the increase in plastic usage caused by packaging. For example, a restaurant might list several takeout containers, such as those described in the preceding section, on their app page and allow customers to decide whether they are ready to pay a premium for environmentally-friendly packaging. This method ties together the findings that pricing influences online food delivery alternatives [19] and that youth are prepared to pay a premium for green consumption [20].

Similar to extended producer responsibility, OFDS should take the lead and play a larger role in providing new solutions to reduce plastic consumption from food delivery packaging. Even though the fact that OFDS is not a plastic manufacturer or a retailer of plastic-based products, it should be considered accountable for the rise in plastic consumption due to food delivery because its business model has accelerated the use of single-use plastics, particularly during the pandemic. Currently, these platforms' primary visible effort is the option to not request cutlery. OFDS is in a unique position to implement high-impact actions in a short period. Given that one of the barriers preventing restaurants from using sustainable packaging materials is cost, offering incentives to those that do so could result in a positive consequence. Incentives might be concerned with the overall impact of the used takeaway container on the environment. Furthermore, the OFDS can bargain with producers of sustainable packaging materials for the restaurants in their network as a group. Restaurants that desire to employ these types of takeout containers benefit from a top-down strategy to promote sustainable packaging.

Because limiting plastic use during the first instance is the most effective strategy to decrease waste, online FD services should develop a strategy to encourage people to reuse their food containers. In Japan and South Korea, for example, restaurants that deliver directly to clients utilize ceramic bowls or plates as takeout containers. The delivery rider will then return to pick up the used ceramic bowls or plates. Online FD should invest in the development of innovative operational frameworks that will result in the circular reuse of food containers, similar to the situation described above.

Government initiatives to manage plastic waste are expected to have a significant impact, despite their longer lifespans. Investing in infrastructure that supports and follows the recycling hierarchy, such as depolymerization of plastics for reuse in synthetic material manufacturing, reduction of plastics to lesser types of materials, and waste-to-energy systems are just several examples [21]. Governments are also being urged to examine current legislation to see if it is capable of dealing with the modern challenges created by increased plastic consumption.

VII. CONCLUSION

Plastic pollution, food waste, and a high carbon footprint are the three major environmental impacts of online food delivery services on sustainability. Online food delivery has offered suffering restaurants a new or extra revenue source as a result of the pandemic. Online food delivery helped the restaurants to stay in business, and takeaway containers and packaging materials have contributed to unsustainable plastic waste. This study examined the issues restaurants face in terms of sustainability in a systematic way, as well as alternative methods for promoting responsible plastic consumption. Offer incentives are given to those who utilize sustainable packaging materials and establish new operational frameworks that will lead to the circular usage of food containers within their restaurant to prevent plastic pollution linked with online food delivery services.

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