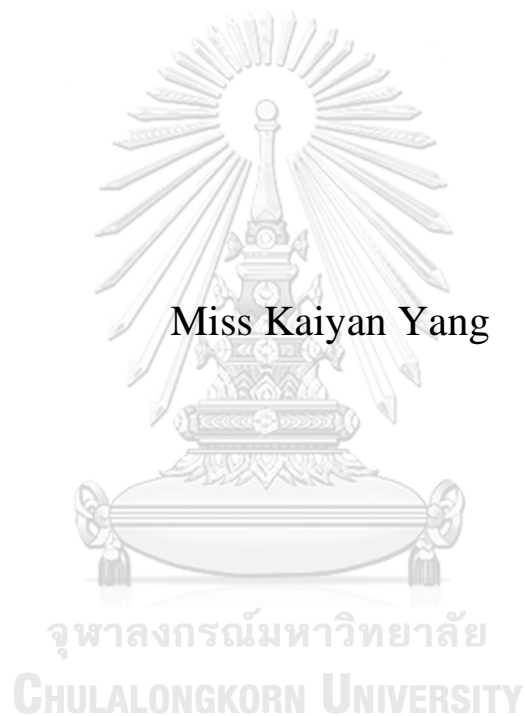Consumers' Intention in Avoiding Plastic Packaging from
Online Food Take-out: A Case Study of Beijing and Shanghai,
China.

Miss Kaiyan Yang

จุฬาลงกรณ์มหาวิทยาลัย
CHULALONGKORN UNIVERSITY

A Thesis Submitted in Partial Fulfillment of the Requirements
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การศึกษาความตั้งใจของผู้บริโภคในการหลีกเลี่ยงบรรจุภัณฑ์พลาสติกจากการสั่งอาหารออนไลน์:
กรณีศึกษาเมืองปักกิ่งและเซี่ยงไฮ้ ประเทศจีน

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ไคยาน หยาง : การศึกษาความตั้งใจของผู้บริโภคในการหลีกเลี่ยงบรรจุภัณฑ์พลาสติกจากการสั่งอาหารออนไลน์: กรณีศึกษาเมืองปักกิ่งและเซี่ยงไฮ้ ประเทศจีน. (Consumers' Intention in Avoiding Plastic Packaging from Online Food Take-out: A Case Study of Beijing and Shanghai, China.) อ.ที่ปรึกษาหลัก : สุจิตรา วาสนาดำรงดี

ประเทศจีนกำลังประสบปัญหามลพิษพลาสติกที่ทวีความรุนแรงขึ้น โดยเฉพาะอย่างยิ่งในช่วงการระบาดของโควิด-19 เมื่อการล็อกดาวน์ของเมืองกระตุ้นธุรกิจซื้อกลับบ้านและสั่งอาหารออนไลน์ แม้ว่ารัฐบาลจะพยายามควบคุมการใช้บรรจุภัณฑ์พลาสติกแบบใช้ครั้งเดียว แต่ปัญหาขยะพลาสติกยังคงถาโถมในช่วงเวลาสำคัญที่ต้องมีการพัฒนาประเทศสู่หนทางการพัฒนาที่ยั่งยืน กุญแจสำคัญในการแก้ไขปัญหาการใช้บรรจุภัณฑ์พลาสติกแบบใช้ครั้งเดียวอย่างล้นหลามคือ การลดปริมาณการใช้พลาสติกลง ควบคู่ไปกับการใช้บรรจุภัณฑ์ทางเลือกที่เป็นมิตรต่อสิ่งแวดล้อม ได้แก่ บรรจุภัณฑ์ที่ย่อยสลายได้ทางชีวภาพและบรรจุภัณฑ์ที่ส่งคืนเพื่อนำกลับมาใช้ซ้ำได้ การศึกษานี้ได้ทำการศึกษาระดับความเต็มใจของผู้บริโภคในการยอมรับบรรจุภัณฑ์ทางเลือกด้วยทฤษฎีพฤติกรรมตามแผน (TPB) โดยมีการพัฒนามาตรวัดตัวแปรตามทฤษฎีต่อยอดจากงานวิจัยที่ผ่านมาและได้มีการตรวจสอบความน่าเชื่อถือและความถูกต้องผ่านการวิเคราะห์องค์ประกอบเชิงยืนยัน (CFA) ในโปรแกรม SmartPLS การศึกษานี้ได้เก็บข้อมูลด้วยการกระจายแบบสอบถามออนไลน์ให้กับกลุ่มผู้บริโภคคนจีนที่อาศัยอยู่เมืองปักกิ่งและเมืองเซี่ยงไฮ้ โดยได้รับแบบสอบถามตอบกลับจำนวน 536 ชุด สรุปแบบสอบถามที่ใช้ในการวิเคราะห์จำนวน 430 ตัวอย่าง ผลการวิเคราะห์พบว่า ปัจจัยด้านการรับรู้ถึงการควบคุมพฤติกรรมของตนเอง (PBC) ของผู้บริโภคมีผลในเชิงบวกอย่างมากต่อความเต็มใจที่จะจ่ายมากขึ้นสำหรับการใช้บรรจุภัณฑ์ที่ย่อยสลายได้ทางชีวภาพและความเต็มใจที่จะเข้าร่วมในโครงการส่งคืนบรรจุภัณฑ์ที่ใช้ซ้ำได้ ส่วนปัจจัยด้านทัศนคติด้านสิ่งแวดล้อม บรรทัดฐานทางสังคม และพฤติกรรมที่เป็นมิตรต่อสิ่งแวดล้อมในอดีต มีความสัมพันธ์โดยตรงที่น้อยกว่าต่อความตั้งใจที่เปลี่ยนไปใช้บรรจุภัณฑ์ทางเลือก โดยอิทธิพลของปัจจัยเหล่านี้ถูกลดทอนด้วยปัจจัย PBC อย่างไม่เป็นสัดส่วน นอกจากนี้ ยังพบอิทธิพลกำกับระหว่างตัวแปรทางเศรษฐกิจและสังคมกับความเต็มใจที่จะมีส่วนร่วมในโครงการส่งคืนบรรจุภัณฑ์ที่ใช้ซ้ำได้ (WTP) และความเต็มใจที่จะจ่ายบรรจุภัณฑ์ทางเลือก (WTM) การศึกษานี้จึงมีข้อเสนอแนะว่ารัฐบาลควรเสนอมาตรการจูงใจให้ภาคอุตสาหกรรมสนับสนุนบรรจุภัณฑ์ทางเลือกที่เป็นมิตรต่อสิ่งแวดล้อม นอกจากนี้ ควรมีการส่งเสริมบรรจุภัณฑ์ทางเลือกอื่นผ่านการให้ความรู้เกี่ยวกับพลาสติกในการเรียนการสอนระดับมัธยมศึกษาและมหาวิทยาลัย และให้มีการสื่อสารรณรงค์ในแพลตฟอร์มโซเชียลมีเดีย นอกจากนี้ ควรกำหนดกลุ่มเป้าหมายในการรณรงค์ คือ กลุ่มเยาวชนและผู้หญิง เนื่องจากเป็นผู้บริโภคหลักของการซื้ออาหารออนไลน์และการซื้อกลับบ้าน ผลการศึกษานี้สามารถนำไปปรับใช้กับเมืองอื่น ๆ

สาขาวิชา	สิ่งแวดล้อม การพัฒนา และความยั่งยืน	ลายมือชื่อนิสิต	....
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6288013920 : MAJOR ENVIRONMENT, DEVELOPMENT AND SUSTAINABILITY

KEYWORD: plastic pollution China online food takeout green packaging Theory of Planned Behavior PLS-SEM

Kaiyan Yang : Consumers' Intention in Avoiding Plastic Packaging from Online Food Take-out: A Case Study of Beijing and Shanghai, China. . Advisor: Dr. SUJITRA VASSANADUMRONGDEE, Ph.D.

China's plastic pollution has gotten worse, especially during the COVID pandemic when the city's lockdowns boosted the food takeout business. Although the government has made efforts in curbing the use of conventional single-use plastic packaging, the problem is still looming up in the critical time of building ecological civilization. The key to resolve the overwhelming usage of disposable plastic packaging lies in reduction, along with using green alternatives: biodegradable packaging and returnable containers. The study investigated consumers' willingness to adopt new alternatives by applying the theory of planned behavior (TPB). The measurement scale, developed upon previous literature, gains validated reliability and validity after running confirmatory factory analysis (CFA) in SmartPLS. The study distributed 536 questionnaires online, targeting consumers from Beijing and Shanghai. 430 valid samples were collected and analyzed, with results showing that consumers' perceived behavior control has strong and positive effect on their willingness to pay more to using biodegradable packaging and willingness to participate in the returnable container programs. The environmental attitude, social norms and past green behavior show less direct relationships with people's adopting intentions. Their effects on the intentions are mediated by perceived behavior control disproportionately. The moderating effect is also been found between socio-economic variables and WTP&WTM. The study thus made the recommendations that the government should roll out industrial-support incentives to support the development green alternatives. Besides, promotions of alternatives should also be stressed through incorporating plastic relevant knowledge into education plan of middle schools and universities and distributing advisements on social media platforms. In addition, the young and female should be set as the targeted groups to promote the use of green alternatives as this group of people are the major consumers of online food takeout. More importantly, the study can be applied to other cities in China with the same policy and cultural backgrounds.

Field of Study:	Environment, Development and Sustainability	Student's Signature ....
Academic Year:	2020	Advisor's Signature ....

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CHAPTER 1: INTRODUCTION

1.1 Background

Nowadays plastic is dispensable for people's ordinary living. With lightweight, water-resistant and portable properties, the low-cost material is widely used in packaging. For many reasons, the recycling rate of plastic waste is rather low. It is estimated that less than one third of the plastic waste has been recycled in Europe, most of which went to incineration and landfill, causing severe environmental pollution (**Figure 1**). The situation facing by the whole world is even gimmer. Only around 1/10 plastic waste has been recycled, over a half of which was dumped in the open air or ended up in landfill (D'ambrières, 2019). Data shows that the global production of plastics in 2018 reached 454 million metric tons, with an expected growth rate of 3.2% from 2020 to 2027. A latest research' estimation shows that 11% of plastic waste generated globally, about 19-23 million metric tons, went into aquatic ecosystems in 2016 (Single- et al., 2020). What is worse, even considering the commitments set by the governments to curtail mismanaged plastic waste, there is still a great possibility that up to 53 million metric tons of plastic emissions into aquatic ecosystems per year by 2030 (Single- et al., 2020). This crisis is not only faced by marine system but the whole ecosystem on the earth. Settling this plastic crisis thus becomes a pressing issue.
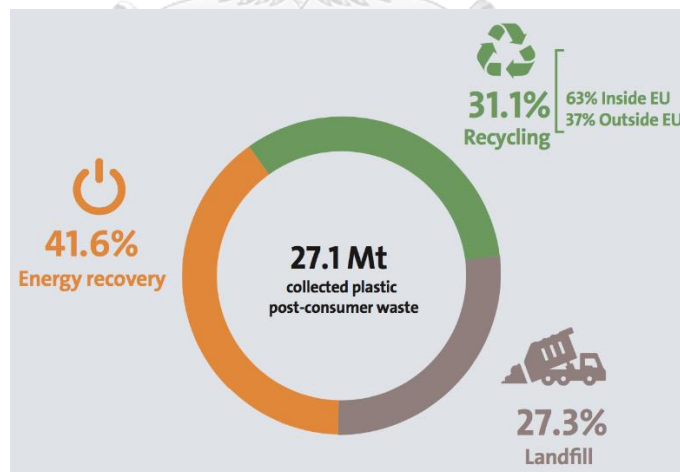
Figure 1 Management of plastic waste in Europe in 2016 (EU28 + Norway and Switzerland)

(Source: PlasticsEurope Market Research Group (PEMRG) and Conversio Market & Strategy GmbH)

China is estimated as the largest plastic consumer failing in managing plastic waste in a sustainable way. Data shows that most of the plastic waste is generated by packaging

industry, with foods and beverage sector claiming the biggest share (Our World in Data, 2015; Bloomberg and Televisory's Research, 2017).

Since Ele.me, the first food delivery application in China, appeared in 2009, the market size surged to 653.6 billion RMB (about 95.6 billion US dollars) from zero within one decade, with around 460 million consumers (iimedia Research, as cited in Daxueconsulting, 2020). It is estimated that Beijing and Shanghai are among top 5 regarding online food demand.

However, the booming industry also is coming along with a huge amount of plastic packaging waste. The total amount of packaging waste from online food take-out business witnessed a skyrocket increase from 0.2 million metric tonnes in 2015 to 1.5 million metric tons in 2017, 75% of which is polystyrene (PS) and polypropylene (PP) plastic containers(Song et al., 2018). The year 2016 saw 1.33 metric tons of plastic waste and 0.35 metric tons of wooden chopsticks waste generated from online food delivery(Jia et al., 2018). There is a study showing that two packaging item categories, "paper boxes, wooden chopsticks and plastic bags" and "plastic boxes, wooden chopsticks and plastic bags", respectively account for 13% and 61% of total food delivery packages in Beijing(G. Liu et al., 2020). A Life Cycle Assessment (LCA) study estimates that in online food take-out business, plastic bags, chopsticks and plastic boxes respectively account for about 35%, 32% and 27% of total packaging usage(G. Liu et al., 2020). Worse still, China now does not figure out a solution estimated effective to solve this problem. These two forces now are synergizing and worsening the plastic waste management scenario in China.

The next section will give a detailed introduction of China's plastic packaging crisis in this special time.

1.2 COVID-19 and Plastics

Data shows that there were 416 million of online food take-out consumers in 2019, up from 60 million back in 2011's China (Zhou et al., 2020). More importantly, the figure still keeps rising. iiMedia Research's report (2020) predicted that online food delivery business will register over 650 billion yuan by 2020, up from 577.93 billion yuan in 2019. In light of COVID-19 pandemic, work-from-home and self-isolation become common practices for many people to prevent the spread of the epidemic. Although the whole catering industry bore the brunt of this aggressive pandemic, online food delivery business was the fastest one recovering from the strike. Data from China's National Bureau of Statistics also demonstrates that even though the whole catering industry was hit by COVID-19 earlier in 2020, it began to recover since the end of February, particularly in terms of the online food take-out business. The reachability rate of target output of online food delivery industry was about 10% higher than that of the whole

catering industry. COVID-19 nudged more people to try online food take-out amid the pandemic. With the situation gradually turning better, more people start to order food online since coronavirus prevention measures still remain stringent. It therefore accelerated the process of food outlets switching their business focus from offline to online to save losses. Meituan Research Institute predicts that online food delivery will claim 20 % of China's catering industry by 2020. New data released by two giant online food delivery companies also shows that they are gradually recovering from the toll of COVID-19. Meituan claimed that its second-quarter revenue of online food take-out business increased 13.2%, while Ele.me achieved a 15% of growth in this regard. According to Meituan's forecast, next three years will witness the market value expanding to one trillion yuan (about 142 billion U.S. dollars).

It can be deduced that online food delivery service will see a huge development in the future. However, this type of business mode brings environmental problems, which are resulted from the overconsumption of disposable plastics. A coin has two sides. On the one hand, plastics, noted for lightweight, durable, waster-proof properties and high cost-efficient performance, go ubiquitous in food packaging on food take-out and bring huge convenience to human's life (Marti, 2018). On the other hand, plastic waste is notorious for polluting soil, water and marine ecosystems, swarming into food chains, and jeopardizing the life and health of human and wildlife on the earth (Marie et al., 2019; Chae & An, 2018). Even the plastic crisis has arisen high attention worldwide, the attention has not been paid equally to every occasion overwhelmed by single-use plastics. With the booming of online food delivery business in recent years, more and more researchers and environmental activists are bombarding food packaging waste generated on this occasion in full swing (Klemeš et al., 2020; Wang et al., 2018).

To deal with the environmental pollution induced by the massive consumption of disposable plastics, Chinese government issued a new plastic ban policy in January, 2020. Furthermore, Chinese government now is pressing forward the implementation of "waste sorting" policy with every effort. Under this policy paradigm, which is combing plastic ban and "waste sorting" campaign, the production and sale of disposable foam, single-use plastic tableware and non-degradable plastic bags, mostly for food takeout and takeaway, will be banned at the end of 2020.

Noteworthily, the effectiveness of policy implementation cannot be guaranteed according to previous experience. China rolled out a nationwide campaign of limiting ultra-thin plastic bags from 2008, which was ended up in failure in a manner as it did reduce single-use plastic bags consumption in supermarkets while not in disproportionately numerous places that are less-regulated and informal such as grocery markets, street vendors and so on (Peng & Liu 2012; Xu 2010; Han 2009). Moreover, the usage of plastic film bags in supermarkets is still rampant. Apart from it, the campaign gradually deviated from its goal as customers increasingly get used to being

charged for using plastic shopping bags according to a research by Yin (2016). More importantly, the gap of plastic shopping bags reduction is filled by plastic packaging used elsewhere such as online food delivery. Different from "plastic limit" campaign in 2008, the plastic ban policy promotes the use of biodegradable materials as alternatives of disposable plastics. But how much change biodegradable alternatives can make is still under debate. Existing arguments point that this solution could arise environmental trade-offs (UNEP, 2020; Butler, 2007; Chan-Halbrendt et al., 2009). According to a report published by a UK think tank Green Alliance (2020), phasing out plastic packaging and adopting alternative materials probably cause more pollution if infrastructures for collecting and treating substitute materials are not in place.

Existing researches point out that reducing the total usage of single-use plastics is the key to address this plastic crisis (Miller, 2012). To reduce the total amount of single-use plastics, there is a need to promote all green behaviors relevant to online food take-out consumption, generally including avoiding, reducing, reusing and recycling conventional disposable packaging. It should be emphasized that the most preferable behavior should be "avoiding" waste generation. Consequently, it is necessary to clarify what factors motivate people to avoid the use of conventional disposable food packaging.

1.3 Problem Statement

COVID-19 and the New Plastic Ban policy adds many uncertainties on people's normal perceptions and consequently influence their behaviors towards food packaging. These uncertainties intensify the need of reinvestigating what factors drive people's behavioral intention towards food packaging at individual level. There are two arguments elaborating why this investigation is vital in this special period.

Firstly, there exists an insufficiency of previous studies on studying the avoiding attention and behaviors towards food packaging. Moreover, few studies in this field try to study the relationship between other green behaviors (reduce, reuse, recycle) and avoiding attention towards food packaging in light of specific policy or situational contexts. This research, however, is conducted against the backdrop of COVID-19 and China's special campaigns of "plastic ban" and "waste sorting". First of all, it should be noted that other sustainable behaviors may also be involved in people choice portfolio of dealing with food packaging. Yet there are many researches focusing on studying consumers recycling perceptions or behaviors on food packaging (Marti, 2018; Nemat et al., 2019; Wikström et al., 2016), with few research focusing on studying the relationship among all the possible green behaviors of dealing with food packaging together. Moreover, COVID-19 brings up people's concern towards food safety regarding how food is prepared, packaged and delivered (Shahbaz et al., 2020), which may consequently change people's perceptions and routine behaviors of dealing with

food packaging. Therefore, there is a need to re-estimate people's perceptions and behaviors towards food packaging and the correspondent driving factors in this new context, particularly for food packaging avoidance.

Apart from the above-mentioned argument, there is a new conflict emerged at this stage that may change people's perceptions and behaviors towards food packaging. COVID-19 boosts online food delivery, leading to the rise of food packaging consumption. While the coming new plastic ban policy will ban the use of single-use plastics for food packaging and "waste sorting" campaign requires people to sort all their waste including food packaging and food waste. The conflict generated in the process can influence people's perceptions of dealing with food packaging and consequently change their behavioral patterns.

Based on the above two arguments, clarifying the factors that drive the change of people's perceptions and behaviors becomes necessary. Only through this way, the government and relevant interest groups can develop plausible solutions in order to motivate people to take sustainable behaviors, especially avoidance, towards conventional food packaging. Therefore, the aim of this research is to figure out what factors influence people's avoiding intention and correspondent behaviors towards food packaging usage against COVID19 and the policy context under the "New Normal" scenario. By doing so, recommendations can be proposed to advance the new policy for its implementation to ensure the effectiveness.

This research takes Beijing, capital city of China, and Shanghai, the economic center in China, as the study area. These two cities were the top 2 cities in regard of municipal solid waste (MSW) generation in 2018. Besides, they are also among the top 10 cities in China noted for booming online food take-out demand. To solve the overwhelming problems triggered by massive waste generation and mistreatment, two cities have formally launched "waste sorting" policy respectively in 2019 and 2020. The new plastic ban policy is also expected to be launched by the end of 2020. With around 21.5 and 24.3 million dwellers, Beijing and Shanghai are the holy land for many young Chinese dream seekers from all over the nation. Young people, as the main consumer group of food take-out, feeding food delivery stores and platforms online. As two metropolises gather people from different places in China, it can be counted as the epitome of China. Hence, this study can potentially make contributions below. Firstly, the study of Beijing and Shanghai can estimate the general avoiding intention towards disposable food packaging of Chinese consumers. Moreover, as they are China's most significant cities, their management practices will be regarded as an example of other cities nationwide.

Based on the above argument, the research focuses on the following question and objectives:

Question:

What factors influence people's avoiding intention towards conventional food packaging on food take-out against COVID-19 and relevant policy paradigm?

Objectives:

1) Investigate the status quo of potential alternatives provided in the future for people to avoid using conventional food packaging.

2) Identify the factors that influence people's avoiding intention towards food packaging on food take-out against COVID-19 and relevant policy paradigm.

1.4 Scope of the study

This research is to investigate consumers avoiding attention against COVID-19 and New plastic ban as well as "waste sorting" campaign. Beijing and Shanghai are the study area, where "waste sorting" policy has already been formally implemented and "New plastic ban" implementation is under progress. As there are no specific and detailed solutions proposed by the government regarding what will be the alternatives of banned plastics, the study will list possible alternatives effective to resolving plastic problem in food take-out based on literature review. Furthermore, it should be bore in mind that most of the alternative solutions are not widely adopted in the society. Most people have no experience or even knowledge in using alternatives to replace disposable plastic packaging. That being said, there is chance that these alternatives may be promoted after the "new plastic ban" policy being stably put on ground. Therefore, the research is to study the potential avoiding intention of consumers.

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CHAPTER 2: LITERATURE REVIEW

2.1 Chapter Overview

Food packaging issue has come under the spotlight in recent years due to the severe environment pollution it generated. The outbreak of COVID-19 accelerates the booming of online food delivery worldwide, surging the demand of food packaging materials, which now are mostly composed of disposable items such as single-use plastics (Hobbs, 2020; WRAP 2020). The deteriorating plastic crisis is pressing. Therefore, it is significant to work out an effective solution to response to this issue. Improving people's awareness of reducing food packaging is one of the most effective solutions on the table (Escario et al, 2020). To avoid falling into the old disastrous track again by implementing ineffective policies or campaigns, the factors that influence people's avoiding intentions should be investigated. As a result, the literature review will focus on studies that explore the factors that influence people's intention and behavior of adopting sustainable and pro-environmental practices, particularly in dealing with food packaging waste or disposable plastic waste. With the time and information limitations, this research only focuses on disposable food packaging on online food take-out.

This chapter is divided into five sections. The first section above is a general overview of the literature review. The second section aims to clarify major concepts appearing in the study. The third section concerns the plastic and waste relevant policies in China, with a focus on plastic related regulations such as "New Plastic Ban" and "Waste Sorting" regulations. The section followed focuses on interpreting major behavioural theories used for exploring how consumers develop pro-environmental or sustainable intention or behaviour in previous literature. This section aims to identify the research gap, based on which a theoretical framework of underlying theory is developed for this study. The fourth section proposes hypotheses based on the above identified research gap. Then comes the last section, which is to summarize the major findings in reviewed literature and recap research gaps.

2.2 Major Concepts and Definitions

Single-use Plastics/Disposable Plastics

Single-use plastics, also named disposable plastics, are plastics designed for one-time usage. Commonly used for packaging, single-use plastics include but not limited to plastic shopping bags, plastic bottles, stirs, straws, cups and tableware for food packaging (UNEP, 2018). LDPE, PS, EPS, PP, PET and HDPE are six major polymers used for producing disposable plastics, as shown in **Figure 2**.
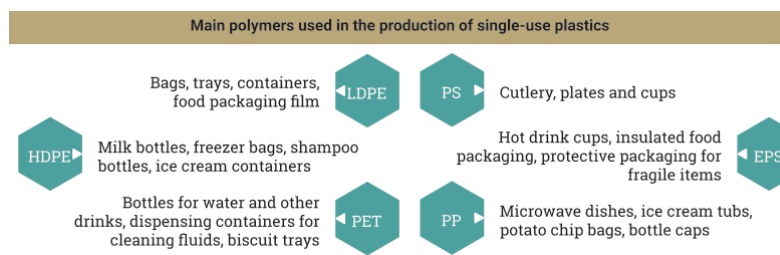
Figure 2 Main Polymers Used in Producing Single-use Plastics *(Source: UNEP, 2018)*

Degradable, Biodegradable and Compostable Plastics

All plastics are made from two categories of materials, fossil-based and bio-based.

Fossil-based plastics are composed of conventional plastics such as PE, PP and PET, and bioplastics such as PBAT and PCL. The latter is biodegradable. Bioplastics such as PE, PET, PA and PTT are not degradable, while bio-based PLA, PHA, PBS, Starch blends are degradable (WRAP, 2019).

Biodegradable plastics can be degraded into greenhouse gases such as carbon dioxide, methane, waste and biomass under certain environmental conditions (WRAP, 2019). This type of plastics can be broken down into small pieces such as microplastic without required temperature and humidity conditions. Microplastics may be mistakenly ingested by animals and consequently sneak into the food chain, posing a threat to the health of animals and human beings. (Greenpeace, 2019).

Degradable plastics are capable of fragmentation through UV radiation, oxygen or biological attack. Degradable plastic is different from biodegradable plastic as chemical addictive is used in producing degradable plastics for accelerating the breakdown process(Kershaw, 2016).

Compostable plastics can be fragmented with specific time, temperature and humidity conditions through industrial facilities(Kershaw, 2016).

Biodegradable plastic and compostable plastic promoted in China currently follow the standard issued in 2006, which are different from heat-, oxide- and photo-degradable plastics. The standard, however, does not specify the raw materials used for making such biodegradable plastic products. The new standard issued by Hainai Province in 2020 indicates that the raw materials making such products must be biodegradable plastics, integrating an appropriate proportion of natural polymers materials such as cellulose material. Bio-based non-degradable plastic is not in this scope. The degradability requirement of this standard only supports biodegradable plastics that can be degraded in fresh water or ultimate aerobic environment. But an informal standard has been issued by China Light Industry Council, introducing more standards to test the

degradability of plastics, which still exclude heat-, oxide- and photo-degradable plastics.

Food Packaging on Online Food Take-out

It refers to the packaging used for food bought from restaurants or stores and will be transported and consumed at other places. Plastic, featured lightness, shatter-resistance, waterproof properties and noted for cheapness, is the most widely used materials for take-out and takeaway food packaging. Foamed plastic container, PP disposable tableware, paper disposable tableware, ultra-thin plastic bags and oxo-degradable tableware are the most commonly-used packaging for take-out food.

COVID-19

The COVID-19 pandemic, breaking out in December 2019, is an acute respiratory disease induced by coronavirus (WHO, 2020). It was firstly identified in Wuhan, China, and then spread across the whole world rapidly, resulting in millions of cases and tens of thousands of deaths. Many countries introduced lockdown restrictions when they were enduring the hardest time of this pandemic, when people kept social distancing through self-isolation at home, booming O2O (online-to-offline commerce) market.

Relevant Policies: New Plastic Ban and Waste Sorting policy

The relevant Policy paradigm refers to the new plastic ban policy introduced in January, 2020 and waste sorting policy. The former one is introduced to limit the use of single-use plastics, mainly in catering industry. The later one firstly was seriously implemented in Shanghai last year and then officially launched in Beijing in May. The policy will be gradually implemented in the other 44 cities including all province-level cities at the end of 2020. The detailed elaboration of the policy is present in the next section.

2.3 Plastic Crisis and Food Packaging

Data shows that plastic production worldwide was more than 454 million metric tons in 2018, up from 2 million tons in 1950 (United Nations, 2020). 343 million tons of them will become waste every year, with 19.5% recycled, 25.5% incinerated and 55% discarded(Geyer, 2020; United Nations, 2020). Therefore, this crisis, ignited by unrestrained use and mismanagement of plastics, takes a toll on the whole ecological system on the earth. Notably, the marine ecosystem bears the severest brunt. It is estimated that there are over five trillion pieces of plastics in the ocean. As plastic takes over 500 years to degrade, the dumped plastic waste is wandering in oceans, threatening marine life. Marine animals not only die from mistaking plastics as food but getting entangled in plastics. Ironically, the disaster we human brings to marine life will finally harass ourselves as the majority fish we eat would have ingested microplastics.

To avoid reaping what we sowed, the whole world must take actions right away, particularly countries that fall short in sustainably managing the plastic waste they consume. China is estimated as the top one economy for mismanaged plastics (**Figure 3**). For total 20 rivers transferring over 90% plastic waste into oceans, six of them are belonging to Mainland China (**Figure 4**). The plastic input from Yangtze river is startling huge compared to the rest 19 rivers as the figure below shows.

Estimated mass of mismanaged plastic waste
2010, tonnes, m

Source: "Plastic waste inputs from land into the ocean",
by J. Jambeck et al., *Science*

Figure 3 Estimated mass of mismanaged plastic waste *(Source: Our World in Data)*

Plastic ocean input from top 20 rivers, 2015
Plastic input to the ocean from the top 20 polluting rivers across the world. Shown is the given river, its location, and estimated annual input of plastic to the oceans in tonnes.

Source: Lebreton et al. (2017)   CC BY
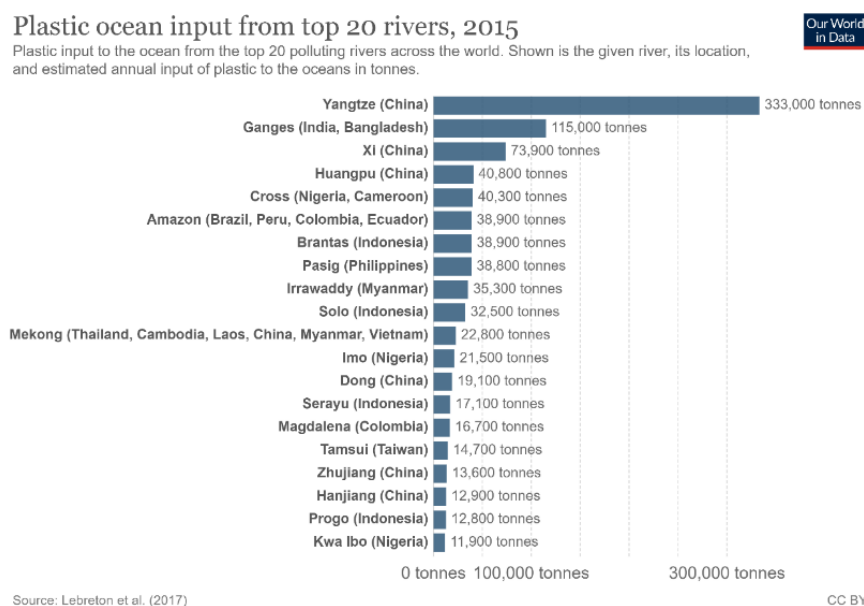
Figure 4 Plastic ocean input from top 20 rivers, 2015 *(Source: Our World in Data)*

In order to solve this issue, it is important to be clear where the plastic waste comes from. As **Figure 5 & 6** illustrates, packaging industry claims the biggest share of global plastic production, with 36% proportion. It is predicted that about 343 million tons of plastic waste will be produced every year, with around 46% of which is packaging waste (Geyer, 2020). Most of the plastic packaging goes to foods & beverage industry (**Figure 7**). In China, online food delivery business alone has consumed 7.3 billion plastic packaging, exhausting all the efforts gained by "plastic limit" order implemented a decade ago.
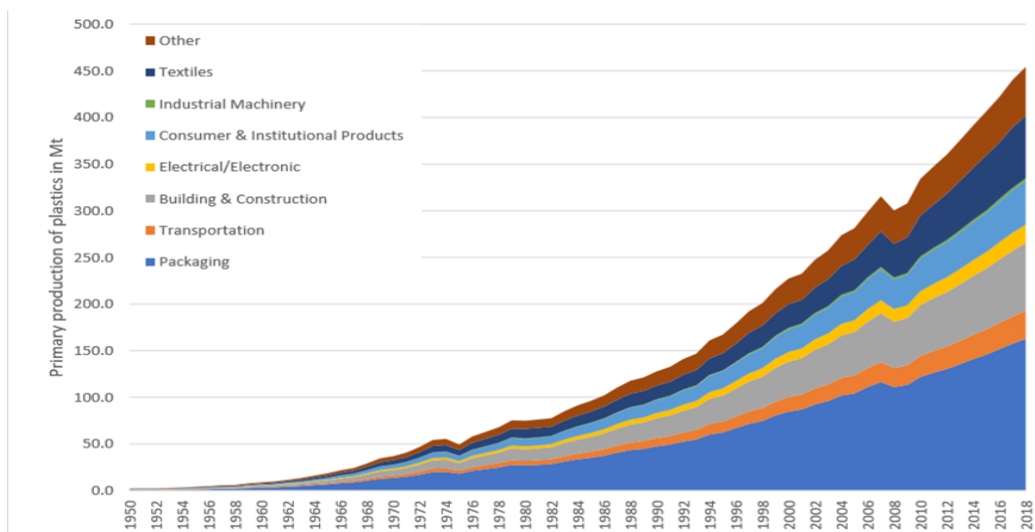
Figure 5 Global primary and global plastic production (in million metric tonnes) by sector between 1950-2018 *(source: United Nations, 2020)*
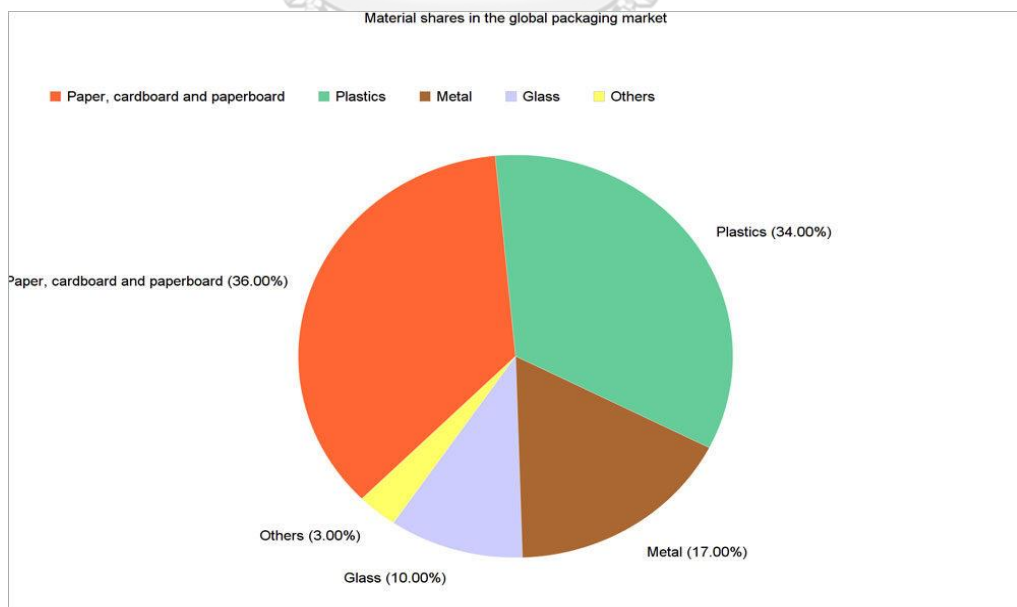
Figure 6 Material shares in the global packaging market
(Source: Packaging Statistics That Might Surprise You | Packaging Distributors of America, 2016)
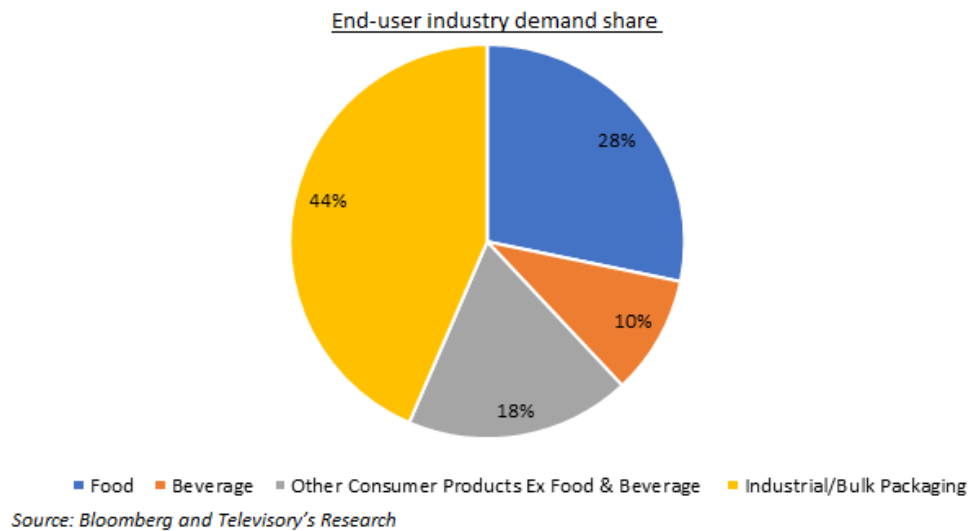
Figure 7 **End-user industry demand share 2017**
(Source: Bloomberg and Televisory's Research, 2019)

2.4 Plastic Waste Management and Consumers Behaviors

The amount and types of packaging waste generated in our daily life are largely dependent on how people deal with packaging. In this sense, food packaging waste management is decided by people's behaviors toward food packaging.

According to Zero Waste SA (2011), the priority of plastic waste management is to avoid the generation of plastic waste (**Figure 8**). From the viewpoint of waste management at the macrolevel, however, it is almost impossible to avoid treating any waste. This is also why many literatures put the emphasis on waste recycling or reduction instead of prevention (Masud et al., 2019; Mwanza & Mbohwa, 2017; S. L. Wong et al., 2015). While at the individual level, people can help to reduce the total amount of plastic waste generation by avoiding the use of plastics. Apart from avoiding plastic waste generation, reducing the unnecessary usage of plastics can be counted as another approach of reducing plastic waste in total. Reusing plastics for many times will also reduce total plastic waste. According to The Waste Framework Directive (2008/98/EC), "recycling" aims to reprocess waste materials into products or materials but not fuels or energy, while "recover" is to transform waste materials into something that can replace other materials or fulfil a specific use in power plants or other scenarios. From the definitions of "recycle" and "recover", obviously, these two operations are mostly being done by professional facilities. Therefore, for individuals, it is unrealistic to recycle or recover plastic waste by themselves. As a result, in order to realize these two operations of waste management regarding food packaging, people need to resell or donate the food packaging waste to waste pickers or waste shops. Under the context of "waste sorting" campaign in China, only by separating food packaging waste into

different categories for separate collection and treatment can the operation of "recycle" and "recover" being possibly conducted. In plastic waste management, only the waste that cannot being recycled or recovered goes into the next step, which is appropriate treatment or disposal such as landfill in order to minimize the adverse impacts on the environment. Correspondently, the least preferable behaviors of people towards food packaging waste can be littering, throwing away, open burning and so on.

Based on the above argument, a hierarchy respectively for waste management organizations and individuals can be adapted from Plastic Waste Management Hierarchy as a reference of dealing with food packaging (**Figure 9&10**).

Figure 8 Plastic Waste Management Hierarchy *(Source: ZeroWasteSA, 2011)*
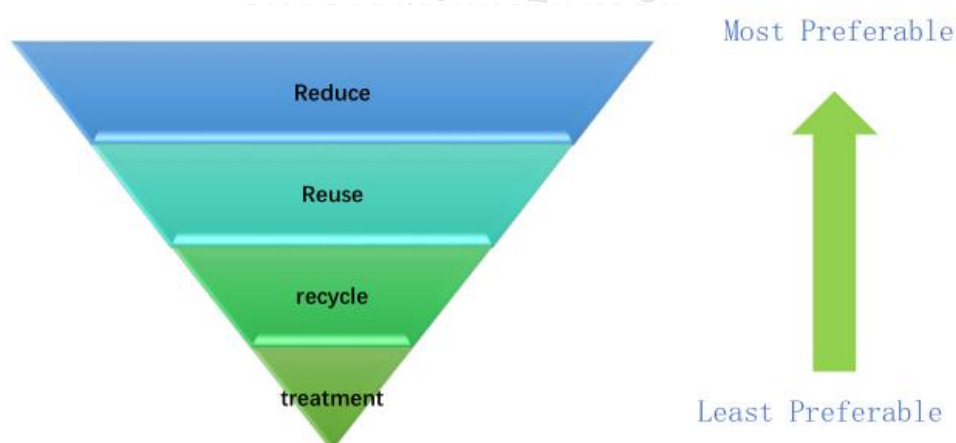
Figure 9 Plastic Waste Management Hierarchy for organizations *(Source: Adapted from Plastic Waste Management Hierarchy of ZeroWasteSA)*
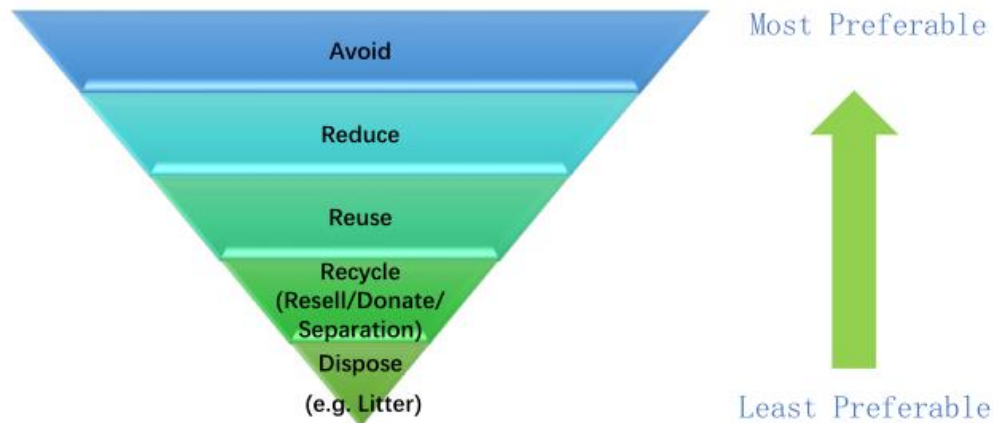
Figure 10 Hierarchy of Individuals Behaviors Toward Food Packaging *(Source: Adapted from Plastic Waste Management Hierarchy of ZeroWasteSA)*

Some studies mention that waste prevention at source should be regarded as the priority (Cox et al., 2010; Crampton, 2018; Salhofer et al., 2008). For individuals, the most preferable behavior boils down to waste prevention. While there are still not too much literature focusing on investigating consumers waste avoiding attention, especially when it comes to food packaging waste. There are some reasons for this phenomenon. Firstly, for the concern of freshness and hygiene, most food must be packaged. Single-use plastics, cheap and lightweight, always come as the first choice for business. Secondly, current consumerism promotes convenience which has developed into consumers' habit. Based on the above paradigm, people are prone to form a fixed mindset which counting plastic waste prevention as almost impossible. However, people usually fail by default. With sound policy, regulations and other effective incentives, which aim to drive people take waste avoidance behaviors, there still remain a chance that waste prevention at individual level will be a mainstream in the future. There already existed some solutions (Ivanković et al., 2017; Sarkar et al., 2019; Singh et al., 2016) emerging in the catering industry working towards this direction.

That being said, other sustainable behaviors clustering under the terms of "Reduce", "Reuse" and "Recycle" still play an indispensable role in dealing with this crisis. More importantly, easier behavior modes such as reusing single-use plastic bags can become a nudge to more complicated behaviors such as preventing the use of disposable plastics (Arias & Trujillo, 2020; Thøgersen & Noblet, 2012).

2.5 Relevant Policies in Other Countries

Multiple solutions, formal or informal, are brought on the table to deal with the plastic crisis, including public-private initiatives and policy instruments implemented by

national authorities. Policy tools used for curtailing the use of SUPs are comprised of regulatory instruments such as ban, economic instruments such as levy, and the combination of the above two (United Nation Environment Programme, 2018). Looking into the global trend, there are more and more countries initiating and implementing regulations on plastic bags, Styrofoam and some other plastic utensils after 2015. **Table 1** shows the regional trends of introducing policy tools to reduce plastic bags and Styrofoam products. Obviously, most the countries in the world have made some efforts to minimize single-use plastic usage by harnessing policy or voluntary instruments. Western countries were prone to introducing both regulatory and economic instruments at local level. Other countries featured using mainly bans nationwide to curtail plastic consumption. Noteworthily, the available information shows that countries using only bans sometimes failed due to ineffective regulation enforcement. Even though the levies lunched in some countries such as the US and Australia gained some effect, they also induced the surging usage of alternatives such as thicker and reusable plastic bags in the long run.

Table 1 Regional Trends of Instruments Used to Reduce SUPs and Styrofoam Products

Region	Countries	Year of Implementation	Level	Policy Tools	Effect
Africa	25 countries	2014-2017 (more than half)	national	mainly bans	Most of the information are not available, but limited data shows the outcome was not ideal.
Asia	several countries	more than a decade ago	national	levies and bans	There was small effect due to ineffective ban enforcement in some countries but the result was good in Japan owing to its effective waste management system.
Europe	most European countries	EU Directive 2015/720 (goal of 2025); European Strategy for Plastics in a Circular Economy (2018-2030)	regional, national and local	mainly economic instruments, unique for introducing public-private partnership	Despite some countries with unavailable information, most countries gained outstanding results.
Oceania	a bunch of countries	started from 2003	local and national	mainly bans with several levies	Trade-offs: increased consumption of thicker bags.
Central and South America	a bunch of countries	from 2009 to 2018	national	mainly bans	Effect was small due to ineffective enforcement.
North America	Canada and the US	started from a decade ago	local	mainly bans with several levies	Trade-offs: The consumption of reusable and thicker plastic bags increased.

(data source: United Nation Environment Programme, 2018)

2.6 Relevant Policies in China

2.6.1 "Waste Sorting" Policy

Earlier in 2017, the Chinese government already required major cities to launch compulsory waste-separating systems by 2020 (F. Chen et al., 2018) in *The Notice of Accelerating the "waste sorting" Development in Some Major Cities*. In 2018, Shanghai and Beijing were among the top 2 cities in terms of municipal solid waste (MSW) generation (in residential sector), respectively producing 9,843,000 and 9,294,000 metric tonnes of waste, accounting for around 4.7% and 4.4% of total MSW generation nationwide (*The Annul Report of Municipal Solid Waste Pollution of Big- and Medium-Sized Cities of PRC, 2019*). Beijing and Shanghai have about 21.53 million and 24.24 million residents, producing 27,000 tons and 22,000 tons of daily waste respectively. The daily waste generated per capita of two cities are 1.1-2 kg or so, putting the cities under huge pressure in dealing with this waste appropriately without source-separation. More importantly, the plastic waste generation amount is predicted to keep a 14%-19% of increase per year until 2050 in Beijing (Jiang et al. 2020.). In May, 2020, Beijing officially rolled out citywide compulsory "waste sorting" policy, following Shanghai, the first megacity in China implementing this policy. After the policy implementation, there is about 4,400 tons waste is collected for recycling per day in Shanghai and topping 8,000 and 8,200 tons of cooking waste being well-treated in Beijing and Shanghai per day. The specific guidelines for source-sorting of Beijing are showing in Figure 11. In Shanghai's "waste sorting" rules, waste is categorized into four types, which are "dry waste" (equivalent to others in Figure 11), "wet waste" (equivalent to food waste in **Figure 11**), "hazardous waste" and "recyclable waste".
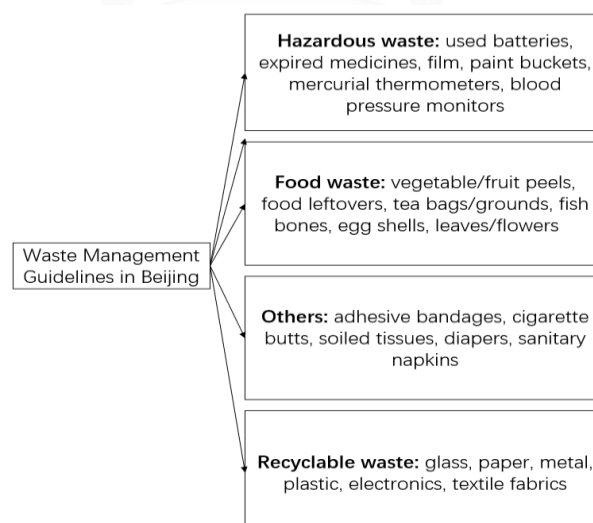
Figure 11 Waste Management Guidelines in Beijing (Source: Adapted from CGTN)

To ensure the effectiveness of the policy, Beijing has enacted relevant regulations, with some items underwrote by laws. Responsibilities of stakeholders are clarified. **Table 2**

demonstrates the details of the regulation.

Table 2 Details of Waste Sorting Policy in Shanghai

Details of Waste Sorting Policy in Shanghai				
Policy, rules and regulations	Stakeholders	Activities		
		Enforcement and publicity	Actions	Violation
National Waste Sorting Policy; Shanghai New Mandatary Waste Sorting Rules;	The city authority	Offline: 1) voluntary activities in neighborhoods to guide and teach people why and how to sort waste; 2) Advertising waste-sorting knowledge through electronic screens, bulletin boards, flyers in communities; Online: 1) Shanghai Urban Management Authority has issued online guidelines via WeChat (Chinese people's major instant messaging app); 2) Propaganda on Newspaper, television and social media platforms such as Weibo (Chinese counterpart of Facebook).	Not specified	N
	Businesses		Restaurants stop in providing disposable chopsticks, spoons, forks and knives if consumers do not require them; Malls and supermarkets stop in offering free plastic bags; Hotels stop in offering disposable toothbrushes, combs, shavers, sponges or nail files.	Shanghai: **Offender will be fined between 500 yuan (70.6 U.S. dollars) to 5,000 yuan**
	Consumers		Sorting waste according the guidelines; Dumping sorted waste into correspondent garbage bins in fixed location and time points	Violation: be educated and persuaded. Individuals will be fined for **50-200 yuan** or participate in community service if violating the regulation.

Table 3 Details of Waste Sorting Policy in Beijing

Policy, rules and regulations	Stakeholders	Activities		
		Enforcement and publicity	Actions	Violation
National Waste Sorting Policy; Beijing New Mandatary Waste Sorting Rules;	The city authority	Offline: **1) A three-month law enforcement campaign launched by law-enforcing bureau to guide and monitor household garbage sorting; 2) More than 113,000 garbage bin stations are set up in neighborhoods, with 980 closed cleaning and transfer stations;** 3) voluntary activities in neighborhoods to guide and teach people why and how to sort waste; 4) Advertising waste-sorting knowledge through electronic screens, bulletin boards, flyers in communities;	Having been sorting waste since 2017	N
	Businesses		Restaurants stop in providing disposable chopsticks, spoons, forks and knives if consumers do not require them; Malls and supermarkets stop in offering free plastic bags; Hotels stop in offering disposable toothbrushes, combs, shavers, sponges or nail files.	**Offenders will be fined between 5,000 yuan (706 U.S. dollars) and 10,000 yuan (1,400 U.S. dollars). Repeated offenders will be imposed a maximum of 50,000 yuan (7,060 U.S. dollars) fine**
	Consumers	Online: 1) Beijing Urban Management Authority has issued online guidelines via WeChat (Chinese people's major instant messaging app); 2) Propaganda on Newspaper, television and social media platforms such as Weibo (Chinese counterpart of Facebook).	Sorting waste according the guidelines; Dumping sorted waste into correspondent garbage bins in fixed location and time points	Violation: be educated and persuaded; Individuals will be fined for **200 yuan (28 U.S. dollars)** or participate in community service if violating the regulation.

Note: Bold content is the difference between two cities

Although from **Table 2&3**, it is evident that the governments have made a lot of effort to ensure the effectiveness of regulation enforcement, some official reports showed that there still exist cases of violation. According to Cudjoe et al. (2020), the difficulty of sorting waste due to lack of time, space or facilities is the major barrier that stop people from observing the regulation in Beijing.

The regulation triggers the movement of managing disposable plastics as it contains some items requiring some business players to stop in offering customers single-use plastic products. Although it hasn't officially banned the use of disposable plastic tableware or foam plastic containers, it has required food delivery apps to set "No need of cutlery" by default. By setting this option, consumers can get rewards points. However, it is doubted that how much change it can make if there is no mandatary

request for platforms, food outlets or consumers. By the completion of the proposal, two mainstream online food take-out platforms, Meituan and Ele.me still have not set "No need of cutlery" by default. They provide several options for consumers to choose by themselves, respectively "No need of cutlery", "Need one set of cutlery", "Need two sets of cutlery" and consecutively until "Need seven sets of cutlery" (The maximum value for Ele.me is five). Worse still, Meituan add one more option on the "cutlery choosing" page, which allows consumers to set "Remember and keep my options next time". As past experience shows, even though consumers choose "No cutlery" option, food outlets on the platforms still placed cutleries in packaging bags. There were several reasons for it. Firstly, according to some store owners, they are prone to ignoring this special requirement from consumers during peak time. Besides, they are afraid that consumers will complain if they do not offer cutleries. What's worse, there is a loophole on the platforms, the price will not be changed whatever consumers choose "need cutlery" or not. From consumer side, many consumers will not select this option in the sacrifice of convenience. After all, most people choose to order food online for convenience and time-saving concerns as they are at work (52.4%), unwilling to dine out (51.4%) or lack of time (39.8%) (iimedia 2017, as cited by Maimaiti et al., 2018).

2.6.2 New Plastic Ban Policy

In January 2020, the Chinese government enacted a policy targeting in reducing single-use plastic waste. The policy will be rolled out in several phases, as **Table 4** presents. The banned plastic items that are highly relevant to food take-out are disposable foam tableware, nondegradable single-use plastic tubes, nondegradable single-use plastic tableware and nondegradable plastic shopping bags.

Table 4 Banned Items of "New Plastic Ban" Policy

List of Banned Plastics			
Banned plastic products	Scope of the Ban by the End of 2020	Scope of the Ban by the End of 2022	Scope of the Ban by the End of 2025
Disposable foam tableware	production and sale	N (not specified)	N
Disposable plastic cotton buds	production and sale	N	N
Personal care products containing microplastics	production	sale	N
Nondegradable single-use plastic tubes	catering industry	N	N
Nondegradable single-use plastic tableware	Urban built-up areas and dine-in in tourist attractions of above prefecture-level cities (Jilin and Hainan province)	Built-up areas and dine-in in tourist attractions of above county-level divisions	N
Nondegradable plastic shopping bags	Shopping malls, supermarkets, pharmacies, book stores, takeaway and online take-outs, and exhibitions of municipalities, built-up areas of province-level cities (fully banned in Xizang, Yunnan, Jilin, Jiangsu, Hainan and Gansu province)	Shopping malls, supermarkets, pharmacies, book stores, takeaway and online take-outs, and exhibitions of prefecture-level cities and built-up areas of coastal counties	Open markets of prefecture-level and coastal counties
Ultra-thin plastic bags	Hainan province	N	N

Beijing is among the first group of cities which are required to ban disposable plastics listed above. In May, it issued *Beijing New Mandatary Waste Sorting Rules* which containing some items in regulating the use of ultra-thin plastic shopping bags and disposable plastic packaging of online food delivery platforms, in order to reinforce the effort of source-separation campaign, which focuses on waste source-reducing and waste recycling. The details of the "New Plastic Ban" policy in Beijing and Shanghai are presented in **Table 5**

Table 5. Details of the National New Plastic Ban Policy (at initial stage in Beijing and Shanghai)

Details of National New Plastic Ban Policy (Initial Stage in Beijing and Shanghai)：New Plastic Ban Policy (and local rules & regulations); National Policy of Advancing the Establishment of Green Packaging Standards in Express Delivery Industry	
Comments (from the author)	**Preparedness**
1) Currently no special laws or regulations issued in Beijing except relevant items in Beijing (Shanghai) New Mandatary Waste Sorting Rule; Beijing's Green Packaging Standards for Food Take-out is still in enactment; 2) Not officially mentioning how to regulate street food stalls.	Stakeholders：the city authority 1) Promote the use of alternatives such as cloth bags, paper bags and biodegradable bags; 2) Promote using recycling and reusable containers in delivery and logistic system; 3) Advance the supply of green products with no harmful addictive to human and the environment; 4) Improve waste collection and transportation capability; 5) Improve the efficiency of waste to resources; 6) Accelerating the enactment of laws and regulations to regulate the market players; 7) Strengthen policy support of R&D in green packaging, green logistics, biodegradable alternatives and intelligent collecting facilities; 8) Strengthen the propaganda of reducing disposable plastic usage through newspaper, television and social media platforms such as Weibo (Chinese counterpart of Facebook);
1) No right to require stores settling on the platforms to offer customers green packaging; 2) Lack of publicity, few consumers there exist these plans; 3) Potential greenwashing: small efforts were made after 2017, particularly Ele.me	Stakeholders：the city authority Online food delivery platforms **Ele.me (饿了吗)**: 1) Ele.me rolled out "Blue Earth Plan" in September 2017 to work with high education institutions, environmental organizations, platform stores, packaging suppliers and NGOs for sustainable online food delivery service; 2) Setting up green take-out packaging R&D lab, and rolling out "Edible Tableware" pilot program in Shanghai. 3) Engaging in "Green Logistics 2020 Plan" led by Alibaba Group. **Meituan (美团)**:1) Meituan rolled out "Green Mountain Plan" in August 2017 to reduce take-out plastic packaging pollution; 2) Establishing "Green Take-out League", and issuing Green Take-out Pact; 3) Planning to distribute over 20 million biodegradable bags and one million paper bags in pilot areas; 4) Planning to build food containers collecting system in over 20 provinces nationwide; 5) Inviting Angelababy, a famous Chinese female idol star, to advocate consumers opting out "No need of cutlery" when making orders; 6) Work with multiple NGOs to improve public environmental awareness through propaganda.
1) Using fake biodegradable packaging; 2) Using other alternative materials which may pose threat to food safety.	Stakeholders：businesses Food outlets on online platforms 1) Eco-design packaging; 2) Paper, biodegradable packaging; 3) returnable containers; 4) No solutions provided by street food stalls
1) Be prudent of choosing raw materials used for producing packaging in case of producing more pollution or challenging food security.	**Stakeholders：businesses** **Alternative producers** 1) Paper packaging, biodegradable plastics;
1) There is a potential risk that consumers will mix up biodegradable plastics with food waste as they misunderstand that biodegradable plastics can be degraded under any conditions.	Stakeholders：consumers 1) Reusing plastic bags which are not contaminated from take-out packaging; 2) Recycling plastic bottles for beverage; 3) Reducing plastic usage by asking for less disposable packaging from food stalls and stores, refusing over-packaging; 4) Avoiding the use of disposable plastic packaging by choosing "opt-in" option on food delivery apps, using returnable containers; turning to green alternative packaging; onsite consumption; bringing own containers and so on.

Meituan and Ele.me are the two major O2O food delivery apps in China, with market share of 65% and 33% respectively, as **Figure 12** shows. In early August 2017, two apps were sued by an environmental NGO in China for producing severe "White Pollution" (disposable plastic pollution). As a response, two apps have subsequently

rolled out plans to accelerating the development of green packaging for online food take-out.
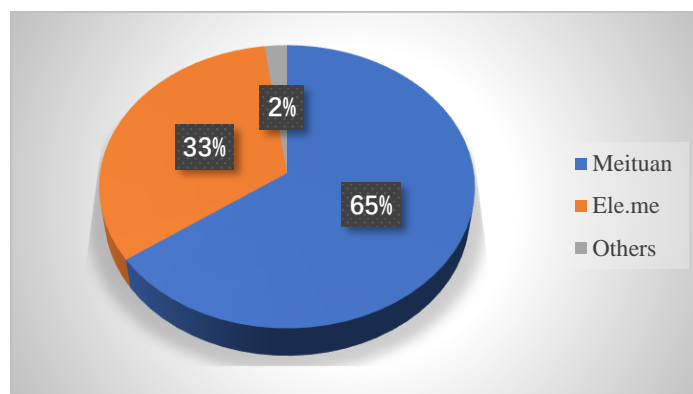
Figure 12 Market Share of O2O Food Delivery Apps in China (Q2 2019)
(Source: Data from *The Food Delivery Market in Great China in 2019 | Daxue Consulting*)

From **Table 2-4&2-5**, it is evident that the "New Plastic Ban" policy is at the initial stage nationwide. Most cities do not have any local rules or regulations currently except some pilot provinces or cities formally implementing "Waste sorting" regulations. Even it is at the starting point, the ambitious goals and determined mind stated by the central government have startled business stakeholders. Relevant industries such as the catering industry, particularly online food delivery platforms and online food outlets, express delivery industry and food packaging producers & suppliers are now trying to work out solutions towards green packaging system. Companies also realize the importance of reducing disposable plastic usage by improving public pro-environment awareness in this regard.

2.6.3 The Latest Progress of Policies

Beijing had issued a citywide action plan called *The Action Plan of Resolving the Plastic Pollution of Beijing 2020-2025* to facilitate the progress of resolving plastic pollution, in which it sets specific goals for the catering industry, express delivery business, wholesale and retail, hotel industry and agricultural sector. Undegradable single-use plastic packaging for online food take-as well as single-use plastic tableware are banned in the urban constructed areas from 1 July, 2021;

By the end of January, 2021, an integrated waste management system with 1,324 of waste-sorting stations, 63,900 of fixed waste collection stations and 3535 of trash trucks was built up. Over 70% of residential waste was appropriately sorted out in January, resulting in a 22.7% of reduction in waste generation for landfill and a recycling ratio of 37.5%.

In 21 April, 2020, Shanghai Landscaping & City Appearance Administrative Bureau issued The Action Plan of Establishing a Citywide Integrated Waste-sorting System

2018-2020. This plan aims to realize waste sorting in all districts and ensure that over 90% of the residential areas meet waste-sorting requirements. By the end of 2020, plastic straws are replaced by paper straws in the milk tea stores in Shanghai.

2.7 Behavioral Theories

There is no standardized definition of the term "behavior". The concept of "behavior" has been given with different definitions within academic research fields. Based on the review of previous studies, the term "behavior" is conceptualized as a person's decision-making process, in which the person's intention, stimulated or influenced by inner psychological conditions or outer environment, will lead to a decision(Silva, 2020). "behavior theory" thereby is a theory used to explain the intention to decision-making process(Silva, 2020).

Behavior theories, originating from psychology study, are widely applied to other disciplines including business economics, social science, computer science, engineering and so on(Silva, 2020). One of the most prevalent applications is in environmental study (Culiberg & Elgaaied-Gambier, 2016; M. S. Kim & Stepchenkova, 2020; Maki et al., 2019). According to Silva(2020), human behaviors are composed of 21 types under two categories, specific or general, in which pro-environmental behavior is belonging to general human behaviors.

The most used behavioral theories in studying pro-environmental or sustainable behaviors are Theory of reasoned action (TRA), Theory of planned behavior (TPB), Nudge theory(NT), Value-Belief-Norm theory (VBN) and other cognitive and learning theories (Ayob et al., 2017; Gupta & Sharma, 2019; Yu Liu et al., 2017; Palupi & Sawitri, 2018; Si et al., 2019). The major constructs of these theories include knowledge, beliefs, values, all kinds of norms, personality, emotions, past experience, attitudes and intentions (Pronello, 2018).

However, none of these theories are perfect. TRA was criticized for unable to predict behaviors because of insufficient constructs. It argues that behavioral intention is decided by two constructs, respectively attitude and subjective norms (Fishbein, 1979). For this concern, TRA was extended into TPB by adding one more construct, perceived behavior control (Icek, 1991). Numerous studies have validated the superiority of TPB over TRA (Hunt & Gross, 200; Aguiar et al., 2015; de Leeuw et al., 2015; Ozkan & Kanat, 2011; Ceglia et al., 2015; Hanss et al., 2016). Even so, there are still loopholes in this theory which are detected by some studies. For this reason, researchers started to incorporate new constructs into TPB to better predict behaviors. Some researchers combine TPB with other theories such as VBN, theory of interpersonal behavior, TRA and so on (Si et al., 2019). It is investigated that the most commonly used new constructs in this regard are situational, cultural factors and habits or past experience

(Liu & Bai, 2014; Ertz et al., 2016). And existing literature proves that by introducing new factors into TPB, the prediction of intentions and behaviors becomes more accurate (Donald et al., 2014; M. J. Kim & Hall, 2019; Kumar, 2017, 2019; Si et al., 2019; Song Lin Wong et al., 2018; Yadav & Pathak, 2017).

Situational factors, as one of the most used constructs appearing in extended TPB has no specific definition. Some studies cluster it with social norms(Yue et al., 2013). Against this backdrop, Ertz et al. (2016) reasons that situational factors can be both objective and subjective. Objective situational factors refers to the external environment or realities (Ertz et al., 2016a), which cannot be changed by human beings. Regulations, policies, media, facilities, weather, occasions, the surroundings, cultures, and product price and properties mentioned above are situational factors(Hong & Park, 2018; Phuphisith et al., 202; Wan et al., 2012; Liao & Fang, 2019; H. T. T. Nguyen et al., 2018). While subjective situational factors are people's perceived opinions toward objective situational factors such as perceived effectiveness of policies or enforcement, perceived wealth, perceived difficulties of recycling and so on (Al Mamun et al., 2018; Bortoleto et al., 2012; Cudjoe et al., 2020; Sinthusiri, 2016; Wan et al., 2012). Obviously, the construct of perceived behavior control covers a part of the subjective situational factors. This research is conducted against COVID-19 pandemic and relevant policies in China. Policies, regulations and special time, as situational factors will impose a change on people's routine intention and behaviors according to previous studies (Hicks et al., 2005; Zhaohua Wang et al., 2016). Thus, this research adopts COVID-19 and relevant policy paradigm which includes "waste sorting" policy and "new plastic ban" policy. The detailed analysis of the situational factors (social norms) for this study is presented in the next section.

Past experience or habits are also being proved to be an influential factor of behavioral intention(Ahmad et al., 2016; Fleming et al., 2017; H. T. T. Nguyen et al., 2018; Amoroso & Lim, 2017). For example, Ahmad et al. (2016) found that the past recycling behavior of college students has a significant impact on their future intention or attitude towards recycling. There are also studies showing that past pro-environmental behavior can generate influences on future recycling behavior (Arias & Trujillo, 2020; Nilsson et al., 2017). The effect that produced by current behaviors or past experience is called "spillover effect" (Maki et al., 2019; Truelove et al., 2014). It is supported by goal theory (Dhar & Simonson, 1999), action-based learning theories (Thøgersen, 1999; Thøgersen and Crompton, 2009, as cited in Thøgersen & Noblet, 2012), and a few other action-oriented learning theories. The existing research falls short in combining strong behavioral theories with past behaviors to study the role of "spillover effect" in people's decision-making process, particularly under certain contexts. Hence, this study aims to fill the gap by incorporating past green behavior into underlying theories employed in this research. More details of the relationship between behavioral intention and past green behaviors are given in "Hypotheses Development" section.

The past two decades witnessed a booming development of theory of planned behavior (TPB). There are three constructs in it that exert impacts on behavioral intention, which are attitude, social norms and perceived behavior control. Consequently, intention, as the mediator of other constructs, imposes the major influence on human behaviors. Nevertheless, intention cannot decide behaviors as there exist other factors such as aforementioned situational factors and past experience which may also impose impacts on behaviors. The uncertainty generated by other factors leads to intention-behavior gap, which is hard to be closed (Caruana et al., 2016; Grimmer & Miles, 2017; Hassan et al., 2016; H. V. Nguyen et al., 2019). Therefore, many studies focus on researching intentions, the major direct driver of behaviors. This study, same as previous researches in this regard, also put its emphasis on investigating behavioral intention. But it does not mean that this research ignores the gap. As there are not many choices provided for consumers in nowadays China regarding replacing disposable food packaging by other green packaging, the study aims to predict the avoiding intention of consumers with the scenario that alternatives are offered in the market. These alternatives are in the preparation progress by the government and business stakeholders in China. Therefore, it is impossible to work out the actual avoiding behaviors in such scenario. To put it simply, this study is to predict the avoiding intention of consumers in a setting scenario. In this context, it adopts TPB, a behavioral theory that being validated for numerous times, as the underlying theory (H. V. Nguyen et al., 2019).

Avoiding intention in this study refers to people's avoiding behavioral intention towards conventional disposable plastic packaging. To motivate people to adopt the behaviors of avoiding the use of conventional disposable packaging for food take-out, alternatives must be provided. Alternatives that can potentially develop in the future to resolve "white pollution" in online food take-out business are biodegradable plastics and returnable containers. However, to ensure two alternatives exert the positive effect in dealing with this plastic crisis, appropriate disposal and treatment must be simultaneously put in place. Currently, most biodegradable plastics can only be degraded under certain industrial conditions, which means they are needed to be sorted and put separately. For returnable containers, they can be shared and reused for many times. Consumers are not required to dispose returnable containers themselves but to return the containers they used for food take-out through collecting facilities. In China, biodegradable plastics are disposed and treated together with the category of "other waste" or "dry waste" under the "waste sorting" system in Beijing and Shanghai. Returnable container programs are still at the initial stage of development. Two alternatives have different attributes and fit into different use occasions. For example, biodegradable plastics are more expensive compared to conventional plastics and returnable container services. While returnable container programs, from some people's perspectives, are more inconvenient in terms of post-consumption disposal. Besides, there are studies have already validated that TPB can reflect respondents' willingness to change their attitudes in order to respond to the circumstances perceived to have

individual pay-back such as willingness to pay (López-Mosquera et al., 2014). Therefore, the avoiding intention in this study is replaced by the willingness to pay more (WTM) for biodegradable plastic packaging and the willingness to participate (WTP) in returnable container programs. The detailed analysis is presented in hypothesis development.

2.8 Hypotheses Development

This section lies its focus on further explaining the constructs of extended TPB and subsequently proposing hypotheses. The online food take-out business is faced by great opportunities as well as challenges in China, since it is undergoing leapfrog development while being bombarded as the culprit of "white pollution". As mentioned in relevant policy paradigm section, the Chinese government is now determined to resolve the plastic crisis. The whole catering industry and supply chain stakeholders also make preparedness in developing alternatives to replace disposable plastics in order to adapt to the stricter domestic policy environment. Nevertheless, it is significant to predict how consumers will react to the alternatives portfolio they offer. Will they accept the new alternatives? Will they prefer one alternative than the other one? Do the pandemic and policy change their mind in consuming single-use plastics? What is the major stimulus that trigger their intention to adopt new alternatives? The following parts answer these questions by making assumptions of the relationships among constructs of extended TPB proposed above.

2.8.1 Psychological Constructs

Avoiding intention

Willingness to pay extra/more (WPM) is evolved from willingness to pay (WTP) (Carfora et al., 2017; Shin et al., 2017; Wei et al., 2018). In the study of green consumption or pre-environmental behaviors, it always relates to consumers' willingness to pay more to green products which serve the same function as conventional products (Sinthusiri, 2016). Consumers' WPM is dependent upon multiple factors such as environmental attitude, values, beliefs, norms and so on (Shin et al., 2017; Sánchez et al., 2018)

Same as WPM, consumers' green purchase intention is also estimated to be influenced by norms, attitudes, environment awareness, willingness to pay and some other factors (Prakash & Pathak, 2017). Although in some studies, WTP/WPM is counted as a factor that will influence purchasing intention (Khoiriyah & Toro, 2018; Zhang et al., 2018), it can also be counted as the counterpart or one dimension of a behavioral intention (Hao et al., 2019).

According to previous studies, the major factors that influence people's willingness to pay for a green product are including but not limited to product quality and prices. One of the reasons that there is no alternative material that can replace plastics for food packaging is that the later features equal or better quality. Therefore, if consumers are willing to pay a premium price for eco-friendly packaging, it means people have the intention to avoid generating single-use plastic packaging waste. WPM thus is served as one equivalent of avoiding intention towards conventional disposable plastic packaging in this study.

Willingness to Participate has been investigated in many studies to estimate the behavioral intention of individuals towards a specific program, such as the willingness to participate in a recycling program (Almazán-Casali et al., 2019; Dwivedy & Mittal, 2013; Tsalis et al., 2018; Hui Wang et al., 2020; Zhen Wang et al., 2020). WTP therefore is the other equivalent of avoiding intention in this study.

Attitude and Awareness

In TPB, attitude is defined as the positive or negative evaluation of performing a specific behavior from individual's view(Ajzen, 1991). It can generate direct influence on intention but not behaviors (Ajzen, 1991). People's attitude towards the environment is used in predicting pro-environment behavioral intentions in many researches (Ertz et al., 2016a, 2016b; M. S. Khan et al., 2020; Yu & Yu, 2017). Most studies validate that pro-environmental attitude can generate positive effect on people's pro-environmental intention or behaviors. For example, Wan et al. (2012) found that Hong Kong college students' recycling behavioral intention is positively related to their environmental attitude. Khan et al. (2020)'s case study in Thailand also proves that consumers' green behaviors are significantly influenced by their attitude and knowledge to the environment. Attitude, according to previous literature, is composed of general and specific attitude(Zhang et al., 2019) Specific attitude, which means attitude towards specific thing or item, is proved to be able to predict intention or behaviors better(Ahmad et al., 2016; Zhang et al., 2019). There are also some studies showing that perceived behavior control, as the construct of TPB, can exert a mediating effect on attitudes and social norms (Lin et al., 2021; H. Liu et al., 2013). In environmental studies, Lin et al. (2021) found that PBC (perceived behavior control) serves as the mediator between attitudes and intentions in regard to responsible behavior towards marine protection. Hence, the study set up hypotheses:

Hypothesis 1a Environmental attitude and awareness positively affect people's WTM for biodegradable packaging and WTP in returnable container program.

Hypothesis 1b Environmental attitude and awareness is mediated by perceived behavior control when influencing WTP and WTP.

Social Norms

Social norms can be defined as the pressure from the society which pushes individuals to conduct certain behaviors (Ajzen and Fishbein, 1980, as cited in Yadav & Pathak, 2017). Subjective norms are individuals' perceptions about significant others, who can impose influences on the agent (Ajzen, 1991; Yadav & Pathak, 2017). Multiple studies also prove that social norms/pressure is an influential factor of people's green/pro-environmental behavioral intention (Culiberg & Elgaaied-Gambier, 2016; Farrow et al., 2017; Yu & Yu, 2017). As mentioned above, situational factors are counted as a part of social norms in some studies. Policies or regulations, as situational factors, play an important role in predicting people's behavioral intention. Studies show that policies can drive people to change their behavioral intentions (Werfel, 2017). Sánchez-Medina et al (2014) estimates the mediation effect of perceived behavior control on social norms towards managers' intention to take environmental measures. Thus, the study hypothesizes:

Hypothesis 2a Social norms positively influence people's WTM for biodegradable packaging and WTP in returnable container program.

Hypothesis 2b Social norms is mediated by perceived behavior control when influencing WTP and WTP.

Perceived Behavioral Control

Perceived behavioral control (PBC) refers to the ease or difficulty of an individual to perform a particular behavior (Ajzen, 1991). It is dependent on control beliefs and perceived power. The former can be regarded as the driver or barrier that individuals perceive will influence they perform certain behaviors (Ajzen, 1991; Yadav & Pathak, 2017). While the later one is the evaluation of individuals towards the above behavior driving or impeding factors (Yadav & Pathak, 2017). Empirical evidences prove that PBC can generate direct influences both on behavioral intention and actual behaviors (Leeuw et al., 2015b, 2015a; Hunt & Gross, 2009; Ajzen, 1991). Based on the above argument, it can be hypothesized that:

Hypothesis 3 Perceived behavior control positively influences people's avoiding intention to disposable plastic packaging.

Past Green Behaviors

There are many studies validating that people who take a small step doing something are prone to doing more difficult things in this regard (Dhar & Simonson, 1999.; Fanghella et al., 2019; Suher & Hoyer, 2020; Tangari et al., 2019). For example, those who do a small thing in protecting the environment may move forward by adopting

more complicated pro-environment behaviors (Arias & Trujillo, 2020; Nilsson et al., 2017; Thøgersen & Noblet, 2012; Thomas et al., 2019; Truelove et al., 2014). According to Thøgersen & Noblet (2012), the adoption of small pro-environmental behaviors in daily life may finally lead to people's acceptance of more complicated and significant behaviors. In this sense, it is meaningful for decision-makers to facilitate people to make small changes in their behavioral modes so that one day leapfrog achievement can be realized. As disposable plastics are everywhere in human life, it is very hard to avoid using them. Reusing, reducing and recycling, however, are easier than avoiding. Hence, in this study, reusing, reducing and recycling are regarded as the initial green behaviors, while avoiding as the spillover behavior. Giantari et al (2013) found that past behavior (experience) can be mediated by perceived behavior control in terms on online purchasing intentions. Therefore, this study proposes:

Hypothesis 4a Past green behaviors positively influence people's WTM for biodegradable packaging and WTP in returnable container program.

Hypothesis 4b Past green behaviors is mediated by perceived behavior control when influencing WTP and WTP.

2.8.2 Hypothesis Framework

Bases on the hypothesis development, a framework can be developed as shown in **Figure 13**. There are two alternatives to replace conventional plastic packaging.
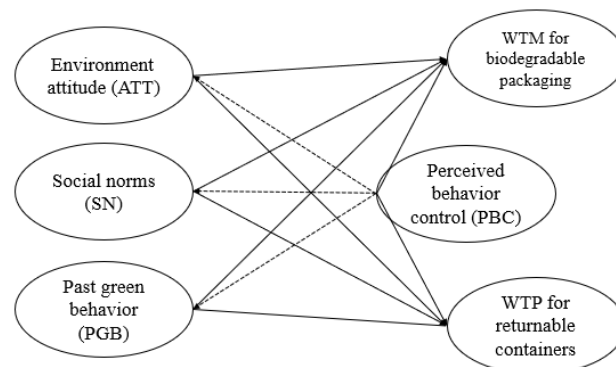
Figure 13 Hypotheses Framework

2.9 Chapter Summary

The literature review firstly elaborates the details of plastic crisis and how COVID-19 worsens the situation. Then it explains some major concepts and terms of the study. It puts emphasis in reviewing current plastic-relevant policies in China, which are "waste sorting" policy and "new plastic ban" policy. The progress of polices in Beijing and Shanghai are presented. It then reviews behavioral theories and identifying theory gaps

in previous study. First, there exist insufficient researches in studying the spillover effect of past green behaviors on avoiding intention with TPB as the underlying theory. Second, situational factors such as regulations and policies are also usually being ignored in previous studies.

Then it argues the appropriateness and benefits of employing TPB in this research. TPB has been validated for numerous times in predicting behavioral intentions and fit into the research purpose of this study, which is to predict intention when actual behaviors patterns haven't been formed maturely. More importantly, it gives a brief introduction of logit model, which will be employed in this study to specifically explore the heterogeneity of people's stated preference towards two alternatives.

Based on the theory gap review, a theoretical framework is proposed, which breaks the research into two parts, comprised of latent variable model and logit model.

The chapter then develops hypotheses to assume the relationship among constructs in proposed latent variables model in the theoretical framework, with a hypothesis framework directly presenting the connections of these constructs. The next Chapter will further illustrate two models and their combination.

CHAPTER 3: METHDOLOGY

3.1 Chapter Overview

The research aims to identify the factors that influence consumers avoiding intention under a specific situational and policy context, based on which correspondent suggestions have been made for decision-makers to take measures so that the new plastic ban policy can be effectively implemented. This part tries to evaluate factors that influence people's avoiding intentions against COVID-19 pandemic and with the new policy about to be implemented by investigating the latent variables using structural equation model (SEM).

3.2 PLS-SEM

Structural equation modeling (SEM) is regarded as the quasi-standard to analyze the cause-effect relationship between latent variables in social science(Joe F. Hair et al., 2011). It was first appeared in 1980 and was widely applied in different researches.

A structural equation model is comprised of structural model and measurement model. The structural model shows the paths between latent variables which are categorized as exogenous and endogenous variables. Exogenous variables, also called independent variables, refer to the latent constructs which have no structural path relationships pointing at them. While endogenous variables are explained by other latent variables, can be regarded as dependent variables. The measurement model reflects the relationships between latent variables and their correspondent observed indicators.

SEM includes Partial least square structural equation modeling (PLS-SEM) and covariance-based structural equation modeling (CD-SEM). The major difference between PLS-SEM and CD-SEM is that the former one aims at maximizing the explained variance of the endogenous latent variables while the later one puts the emphasis on producing a theoretical covariance matrix(Joe F. Hair et al., 2011). Compared to CD-SEM, PLS-SEM was developed later and used less. However, a recent trend witnesses that PLS-SEM, attributing to its advantages, has been increasingly accepted by researchers in business field(Joseph F. Hair, Ringle, et al., 2019; F. Khan et al., 2019; Sarstedt, 2010). PLS-SEM demonstrates superiority in regard of less assumption restrictions, wider range of sample sizes and less distribution requirements.

PLS-SEM is essentially constructed by multiple regressions. (Joseph F. Hair, Risher, et al., 2019) proposes that PLS-SEM can be selected if the study is concerning of estimating an extended theory. It fits well into this study, which develops the established theory by adding more latent constructs. Besides, PLS-SEM performs better results if the structural model features complex path relations and many constructs/indicators (Joseph F. Hair, Risher, et al., 2019). This study has six latent constructs and each construct has multiple indicators, as well as tries to test the

mediation effect between constructs, which suggests that PLS-SEM is suitable in this context.

3.3 Measurement Scale of SEM

The scales are adapted from existing scales in previous literatures. The scale is comprised of the measurements of two alternatives, which are biodegradable packaging and returnable containers (**Table 6)**. Items with "a" are established to measure the psychological constructs of choosing biodegradable packaging, while items with "b" are to measure those constructs of choosing returnable containers. Items without "a" or "b" are set to measure constructs of two alternatives. 5 point-Likert scale is used to measure the items, ranging from "strongly disagree", "disagree", "neither agree nor disagree", "agree" to "strongly agree".

Table 6 Measurement items of Psychological Constructs

Latent Variables	Items	Measurement Scale	Source
Attitude and Awareness	ATT1	"White pollution" is majorly caused by the overuse of disposable plastics in food take-out.	(Pires, 2015)
	ATT2	I am aware that microplastics contamination (mostly from macro-plastics) has already been in human food chain.	(Cudjoe et al., 2020)
	ATT3	I am aware that disposable plastics take at least 200 years to degrade in the natural environment.	(Cudjoe et al., 2020)
Social Norms	SN1	The waste sorting regulation encourages me to use the alternatives to replace conventional disposable packaging for food take-out	(Cudjoe et al., 2020)
	SN2	The new plastic ban policy encourages me to use the alternatives to replace conventional disposable packaging for food take-out.	
	SN3a/b	The media's publicity makes me think about using biodegradable plastic packaging/returnable containers in the future.	(Trivedi et al., 2018)
	SN4a/b	The media's publicity makes me think about using biodegradable plastic packaging/returnable containers in the future.	(C. Chen, 2018)
Perceived behavior control	PBC1a/b	Considering the disposal way, I am confident that if I want to, I can use and dispose biodegradable packaging in an appropriate way/ rent and return returnable containers for food take-out.	(Yadav & Pathak, 2017)
	PBC2a/b	It is easy for me to use and dispose biodegradable packaging/ rent and return returnable containers.	(Al Mamun et al., 2018)
	PBC3a/b	I can pay a premium for biodegradable packaging/ deposit enough money to rent containers.	
	PBC4a/b	I am confident that I have enough time and resources to use and dispose biodegradable packaging/ participate in the returnable container program.	
Past Green behaviors	PGB1	I sort food waste from packaging waste, whenever possible.	(Trivedi et al., 2018)
	PGB2	I reuse non-contaminated plastic bags from food take-out packaging, whenever possible.	
	PGB3	I recycle food take-out packaging whenever possible.	
WTP for biodegradable packaging	WTM1	It is acceptable for me to pay more for biodegradable packaging for food take-out in the future.	(Prakash & Pathak, 2017; Wei et al., 2018)
	WTM2	The probability that I will pay more for biodegradable packaging for food take-out is very high.	(Al Mamun et al., 2018)
	WTM3	I am willing to consider spending more for biodegradable packaging.	(L. Zhang et al., 2019)
WTP for Returnable containers	WTP1	It is acceptable for me to pay a deposit for renting returnable containers for food take-out in the future.	(Prakash & Pathak, 2017; Wei et al., 2018)
	WTP2	I am willing to use returnable containers for food take-out in the future.	(Cudjoe et al., 2020)
	WTP3	The probability that I will participate in a returnable container program for food take-out is very high.	(Al Mamun et al., 2018)

3.4 Basic information

Different alternatives are featured by various attributes. For example, using biodegradable package needs consumers to pay for extra cost, while people who use returnable containers need to pay for the deposit of renting containers and walk for a distance to return them. The attributes of alternatives are given in **Table 7**.

Table 7 Alternative Attributes and Levels

Attributes	Levels
Extra Cost	0 yuan
	1-2 yuan (0.142-0.284$)
	2-3 yuan (0.284-0.416$)
	3-4 yuan (0.416-0.568$)
	More than 4 yuan (0.568$)
Consumption Occasion	Workplace
	Home
	School dormitory
	Outdoor/hotels/tourist attractions
Consumption Time	Less than 1h
	1h-2h
	more than 2h
Walking Time	Less than 100m
	100m-500m
	500m-1000m
	more than 1000m
Deposit	0 yuan
	1 -15 yuan
	16 - 30 yuan
	31-45 yuan
	46-60 yuan
	Above 99 yuan

Socio-demographic characteristics are also being regarded as the basic statistical information in the study, as shown in **Table 8.**

Table 8 Social-demographic Characteristics of Respondents

Socio-demographic Characteristics	Levels
Gender	Male Female
Age	Under 18 18-30 31-45 46-65 Above 65
Education	Primary school Junior high school Senior high school Bachelor Master and the above
Occupation	College Students (including undergraduates and graduates) Students (below college level) Employees (jobs relevant to the EDS) Employees (jobs irrelevant to the EDS) Freelancers Non-workers (retired or unemployed) Others
Income	Below 4000 yuan (439$) 4001-6000 yuan (439-878$) 6001 yuan- 8000 yuan (878-1171$) 8001 yuan- 12000 yuan (1171-1757$) 12001 yuan-18000yuan (1757-2694) Above 18000 yuan (above 2694$)
Location	Beijing Shanghai

3.5 Research design

3.5.1 Study Areas

The research selected Beijing and Shanghai as the study areas since these two cities are the two most representative megacities in China. Beijing is located in Northern China while Shanghai in Southern China **(Figure 14)**. These two cities have officially implemented mandatory "waste sorting" regulations citywide respectively in 2019 and 2020. Beijing occupies $16410.54 km^2$, with a population of over 21.5 million residents. Shanghai has $6340.5 km^2$ while with topping 24.3 million people. With millions of white collars and college students, two cities all feature blooming online food take-out

business. It is worth noting that two cities represent the divergence of the lifestyle and eating habits of Northern and Southern China. Therefore, there is a possibility that the factors that motivate people to choose alternatives of conventional plastic packaging are different.
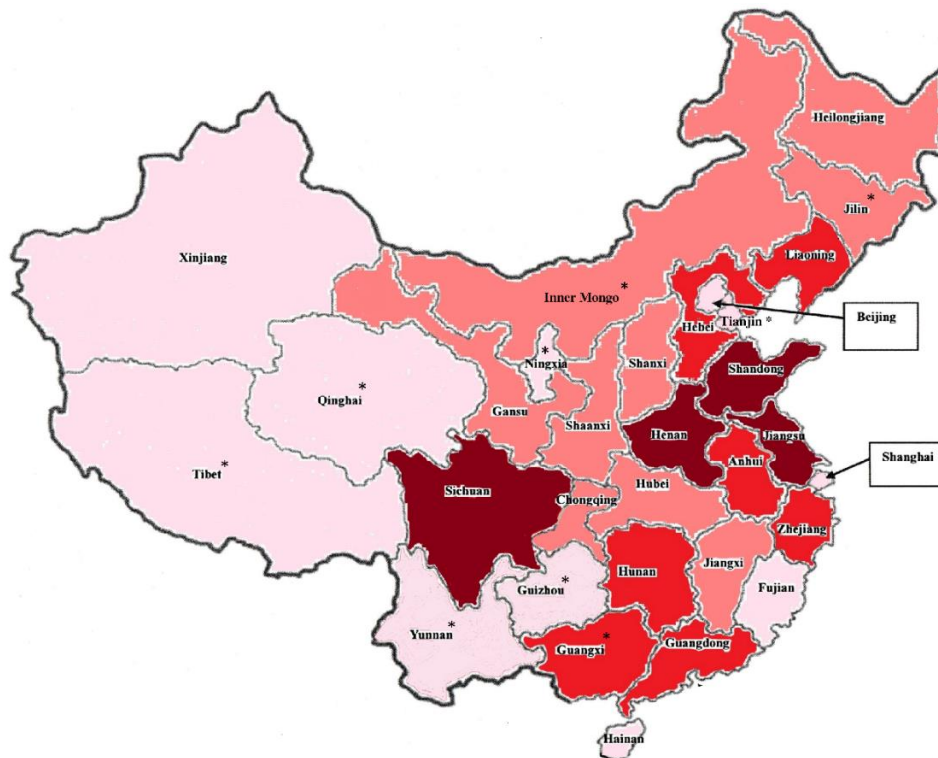
Figure 14 The Geographic Location of Beijing and Shanghai (source: Wu et al., 2013)

3.5.2 Sampling and Data Collection

This study established a SEM model which contains confirmatory factor analysis (CFA) and path analysis. CFA adopting different statistical methods needs different sample size. The most stringent one is to apply MLR for missing data, which needs more than 400 samples for each city. Cochran's Sample Size Formula (Ahmad & Halim, 2017) is the most widely acknowledged and common method to calculate sample size. In this research, the minimum number of respondents under 95% confidence level for study areas (two cities) is 400 in total. As two cities have almost the same size of population, the least sample size of two cities are the same, which are 200 for each. Detailed sample size calculation methods have been summarized in **Table 9.**

In summary, to fulfill all the requirements of a SEM model and ensure high confidence level, totally 400 valid samples are being set as the target sample size of this research.

Table 9 Sample Size calculation

Sample Size Calculation				
Method	**Formula and Sources**	**Standard**	**Beijing**	**Shanghai**
Cochran's Sample Size Formula	$N_0 = \frac{pqZ^2}{e^2}$ e is the margin of error or precision; p is the estimated proportion of the people who have the attribute in question; q=1-p z value can be found in the Z table with specified confidence level	Mainly dependent on the population of study areas	minimum 400 in total	
Sample size for factor analysis (CFA)	(Mundfrom et al., 2005)	variables-to-factors ratio (around 6 for this research) and communality level	from 200 to 260 for each city	
	a. (Anderson & Gerbing, 1984) b. (Jackson, 2001) c. (Tanaka, 1987) c,d (BENTLER & CHOU, 1987)	ML (Maximum Likelihood) with multivariate normal data	For each city: a.>100 b.>200-400 c. 5:1 ratio of cases to free parameters d. 10:1 ratio of cases to free parameters	
	(Hu & Bentler, 1999);	MLM for nonnormal continuous variables (ML with robust standard errors and Satorra-Bentler scaled chi-square)	For each city: >250	
	(Nevitt & Hancock, 2001)	Bootstrap for nonnormal continuous variables	For each city: >200-1000	
	(Creedon et al., 2015) (Tofighi & MacKinnon, 2016)	Bootstrap tests of indirect effects	For each city: 50-500	
	(Savalei & Bentler, 2005) (Yuan & Bentler, 2000)	MLR for continuous nonnormal missing data (robust ML)	For each city: >400	
	(Bandalos, 2014)	Robust DWLS for with binary or ordinal variables (WLSMV in Mplus and lavaan)	For each city: >200-500	
	(Bandalos, 2014)	Robust ML for binary and ordinal variables (MLR with categorical designation in Mplus)	For each city: >50-500	

The study only collected primary data from consumers through online questionnaire survey. A pre-test was conducted before the questionnaire is formally distributed in order to adjust the measurement items. The questionnaire questions are attached in **Appendix.**

3.5.3 Data Analysis Design

The research contains mainly quantitative analysis methods. For quantitative analysis, it focused on building a SEM. Before establishing this model, descriptive analysis was conducted to explore the relationship between the stated choice preference and socio-demographic variables, and some of the alternative attributes. Then SEM was be constructed to test the relationship between extended TPB constructs and avoiding

intention (willingness to pay more and willingness to participate).

Based on the argument, an analysis flowchart **(Figure 15)** can be drawn as following.
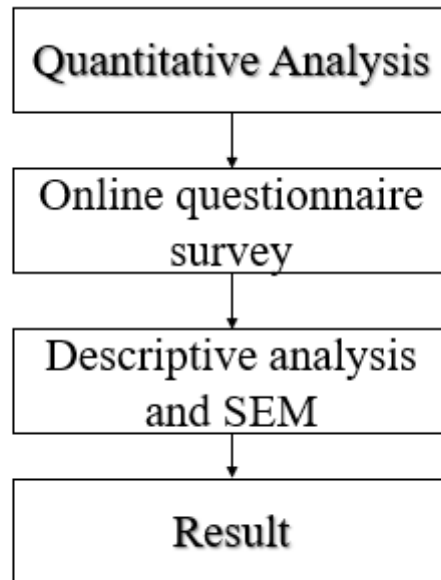
Figure 15 Data Analysis flowchart

3.6 Chapter Summary

This chapter gives a brief overview of how it constructs. Then it elaborates the approach used in this study, which is SEM model. To establish such a model, a measurement scales are adapted from previous studies. For other basic statistical information, the study includes socio-demographic and alternative attributes characteristics. When it comes to the details of research design, sampling, data collection method and data analysis design are elaborated in details. Quantitative methods were adopted for data collection and data analysis. For data collection, web-based questionnaire survey was being conducted for primary data. Data analysis is comprised of statistical analysis such as descriptive analysis and structural equation model.

CHAPTER 4: DATA ANALYSIS

An anonymous questionnaire (see Appendix) was distributed through both online platforms including data collection websites and social media platforms. Most of the questionnaires were distributed via a professional data collection website, credamo.com,

where respondents would be paid for filling questionnaires. The questionnaire is comprised two scales, which respectively estimate the psychological constructs related to "biodegradable packaging" and "returnable containers".

4.1 Descriptive analysis

536 questionnaires were received in February 2021, which ends up with 430 valid samples for further analysis in March 2021. The basic socio-demographic characteristics are presented in **Table 10**. More female (71.5%) was engaging in this survey. There are respectively half of the respondents come from Beijing and Shanghai, which have almost the same population. The ages of respondents mainly cluster in the range of 18-30 (69.2%). Most of them (around 90%) have accepted high education (bachelor or above) and work in private companies (25.7%) or still pursue their education (36.9%). The proportions of different monthly income groups, ranging from below 5,000RMB to above 20,000RMB, are around 10-25%. Existing data shows that the group of consumers who ordered the most from online are aging from 18 to 30 (58.6%) and most of them are female (51.1%) in 2019 (*Daxue Consulting*, 2019).

Table 10: Socio-demographic characteristics of respondents (N=430).

Variable	Item	Frequency	Percentage
Gender	Male	124	28.5%
	Female	306	71.5%
Location	Beijing	215	50%

	Shanghai	215	50%
Age group	below 18	4	1%
	18-30	297	69.2%
	31-45	121	28%
	46-65	8	1.8%
	above 65	0	0%
Education	Primary school and below	0	0%
	middle schools	14	3.27%
	professional schools	41	9.58%
	Bachelor or equivalent	248	57.71%
	Master and the above	127	29.44%
Occupation/company	Students	158	36.9%
	Civil servant	7	1.6%
	SOEs	67	15.7%
	Private company	111	25.7%
	Foreign company	26	6.1%
	Public organizations	43	10%
	Freelancers	11	2.34%
	Non-workers (retired or unemployed)	7	1.63%
Monthly income	below 5000RMB	55	12.85%
	5000-8000RMB	85	19.63%
	8000-12000RMB	106	25.75%
	12000-15000RMB	68	24.53%
	15000-20000RMB	48	11.21%
	above 20000RMB	68	15.89%

Table 11&12 present the proportion distribution of answers to different questions (biodegradable packaging & returnable container). Two scales contain the same questions to measure the psychological constructs of attitude and past green behavior. For the latent variable of "attitude", there are respectively more than 86%, 57% and 81% of the respondents agree that "white pollution" is majorly caused by the overuse of disposable plastics in food take-out, microplastics contamination has already been in human food chain and disposable plastics will take at least 200 years to degrade in the natural environment. For the latent variable of "past green behavior", respectively over 80%, 79% and 55% of the respondents will sort food waste from packaging, will reuse non-contaminated plastic packaging and recycle food take-out packaging.

Compared to returnable containers, respondents show higher agreement in regard of the effect of "social norms" and "perceived behavior control" on their willingness to pay a premium for biodegradable packaging. Over 85% of the respondents agree that social norms such as policies, medias and social networks can influence their intention of choosing biodegradable packaging. While, there are less than 70% of the respondents on average agree that social norms can positively influence their choice towards using returnable containers. The proportions of those who agree that using biodegradable packaging is easy are around 70%-80% on average, higher than the proportions of returnable containers, which are in the range of 39%-75%. It is worth noting that

compared to biodegradable packaging, respondents think that it will be more inconvenient and difficult to use returnable containers.

In regard of willingness to pay more or willingness to participate, respondents show lower agreement level. 59%-70% of the participants are willing to pay more for using biodegradable packaging, while only 40%-49% of those are willing to participate in returnable container programs.

Table 11: The proportion distribution of answers to questions (biodegradable packaging)

Indicator (biodegradable packaging)	Strongly disagree	disagree	not sure	agree	Strongly agree

		Strongly disagree	disagree	not sure	agree	Strongly agree
A1 "White pollution" is majorly caused by the overuse of disposable plastics in food take-out.	Number	2	12	47	252	117
	Proportion	0.5%	2.8%	10.9%	58.6%	27.2%
A2 I am aware that microplastics contamination (mostly from macro-plastics) has already been in human food chain.	Number	6	21	161	182	60
	Proportion	1.4%	4.9%	37.4%	42.3%	14.0%
A3 I am aware that disposable plastics take at least 200 years to degrade in the natural environment.	Number	0	1	78	228	123
	Proportion	0.0%	0.2%	18.1%	53.0%	28.6%
B2 The new plastic ban policy encourages me to use the alternatives to replace conventional disposable packaging for food take-out.	Number	2	10	33	292	93
	Proportion	0.5%	2.3%	7.7%	67.9%	21.6%
B3 The media's publicity makes me think about using biodegradable plastic packaging in the future.	Number	2	15	41	283	89
	Proportion	0.5%	3.5%	9.5%	65.8%	20.7%
B4 If my family or friends use biodegradable packaging for food take-out, I will try them.	Number	0	4	11	261	154
	Proportion	0.0%	0.9%	2.6%	60.7%	35.8%
C5 Considering the disposal way, I am confident that if I want to, I can use and dispose biodegradable packaging in an appropriate way.	Number	2	15	40	237	136
	Proportion	0.5%	3.5%	9.3%	55.1%	31.6%
C6 It is easy for me to use and dispose biodegradable packaging.	Number	1	30	61	240	98
	Proportion	0.2%	7.0%	14.2%	55.8%	22.8%
C8 I am confident that I have enough time and resources to use and dispose biodegradable packaging.	Number	10	33	78	219	90
	Proportion	2.3%	7.7%	18.1%	50.9%	20.9%
D1 It is acceptable for me to pay more for biodegradable packaging for food take-out in the future.	Number	6	59	82	229	54
	Proportion	1.4%	13.7%	19.1%	53.3%	12.6%
D2 The probability that I will pay more for biodegradable packaging for food take-out is very high.	Number	7	83	82	196	62
	Proportion	1.6%	19.3%	19.1%	45.6%	14.4%
D3 I am willing to consider spending more for biodegradable packaging.	Number	9	80	84	198	59
	Proportion	2.1%	18.6%	19.5%	46.0%	13.7%
E2 I sort food waste from packaging waste, whenever possible.	Number	6	35	43	211	135
	Proportion	1.4%	8.1%	10.0%	49.1%	31.4%
E3 I reuse non-contaminated plastic bags from food take-out packaging, whenever possible.	Number	9	39	42	222	118
	Proportion	2.1%	9.1%	9.8%	51.6%	27.4%
E4 I recycle food take-out packaging whenever possible.	Number	15	90	86	185	54
	Proportion	3.5%	20.9%	20.0%	43.0%	12.6%

Table 12: The proportion distribution of answers to questions (returnable container)

Indicator (returnable container)		Strongly disagree	disagree	not sure	agree	Strongly agree
A1 "White pollution" is majorly caused	Number	2	12	47	252	117

by the overuse of disposable plastics in food take-out.	Proportion	0.5%	2.8%	10.9%	58.6%	27.2%
A2 I am aware that microplastics contamination (mostly from macro-plastics) has already been in human food chain.	Number	6	21	161	182	60
	Proportion	1.4%	4.9%	37.4%	42.3%	14.0%
A3 I am aware that disposable plastics take at least 200 years to degrade in the natural environment.	Number	0	1	78	228	123
	Proportion	0.0%	0.2%	18.1%	53.0%	28.6%
B1 The waste sorting regulation encourages me to use the alternatives to replace conventional disposable packaging for food take-out.	Number	7	66	64	236	57
	Proportion	1.6%	15.3%	14.9%	54.9%	13.3%
B5.The media's publicity makes me think about using returnable containers in the future.	Number	7	47	83	238	55
	Proportion	1.6%	10.9%	19.3%	55.3%	12.8%
B6 If my family or friends use returnable containers for food take-out, I will try them.	Number	12	46	61	229	82
	Proportion	2.8%	10.7%	14.2%	53.3%	19.1%
C1 Considering the disposal way given above, I am confident that if I want to, I can rent and return returnable containers for food take-out.	Number	32	82	74	180	62
	Proportion	7.4%	19.1%	17.2%	41.9%	14.4%
C2 It is easy for me to rent and return returnable containers.	Number	33	130	93	128	46
	Proportion	7.7%	30.2%	21.6%	29.8%	10.7%
C3 I am capable of depositing enough money to rent containers.	Number	11	50	50	237	82
	Proportion	2.6%	11.6%	11.6%	55.1%	19.1%
C4 I am confident that I have enough time and resources to participate in the returnable container program.	Number	39	114	109	134	34
	Proportion	9.1%	26.5%	25.3%	31.2%	7.9%
D4 It is acceptable for me to pay a deposit for renting returnable containers for food take-out in the future.	Number	25	93	101	188	23
	Proportion	5.8%	21.6%	23.5%	43.7%	5.3%
D5 I am willing to use returnable containers for food take-out in the future.	Number	37	115	101	148	29
	Proportion	8.6%	26.7%	23.5%	34.4%	6.7%
D6 The probability that I will participate in a returnable container program for food take-out is very high.	Number	38	130	87	143	32
	Proportion	8.8%	30.2%	20.2%	33.3%	7.4%
E2 I sort food waste from packaging waste, whenever possible.	Number	6	35	43	211	135
	Proportion	1.4%	8.1%	10.0%	49.1%	31.4%
E3 I reuse non-contaminated plastic bags from food take-out packaging, whenever possible.	Number	9	39	42	222	118
	Proportion	2.1%	9.1%	9.8%	51.6%	27.4%
E4 I recycle food take-out packaging whenever possible.	Number	15	90	86	185	54
	Proportion	3.5%	20.9%	20.0%	43.0%	12.6%

Table 12 shows the proportions of respondents in regard of willingness to pay more for biodegradable packaging and the willingness to participate in returnable containers program. Respectively around 40% and 50% of the respondents only can accept walking for less than 100 meters and 100-500 meters to return the containers. Less than

15% of the consumers would like to walk more than 500 meters to return the containers. Regarding the deposit that respondents would like to pay, approaching 75% of the respondents are willing to pay less than 30RMB of deposit, the rest would like to pay more than 30RMB of deposit. The willingness to pay more for the fee of using biodegradable packaging shows the same trend.

Table 12: Proportions of WTM and WTP (N=430)

How far you are willing to walk for returning the containers?	
Less than 100m	39.53%
100-500m	47.67%
500-1,000m	11.16%
more than 1,000m	1.63%
How much are you willing to pay for the deposit for renting the containers?	
1-15RMB	45.58%
16-30RMB	28.60%
31-45RMB	13.26%
46-60RMB	9.53%
More than 99RMB	3.02%
How much are you willing to pay for the fee of using biodegradable packaging?	
1-2RMB	45.12%
2-3RMB	32.79%
3-4RMB	14.42%
4-5RMB	6.28%
More than 5RMB	1.40%

4.2 Measurement Model

4.2.1 Reliability and Validity

The study used Partial Least Squares Structural Equation Modelling (PLS-SEM). The model is able to address a broad range of problems with less restrictive assumptions. The reliability and validity of the measurement model are tested using SmartPLS (v. 3.2.9), with the result shown in **Table 13.** Composite reliability (CR) shows higher superiority when it comes to assessing reliability (Hair et al., 2014). If CR value is more than 0.7, it can be concluded that the internal consistency of the scale is reliable. As shown in Table 3, CR of the latent variables of both biodegradable packaging and returnable containers are bigger than 0.7, showing adequate reliability. According to Fornell and Larcker (1981), the AVE needs to be greater than 0.5 to ensure sufficient convergent validity. As shown below, for biodegradable packaging, all the variables can meet the requirement, which means the convergent validity of the measurement is adequate. For returnable containers, the AVE of almost all constructs is more than 0.5, meaning that the convergent validity is adequate. The discriminate validity is assessed based on Fornell-Larcker criterion, which requires that the square root of AVE is bigger than inter-correlations. Based on SmartPLS's result, all the square root of AVE of all

constructs in two models are bigger than inter-correlations, meaning that the discriminant validity of the measurement scale is adequate.

Table 13: Model assessment

| Criterion | Biodegradable packaging | | Returnable container | |
	Estimated model	Result	Estimated model	Result
Internal consistency reliability (Henseler et al., 2016; Fornell & Larcker, 1981)				
Composite reliability>0.7	ATT 0.777	adequate	0.723	adequate
	PBC 0.879		0.889	
	PGB 0.795		0.794	
	SN 0.755		0.83	
	WTM 0.922		0.947	
Convergent validity (Henseler et al., 2016; Fornell & Larcker, 1981)				
AVE>0.5	ATT 0.538	adequate	0.487	adequate
	PBC 0.708		0.671	
	PGB 0.565		0.569	
	SN 0.507		0.623	
	WTM 0.798		0.857	
Discriminant validity (Fornell & Larcker, 1981)				
Fornell-Larcker criterion	Inter-correlations < the square root of AVE	adequate	Inter-correlations < the square root of AVE	adequate

4.3 Structural model

4.3.1 Model Fit

Fit indices of the estimated model are comprised of SRMR, d_ULS, d_G. The criterion of SRMR, d_ULS and d_G are respectively <0.08, 0.95 and 0.95. The indices of both models, shown in Table 3, which are SRMR=0.081 ($\approx$ 0.08), d_ULS=0.784 (<0.95), d_G=0.25 (<0.95) for biodegradable packaging, and SRMR=0.066 (<0.08), d_ULS=0.585 (<0.95), d_G=0.212 (<0.95) for returnable container. They are indicating reliable and adequate fit.

4.3.2 Hypotheses testing

A structural model was built via the bootstrapping procedure in SmartPLS, with a

subsample size of 5,000. The endogenous variables' R2 values in **Table 14** demonstrate that the estimated model of biodegradable packaging can explain 20.4% and 21.1% of perceived behavior control (PBC) and willingness to pay more (WTM), and that the model of returnable containers can explain 16.8% and 55.5% of PBC and willingness to participate (WTP). According Hair et al (2019), R2 shows the model's predictive power. The predictive power estimated constructs are acceptable based on Table 3's result. The path analysis results of biodegradable packaging and returnable containers are presented in **Figure 16&17**.

For biodegradable packaging:

Hypothesis 1a (PC=0.08, p-value=0.199>0.1) and hypothesis 2a (PC=0.19, p-value=0.19>0.1) are not supported. It suggests that environmental attitude and social norms have no direct positive effect on consumers' willingness to pay more for biodegradable packaging. Hypothesis 3 (PC=0.455, p-value <0.01) and hypotheses 4a (PC=-0.014, p-value <0.01) are supported, proving that perceived behavior control (PBC) and past green behavior (PGB) have positive influences on consumers' willingness to pay more (WTM).

Hypothesis 1b (PC=0.115, p-value <0.05), 2b (PC=0.19, p-value <0.01) and 4b (PC=0.310, p-value <0.01) concern about the mediation effects between two constructs, which are all supported. It means that PBC can mediate the effect between ATT, SN, PGB and WTM. As H1a and H2a are not supported, which suggest that there exists a complete mediation effect of PBC on the path of ATT, SN and WTM.

For returnable containers:

Hypothesis 1a (PC=0.017, p-value=0.670>0.1) and hypothesis 4a (PC=0.016, p-value=0.695>0.1) are not supported. It suggests that environmental attitude and past green behavior have no direct positive effect on consumers' willingness to participate in returnable container's programs. Hypothesis 3 (PC=0.666, p-value <0.01) and hypotheses 2a (PC=0.016, p-value <0.01) are supported, proving that perceived behavior control (PBC) and social norms (SN) have positive influences on consumers' willingness to participate (WTP).

Hypothesis 1b (PC=0.098, p-value <0.05), 2b (PC=0.340, p-value <0.01) and 4b (PC=0.091, p-value <0.1) reflect the mediation effects between two constructs, which are all supported. It means that PBC can mediate the effect between ATT, SN, PGB and WTP. As in this model, H1a and H4a are not supported, which suggest that there exists a complete mediation effect of PBC on the path of ATT, PGB and WTP.

Table 14**:** Hypotheses test

Hypotheses	Path	Biodegradable packaging		
		Returnable containers		
		Path coefficient	p	Test result
hypothesis 1a	ATT-WTM/WTP	0.08	0.119	not supported
		0.017	0.67	not supported
hypothesis 1b	ATT-PBC	0.115	0.021	supported
		0.098	0.034	supported
hypothesis 2a	SN-WTM/WTP	-0.065	0.247	not supported
		0.151	0	supported
hypothesis 2b	SN-PBC	0.19	0	supported
		0.34	0	supported
hypothesis 3	PBC-WTM/WTP	0.455	0	supported
		0.666	0	supported
hypothesis 4a	PGB-WTM/WTP	-0.014	0	not supported
		0.016	0.695	not supported
hypothesis 4b	PGB-PBC	0.32	0	supported
		0.091	0.075	supported

$p < 0.01^{***}$; $p < 0.05^{**}$; $p < 0.1^{*}$.
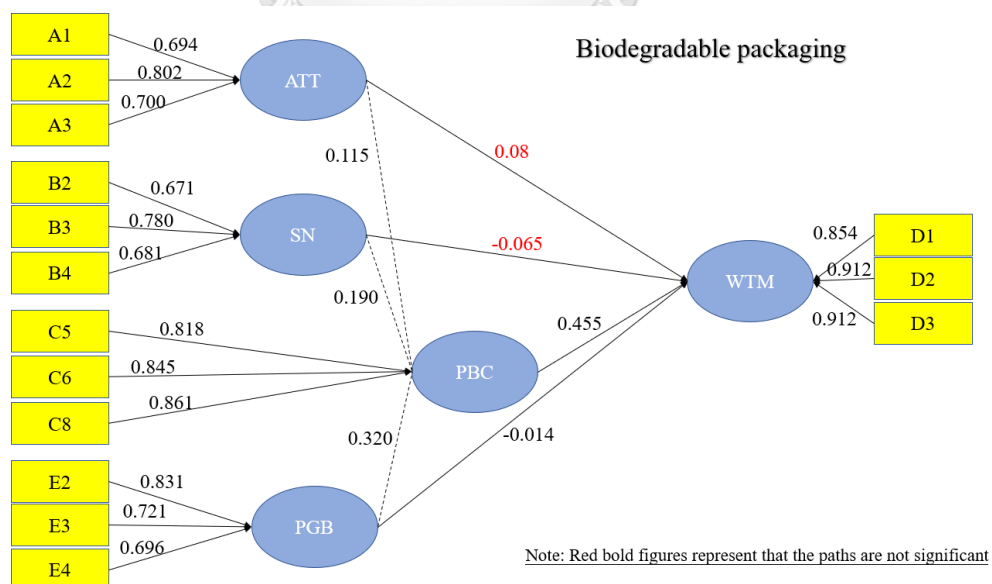
Figure 16 Path analysis result of biodegradable packaging
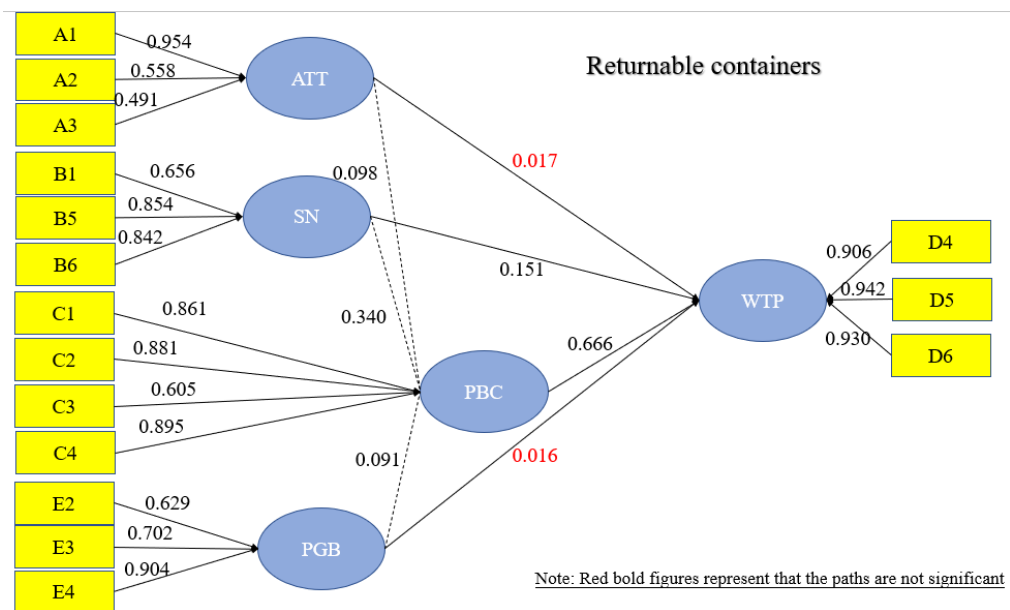
Figure 17 Path analysis result of returnable containers

4.3.3 The moderating effect of socio-economic variables

It has been found in previous studies that socio-economic variables can serve as the moderators among exogenous and endogenous variables (Hsu et al., 2015). This study thus picks "location", "age", "gender", "income", "education" and "occupation" as the variables to assess if there exists mediating effect between ATT, PBC, PGB, SN and WTM or WTP. The results are shown in **Table 15**. It has been estimated that the model fit of all models which exist moderation effect is adequate. It is obvious that the variable of "location" can moderate the relationship between PBC and WTM&WTP, "Gender" can moderate the relationship between SN and WTP, "Occupation" can moderate the relationship groups of ATT-WTM as well as SN-WTP, while "Income" can moderate SN-WTP and PGB-WTM. It means that some socio-economic variables such as location, gender, occupation and income can generate an moderating effect on the path of independent variables to dependent variables (WTM&WTP).

Table 15: Moderating effect assessment

| Moderator | Path | Biodegradable packaging | | |
| | | Returnable containers | | |
		Path coefficient	p	Test result
Location	ATT-WTM	-	not significant	-
	ATT-WTP	-	not significant	-
	PBC-WTM	-0.127	0.004	supported
	PBC-WTP	-0.099	0.002	supported
	PGB-WTM	-	not significant	-
	PGB-WTP	0.017	0.042	supported
Gender	SN-WTM	-	not significant	-
	SN-WTP	0.086	0.003	supported
Occupation	ATT-WTM	0.089	0.05	supported
	ATT-WTP	-	not significant	-
	SN-WTM	-	not significant	-
	SN-WTP	0.069	0.043	supported
Income	SN-WTM	-	not significant	-
	SN-WTP	0.003	0.089	supported
	PGB-WTM	-0.096	0.021	supported
	PGB-WTP	-	not significant	-

$p < 0.01^{***}$; $p < 0.05^{**}$; $p < 0.1^{*}$.

CHAPTER 5: DISCUSSION

5.1 General discussion

The study seeks to examine consumers' intention of replacing conventional plastic packaging with green alternatives. Applying the theory of planned behavior (TPB), the study examines the relationships between the environmental attitude (ATT), social norms (SN), perceived behavior control (PBC), past green behavior (PGB) and willingness to pay more (WTM) or willingness to participate (WTP).

The result shows that ATT, SN and PGB cannot directly affect consumers' adopting intentions towards biodegradable packaging and returnable containers. However, PBC can serve as the mediator between ATT, SN, PGB and WTM or WTP, which is consistent with previous research findings (Giantari et al., 2013; Lin et al., 2021; Sánchez-Medina et al., 2014). It is probably because that people are not familiar with new alternatives due to its limit of use. In this case, even though they are concerning about the environmental problems caused by single-use plastics and are positively influenced by their social networks when it comes to adopting new alternatives, they show hesitation for the lack of knowledge and experience of using biodegradable packaging and returnable containers (PBC). Nevertheless, in the case of biodegradable packaging, PBC and PGB show direct positive effects on consumers' WTM for new packaging choice. In regard of returnable containers, SN and PBC can directly and positively influence consumers' WTP in a returnable program.

The hypothesis testing result shows that social norms including social media, policies & regulations and social networks has a positive effect on consumers' willingness to participate in returnable container program. The result is in line with the previous work which validated that social media such as TV documentaries related to throwaway plastic pollution can significantly improve consumers' willingness to participate in the reusable coffee cup scheme (Sandhu et al., 2021).

The path coefficient from past green behavior to willingness to pay more for biodegradable packaging is negative, -0.014. The reason maybe boils down to the fact that the PGB regarding to disposable plastic packaging are overlapped with the requirements from using and disposing biodegradable packaging. Therefore, respondents probably feel that there is no need to pay a premium for using biodegradable packaging now that they already conducted similar green behaviors such as waste separation, reuse and recycle in terms of using conventional plastic packaging. In this case, people who are prone to using and disposing single-use plastic packaging show a negative WTM for using biodegradable packaging. The mediation effect of PBC on the path from PGB and WTM is positive, meaning that PGB can positively influence WTM if it is mediated by PBC. The major barriers the impede consumers from adopting biodegradable packaging are the extra fee and time that they spend on using it. Therefore, if they think these barriers can be overcome, there is a possibility that they are willing to pay more for using it.

The study also finds that the mediating effect is exerted from some socio-economic variables such as location, gender, income, education and occupation on the relationships between psychological constructs such as ATT, SN, PGB, PBC and dependent latent variables such as WTP and WTM. It means that consumers with different socio-economic characteristics probably hold different opinions regarding ATT, SN, PGB and PBC, which as a result influences their effects on WTP&WTM.

With the facilitation of waste sorting campaigns and more stringent roll-out of new plastic policies, both the government and catering industries need to work out a green route to smoothly transform consumers' the current consumption of using single-use plastics. The study is pioneering in estimating whether the potential solutions are possible to be conducted in the future and what are the enablers & barriers of achieving the assumed green scenario. The detailed policy contributions of this study will be elaborated following.

5.2 Policy implications

As mentioned above, the study is a pioneer in regarding of investigating the psychological influential factors on consumers' willingness to adopt green alternatives under China's policy contexts.

The findings generate some policy implications which provide suggestions for developing green alternatives to phase out conventional disposable packaging. In waste sorting policies, both the national and local government roll out concrete measures in phasing out single-use plastics. However, little effort has been made to develop green alternatives and to investigate the enablers and barriers of consumers' adopting intentions towards green alternatives.

To promote the use of green alternatives, the government should make efforts in improving consumers' perceived behavior control (PBC). The result demonstrates that PBC can not only exert direct effects on consumers' intentions of adopting alternatives (WTM and WTP) but also mediate the relationships between their environmental attitude (ATT), social norms (SN) and the adopting intentions (WTM and WTP). Regarding PBC, consumers' major concern lies in the accessibility, difficulty, time and resources of renting returnable containers and disposing biodegradable packaging, as validated in previous studies (Ertz et al., 2017; Khan et al., 2019; Liao et al., 2018). The government should support the expansion of returnable containers programs by providing more policy or monetary incentives, in order to cut down the time, money and other resources that consumers spend on renting and using the containers (Nguyen et al., 2018). For example, Hainan province has rolled out some regulatory measures to support the development of green alternatives such biodegradable packaging and returnable containers by offering tax reduction. Apart from it, cheaper and more durable biodegradable packaging should be provided to consumers to replace conventional ones, which has been proven to be the major concern for most consumers (Ivanković et al., 2017). It is reported that there is a lack of waste recycling facilities in some neighborhoods in Beijing and Shanghai. Therefore, placing more garbage bins to recycle used biodegradable packaging is also important (Cudjoe et al., 2020).

As discussed above, SN can positively influence consumers' willingness to participate in the returnable container programs. In this regard, the government should also promote returnable container programs by educating the public, particularly the youngsters, through plastic pollution-related documentaries. For example, the authorities responsible for education should incorporate popularizing the knowledge regarding to plastic pollution into the education plan. Previous literatures have found that social media can generate impacts on consumers' purchase intention and motivation such as altruism and egoism (Tu et al., 2021). The findings are relevant for marketers to implement better communication strategies on social media to increase consumers' motivations and adopting intention toward green alternatives. For example, advertisements regarding the use of returnable containers can be posted on the most popular social media platforms such as WeChat and Weibo or offline posters on campuses. WeChat and Weibo have been validated that have strong promotion effectiveness.

Although the results show that attitude, social norms and past green behavior have little direct positive relationship with consumers' adopting intention in general, there is every need to strengthen the promotion of green alternatives and the policies, and encourage people to take more green actions. It is because ATT, SN and PGB could facilitate the adopting intentions once the problems of PBC, which make people concerned such as lack of enough waste or container collection facilities, are well resolved.

Promotions to replace conventional packaging with green alternatives should be focused on targeted groups. As youngsters and female comprise the major groups of using online food delivery packing, the promotion campaigns should be mainly focused on the above two groups. It has been proven in previous studies that the practicality such as the reusability, convenience and durability could be the major barrier that impede the adoption of green alternatives (Hao et al., 2019).Therefore, more investments should be poured in facilitating technological innovation to improve the properties of green alternatives so that it can meet the requirement of practicality from consumers. As there is more than half of the consumers would like to pay a premium for over 2RMB for using biodegradable packaging, the manufacturers should not worry too much about the unsalable problems induced by the price increase.

5.3 Limitations

The study has several limitations regarding sample structure, innovative result interpretation validation and research scope & research content.

Firstly, the samples are inappropriately distributed among different groups of people, as the respondents are majorly comprised of the young (18-30: 69.2%), female (71.5%), students (36.9%) and people (87%) with relative high education (bachelor or above). That being said, there is data presented above shows that the major consumers of food takeaway business are comprised of the young and the female. Also, the result shows that reliability (Composite reliability>0.7) of the scale is adequate. Previous literatures conducted in China also use the sample that dominated by a certain age group in the environmental studies. For example, in a case study of consumers' willingness to pay

more for safe vegetables, the main respondents are the young to middle-aged people with high education(Zhang et al., 2018). Therefore, this limitation is arguable.

Secondly, it also has some limitations in regard of validating the interpretation of complete mediation effect of PBC on ATT, SN, PGB and WTM/WTP from previous literature. In the future research, more work thus should be put on investigating the complete and partial mediation effect of PBC on the paths of ATT, SN, PGB and WTM/WTP, particularly in the environmental studies.

Thirdly, it only investigates the psychological factors that could generate negative or positive impacts on people's adopting intention of green alternatives. Other factors such as socio-economic characteristics were also being investigated and found having influence consumers' willingness to pay more of biodegradable packaging or willingness to participate in returnable container programs. However, how and to what extent that these socio-economic factors influence the relationships between psychological variables are still not clear. For example, are consumers with higher education are more prone to have the positive attitude and thus generate a positive influence on their willingness to pay more or willingness to participate?

Also, it should include a research aiming to investigate the barriers of developing green alternative from the viewpoints of other involved stakeholders such as the suppliers of biodegradable raw materials, manufactures as well as industries in processing and degrading biodegradable plastics, and companies in providing returnable containers. In future studies, the impacts of other factors and barriers should also be put into consideration.

Finally, in regard of research scope and specialty, the research was conducted in an assumed future scenario with only two green alternatives in the field of online food take-out business, which may reduce the research's application scenarios and fields when more green alternatives are developed in the future. In addition, the research was conducted in Chinese cities. The research can be applied to other cities with the same cultural and policy background in China, as validated by another study which distributing questionnaire across the whole country and came out with the same result that perceived behavior control, social norms and environmental awareness can significantly influence people willingness to pay for green packaging (Hao et al., 2019). However, it probably inappropriate when directly being applied to other countries. The indicators to measure the psychological construct of social norms should be changed when applying to other countries due to the different plastic waste-related policy backgrounds of other countries. Furthermore, the research was conducted during the time of COVID-19, the influence of the special context in change of people's mind and habit of using green alternatives should also be investigated.

CHAPTER 6: CONCLUSION

The research is conducted under the context of COVID-19 and China's "New Plastic Ban" policy, when people's online food ordering habit has been changed due to city lockdowns and the roll-out of new policy to restrict the use of disposable plastics in pilot cities (mainly Beijing and Shanghai).

Applying Theory of Planned Behavior (TPB), the study adopts PLS-SEM as the method to investigate the relationships between the psychological constructs of attitude, social norms, perceived behavior control, past green behavior and willingness to pay & willingness to participate. 536 of questionnaires were distributed through online channels, with 430 valid samples in total are collected and analyzed in details. It has several academic contributions in theoretical and practical terms.

Firstly, it fills the gap of TPB in the reality by extending it with new constructs. Besides, although there exists studies proving that perceived behavior control can generating mediation effect between attitude, social norms and intentions (Giantari et al., 2013; H. Liu et al., 2013), to the best of my knowledge, there is no single study proves that the complete mediation of PBC existing between attitude, social norms and intentions. The study deducts that when people are not familiar with the new choices, they tend to consider more regarding the availability and accessibility (perceived behavior control) of adopting them. As a result, PBC shows strong relationship with their intentions and can even mediate the relationships of other constructs with intentions. What's more, the mediating effect is exerted from some socio-economic variables such as location, gender, income, education and occupation on the relationships between psychological constructs such as ATT, SN, PGB, PBC and dependent latent variables such as WTP and WTM. It means that consumers with different socio-economic characteristics probably hold different opinions regarding ATT, SN, PGB and PBC, which as a result influences their effects on WTP&WTM.

Secondly, The research can be applied to other cities with the same cultural and policy background in China, as validated by another study which distributing questionnaire across the whole country and came out with the same result that perceived behavior control, social norms and environmental awareness can significantly influence people willingness to pay for green packaging (Hao et al., 2019).

Based on the results, the study thus proposes a set of policy recommendations. The government should formulate concrete support policies or incentives to facilitate the development of emerging green alternative industries. More importantly, as the major psychological factor that concerning consumers while adopting the alternatives lies in perceived behavior control, which reflect perceived difficulty or easiness (related time, money and other resources) of conducting a behavior, the government and alternative providers should consider reduce the difficulty and inconvenience of using or disposing the alternatives.

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