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Household Waste Analysis During the Situation of COVID-19 in Thailand

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Abstract—
During the situation of COVID-19 since 2020, people's lifestyles have changed for example the way to buy the product, the way to have a meal and personal self-protection. These changes lead to increased E-commerce value of retail business growth 81% from 2019 and food delivery order increase 78-84% from 2019 and expected to reach 120 million orders in 2021. The changes are not only creating value in the supply chain but also generate a big amount of waste. Therefore, it is vital to analyze the change of customer behavior during this situation which is related to the household waste and to provide the household waste reduction. The research found that the household waste during the situation has been increased in terms of overall plastic waste which come from E-commerce order and food delivery order and hazardous waste such as infectious waste also spike up as the people have to protect their health. Then the research provides the suggestion to reduce waste which the government and private sector try to promote the campaign for reducing waste and also review the practice of other countries.

Index Terms— Infectious Waste, COVID-19, Food Delivery, Plastic Waste

I. INTRODUCTION

The COVID-19 was first detected in Thailand in February,2020. Since then, Thailand has applied to a new normal lifestyle because of the obstruction of face-to-face participation. People have to keep social distance, cannot gather in a big group and also have to apply self-hygiene protection. The change from the situation of COVID-19 and the new normal lifestyle led to new job value creation such as selling products online, food delivery projects and many hygiene items launching. On the other hand, wastes are also generated. Therefore, the aims of this paper are: 1) to analyze the change of customer behavior related to household waste which happens before and during the situation of COVID-19 and 2) to propose the suggestion to reduce the household waste that occurs. The research methodology has done by specifically searching for the data, referring to the reliable sources, then correcting and analyzing the data related to household waste which happened before and during the situation of COVID-19, finally concluding the data led to the suggestion to reduce the waste.

II. COVID-19 AND SOCIAL CHANGE IN THAILAND

Since the COVID-19 has been detected in Thailand, the peak of the total number of cases is more than 21,000 cases per day. The country has been locked down, department stores have been shut down, the customers cannot sit in the restaurant, people have to keep social distance. There are 3 obvious changes in Thai society during the situation which are: 1) the way to buy the product from

the real store to online store, 2) the way to have their meal at the restaurant to send direct to their home and 3) the way to find the item to protect their health.
Since, the lifestyle has been changed, then the new job is created. Street vendors move to an online merchant, truck driver applies to be a parcel delivery, motorbike taxi becomes

food rider. From these changes can be seen in the value of E-commerce business that is in 2020 E-commerce value grew 1.3% compared to 2019 and expected to grow 19% in 2021 with the value of 71,800 million Baht [1]. Meanwhile, the food delivery business in 2020 grew 78-84% compared to 2019. The packaging in terms of plastic from the historical growth rate was around 1.5% but in 2020 growth rate will almost reach to 9% [2]. It is because of the customer's need from E-commerce business and food delivery business.

III. THE IMPACT OF COVID-19 ON THE ENVIRONMENT

From the COVID-19 situation led to the change of customer behavior, when considered in terms of benefit point of view. It creates many new job's value, decreases traffic congestion and PM 2.5, or even creates new innovation for health protection. On the other hand, the situation causes environmental impact. To list the environmental impact from COVID-19, it can be described in term of the main activities that are changed in Thais society which are E-commerce activity, food delivery and health protection.

A. E-commerce activities

The value creation of E-commerce activities is the product has been sent directly to the customer's address. Moreover, the product when it is sent to the customer has to be in a good condition. So, the packaging takes an important role to protect the product along the transportation process. The growth of the Thai E-commerce market is stronger than previously anticipated due to COVID-19 that drives Thai people to get familiar with shopping online. The E-commerce value of retail business in 2019 worth 163 billion Baht, in 2020 grows 81%, worth 294 billion Baht and it is projected to grow 20% per year [3]. In the next 5 years the retail E-commerce in Thailand is expected to reach 750 billion Baht [4] as shown in figure 1.

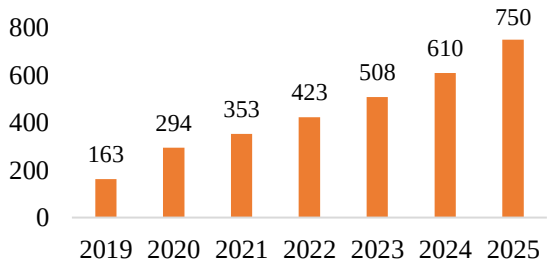

Figure1. E-commerce retail business value 2019-2020 and 5 years forecast.

In 2020 the research from Priceza found that the number of online merchants will have been increased 50% from 2019 to open their store on the 3 E-commerce platforms which are Lazada, Shopee and JD-Central. The well-known brands have also been increased 46% from 2019 to open the official store on Lazada and Shopee. From the great number of the E-commerce values, Thailand post reported that the peak of order number during the situation of COVID-19 around 8 million parcels per day. Normally E-commerce parcels may use up to seven types of packaging materials which are paper bills, envelopes, cardboard boxes, plastic bags, woven bags, tape, and protective materials (bubble) [5]. Therefore, waste from E-commerce packaging causes environmental impact. During the situation, not only non-food products, but also food (fruit and vegetable) was delivered via 3PL provider service. Moreover, in the peak period of COVID-19, the distribution center has to shut down because the staff is infected with the disease so the product is damaged and spoiled and becomes food waste [6].

B. Food delivery

During the situation, the government commands the closure of many services, closing time for restaurant service is only 9 p.m. and the government asks the business to let staff work from home which will help greatly in reducing the spread of infection. During the lockdown period, customers cannot sit in the restaurant to have their meal. Before the outbreak of COVID-19 Food delivery business was worth up to 33-35 billion Baht. Then in 2020, the number of customers using food delivery application service was 66-68 million times which increased 78-84% from the same period in 2019. [7] forecast that in 2021 the food delivery order is expected to reach 120 million times with the value of 53.1-55.8 billion Baht as shown in Table 1.

Table1. Food delivery number orders and value in Thailand Before and During Covid-19 Situation

Year	Food delivery order per year (million orders)	Food delivery value per year (billion THB)
2019 (Before Covid-19 Situation)	37.0	33.0-35.0
2020 (During Covid-19 ripple 1-2)	66.0-68.0	N/A
2021 (During Covid-19 ripple 3)	120.0	53.1-58.0

The most popular applications are Line Man and Grab Food, with the usage statistics increasing by 300-400% compared to the pre-Covid period [8]. Thailand Research Development Institute (TDRI) estimates that 1 of food orders may use up to 7 pieces of plastic waste, including food boxes, sauce bags, plastic spoons, plastic forks, cutlery bags, soup bags and plastic food handle bags [9].

C. Health protection and Self-Examination

During the situation of COVID-19, not only the change of customer behavior in terms of how to

buy the product and food but also the people have to apply the important tools such as social distancing and self-protective tools. The example of health protection items are disposable face masks, N95 masks, spray alcohol, vaccinated syringe, medical gloves regarded as infectious waste. Usually, hazardous waste in hospitals is terminated by the incinerator's method in high-temperature. Meanwhile, people have been using disposable face masks every day during the situation and throwing them away every day. So, it should be considered as infectious waste too. Approximately, 70 million of Thai citizens use 40 million disposable face masks and create an average of 20 million pieces of infectious waste per day because some people may reuse [10]. Other health care items that significantly use during the pandemic are groves, ATK test kit, and vaccination syringe. Considering the vaccination dosage that Thailand expects to reach is around 100 million dosages which means there are 100 million of plastic syringes that become waste.

IV. ANALYSIS OF CHANGE IN HOUSEHOLD WASTE DURING COVID-19

From the change of people's lifestyle, the way to buy the product both food, non-food, and also a health care item. The data showed that the value of E-commerce and food delivery has been increased continually. On the other hand, the activities lead to waste that impacts the environment. To analyze the household waste during the situation of COVID-19 therefore it has been analyzed in 3 main categories which are 1) total of plastic waste, 2) plastic waste from food delivery business and 3) infectious waste.

A. Total of plastic waste

Data from the Ministry of Natural Resources and Environment has shown that the total amount of solid waste increased almost 4 million tons from 24.11 million tons in 2009 to 27.93 million tons in 2018. From the plastic waste problem, the consumption of plastic bags from over the world are 500 billion to 1 trillion pieces per year, or at least 1 million plastic bags are used every minute. In Thailand, the use of plastic bags is up to 45 billion pieces per year, or an average 8 pieces per person per day [11]. Since the spread of COVID-19, the amount of plastic waste has increased 15% or from 5,500 tons per day in 2020 to 6,300 tons per day in 2021 [12]. The amount of plastic waste accounted for 12% of solid waste or 3.35 million tons which includes waste that can be recycled 60% and cannot be recycled 40% the proportion has been shown in figure 2.

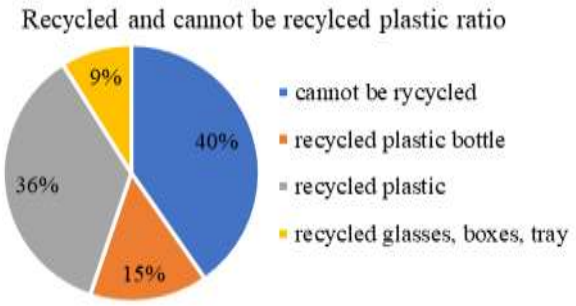

Figure 2. proportion of recycled and cannot be recycled of plastic waste in 2019 in Thailand

Only 2 million tons are recycled, 500,000 tons are plastic bottles and 1.5 million tons of plastic waste is divided into plastics 1.2 million tons and the rest are glasses, boxes, and trays [13]. Moreover, it has been found that during the situation of COVID-19 the plastic waste in Bangkok increased 60% from 2,115 tons per day (January to April 2019) to 3,432.3 in 2021 at the same

period. The number of recycled plastic waste is 659.8 tons and contaminated plastic waste is 2,772.5 ton per day [14] as shown in figure 3.

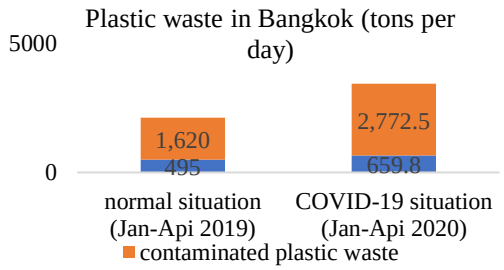

Figure 3. The amount of plastic waste in Bangkok before and during Covid-19 Situation

In contrast, the recycled waste decreased from 23% to 20% due to lack of waste sorting and plastic waste contaminated with food waste as shown in figure 4.

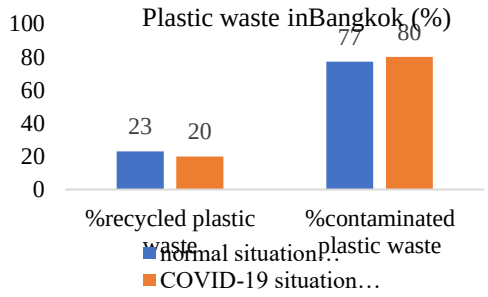

Figure 4. The percentage of plastic waste in Bangkok before and during Covid-19 Situation

B. Plastic waste from food delivery business

To analyze the waste from food delivery business so it can be calculated in terms of plastic packaging that come with food. Then to forecast the amount of plastic waste from food delivery in the future, it is based on a minimum and maximum quantity of plastic waste per order. A minimum quantity is 4 pieces of plastic waste per order which is counted from Food Passion company and maximum is 11 pieces come from The Department of Pollution Control. Environmental Research Institute of Chulalongkorn University found that in 2020, the quantity of plastics waste from food delivery was 1,120-3,080 billion pieces and expected to reach 2,325 – 6,395 billion pieces in 2025 or 34,883 – 95,928 tons as shown in figure 5.

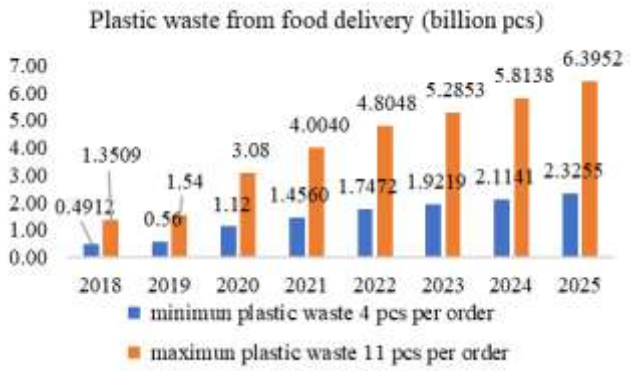

Figure 5. The amount of plastic waste from food delivery 2018-2020 and 5 years forecast

C. Infectious waste

Due to the situation of COVID-19, at the same time, infectious waste has also been increased from the activities that most people have used the item to protect their health such as disposable face masks, Antigen Test Kit (ATK), gloves, PPE, and syringe. The data from the Department of Health found that infectious waste has been increasing every year, and in 2020 infectious waste will reach 34.5 million kg. [15]. However, in 2021 the situation of COVID-19 is worse than in 2020, during July, an average of infectious waste reached 275 tons per day and in August expected to reach 330 tons per day. Therefore, the infectious waste is expected to increase at least doubled time as shown in Figure 6.

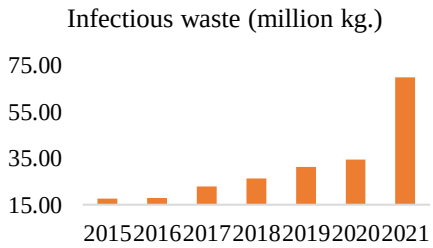

Figure 6. The amount of infectious waste in before and during Covid-19 Situation

The Environment Department of Bangkok reports that infectious waste comes from general infectious waste and infected waste from COVID-19 approximately 37,000 kg - 41,000 kg per day including disposal face masks and Antigen Test Kit (ATK) that rapidly increased recently. Both common infectious waste and infectious waste from COVID-19 have to terminate by burning. Meanwhile, since the pandemic, the fuel burners have to work all the time to let the incinerator operate 24 hours a day to terminate the infectious waste which collected from all departments, including hospitals, public health departments, clinic and state quarantine. The amount of infectious waste collected at this time does not exceed the capacity of an incinerator as 70 tons per day, but when the amount of infectious waste exceeds the capacity, then it will be taken to a conventional solid waste incinerator which can support 500 tons per day [16]

V. WASTE MANAGEMENT PRACTICE

From the change of people's lifestyle, the way to buy the product both food and non-food, and

also a health care item. The data showed that the value of E-commerce and food delivery has been increased continually. On the other hand, the activities lead to waste that impacts the environment. Therefore, it is vital to find the solution to reduce waste that occurs. This paper proposes waste management in terms of Thailand practice and other countries' practices.

A. Thailand practice

Even before the situation of COVID-19 Thailand had to face the waste problem, the government tried to find a solution to reduce waste. Then, during the pandemic, the waste from the activities of E-commerce, food delivery and infectious waste have been increased continually. The E-commerce order is not including not only the product, but also unwanted material that became waste such as packaging. Moreover, as it is mentioned that waste is also from the food packaging order and after used disposal of hygienic protection. To reduce waste that occurs, the food delivery platforms help to apply the option to the customer to not receive the fork, spoon and straw or somehow if the customer chooses to receive it then the customer has to pay as optional. Encouraging restaurants to switch to environmentally friendly packaging such Food packaging made from the pulp and bagasse is another solution to reduce plastic waste. The government needs to reduce the use of plastic and foam, then in 2022 plastic bags thinner than 36 micrometers, styrofoam boxes for food packaging, single-use plastic cups and straw have to be canceled, then target to use 100% recycled plastic in 2040. Waste sorting is one of the practices which should be divided into 3 categories [17] 1. Infectious waste, which is suspected to be contaminated with mucus, saliva, and secretions of patients such as masks, tissues, containers and equipment used for single-use foods such as spoons, forks, glasses, straws, and PPE kits collect in red bags and collect in the red trash. During the situation Bangkok sets the station to place the orange trash to support the disposal face mark after use and prepare the red bag to support in a public area 1,000 stations also control not to let the other solid waste throw in the trash then collect the trash to terminate in the incinerator [18]. 2. General waste includes waste that is not contaminated with mucus, saliva, and secretions of patients such as paper, plastic bags, metal cans, glass bottles, milk boxes, plastic bottles, candy bags, various packaging, collect and pack garbage into the black bag. 3. Food waste collects in a specially arranged container to make fertilizer.

B. Other countries practice

The solution to reduce waste from other countries is not only to find the new material that can be recycled, but also the regulation plays an important role to enforce the producer's concern and response to their product. Governments of large countries around the world are increasing their efforts to develop waste recycling or reusing programs. Germany has the best waste recycling rate in the world. In 2018, Germany recycled 56.1% of the total waste they produced [19]. The government issued a decree to avoid packaging waste and let the manufacturers respond for their own packaging waste. Therefore, manufacturers began to put the symbol 'Green Dot' on their packaging by contracting with the waste collection company to guarantee that the packaging will be reused leading to a parallel garbage collection system with the existing community waste.

The Korea government has enforced the policy to ban all colored plastic and PVC bottles by 2020, then reduce and eliminate the use of disposable glass and plastic straw within 2027.

The example to reduce waste from the giant E-commerce platform as Amazon is to offer the option to allow the product to be shipped without excessive packaging so it can avoid the product that is already packed in the box and then shipped in the big box. When the product has been sent

from the same warehouse, the marketplace can request the customer to ship the product together and offer a discount as a privilege because the customer might take 2 more days waiting for the product delivery. Another solution that can reduce the waste in terms of customers is to shop from the companies that use recyclable and compostable material to produce the packaging [20].

VI. CONCLUSION

The change of personal lifestyle has been forced from the situation of COVID-19. The research found that there are 3 changes which are the way to buy products online, the way of food delivery and the implementation of hygienic products. The way of buying products and food online instead of offline and the increase of hygienic products as a result, the research also found that the wastes are generated and increased more than normal. The unwanted material that comes with the product they buy, after use of catering material and hygienic items are the result of the change of behavior, then the research provides the practice to reduce the waste in Thailand and other countries. In Thailand, the government and private sector try to implement the solution to reduce waste. In other countries, regulation enforcement is also important. The research provides the case from Amazon that is used to reduce waste.

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