Plastic Bag Ban Policy in Thailand: A Step into the 20-Year Roadmap for Plastic Waste Management

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Abstract

This case was originally started from Environmentalist and Policy analyst an non-governmental organization (NGO) "Pordee" questioned about the plastic waste management roadmap for 2018-2030 approved by the Cabinet in July 2019 and policy implementation. A short after the roadmap, in August, 2019, Mariam, a dugong, died due to the many plastic bags found in stomach. Her death stimulated the current campaign to reduce plastic waste. Starting January 1st, 2020, the government enacted a ban on free plastic bags. Seventy-five of Thailand's key retailers (e.g. convenient stores, supermarkets, and etc.) are participating in this program by signing onto a plastic bag reduction policy to cease offering free plastic bags with purchases. One of the main challenges is the lack of enforcement conditions that could cause unaccomplishment of the intended goals. As a result of this policy, Warawut Silpa-archa, Minister of Natural Resources and Environment, expects to see a reduction of 0.78 million tons of plastic waste. Many sectors have questioned the seriousness of this policy's enforcement because the campaigners find that there are still loopholes in solving this problem.

In January 2020, Pordee first compiled all secondary data and took the position of NGO that has monitored government policies by examining claims of the effects of this new policy, data validation, determination of data uncertainty, and analysis of the overall picture of this policy with the 20-year roadmap of plastic waste management.

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After thoroughly understand the roadmap and policy implementation, Pordee generated 2 options for his decision-making. The first option, if the roadmap and policy implementation are aligned, Pordee will actively and continuously support the current policy. The second option, if the roadmap and policy implantation are not aligned, Pordee will purpose to related government agencies additional action plans to meet the roadmap target.

Keywords: Plastic Bag Ban in Thailand, Plastic Waste Management Roadmap, Waste Management

นโยบายการห้ามใช้ถุงพลาสติกในประเทศไทย : ก้าวสู่โรดแมป 20 ปีของการจัดการขยะพลาสติกในประเทศไทย

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บทคัดย่อ

กรณีศึกษานี้เริ่มต้นจากนักวิเคราะห์ด้านสิ่งแวดล้อมและนโยบายขององค์กรไม่แสวงหาผลกำไร (เอ็นจีโอ) ชื่อ “พอดี” ตั้งคำถามเกี่ยวกับแผนงานการจัดการขยะพลาสติก 20 ปี (2561-2573) และการดำเนินนโยบายที่คณะรัฐมนตรีอนุมัติในเดือนกรกฎาคม 2562

ไม่นานหลังจากการประกาศแผนงานการจัดการขยะพลาสติก 20 ปี มาเรียม ลูกพะยูนเสียชีวิต เนื่องจากพบถุงพลาสติกจำนวนมากในกระเพาะอาหาร การเสียชีวิตของมาเรียมกระตุ้นกระแสการรณรงค์ลดขยะพลาสติกในประเทศอย่างกว้างขวาง

ตั้งแต่วันที่ 1 มกราคม 2563 รัฐบาลได้ประกาศห้ามแจกถุงพลาสติกฟรี โดยผู้ค้าปลีกรายสำคัญของไทยเจ็ดสิบห้าราย (เช่น ร้านสะดวกซื้อ ซุเปอร์มาร์เก็ต และอื่น ๆ) เข้าร่วมโครงการนี้โดยลงนามในนโยบายลดถุงพลาสติก ความท้าทายหลักประการหนึ่งของนโยบายนี้ คือ การขาดเงื่อนไขการบังคับใช้ที่อาจทำให้ไม่บรรลุเป้าหมายที่ตั้งใจไว้ จากนโยบายดังกล่าว นายวราวุธ ศิลปอาชา รัฐมนตรีว่าการกระทรวงทรัพยากรธรรมชาติและสิ่งแวดล้อมคาดว่าจะมีขยะพลาสติกลดลง 0.78 ล้านตัน หลายภาคส่วนตั้งคำถามถึงความจริงจังของการบังคับใช้นโยบายนี้เนื่องจากพบว่ายังมีช่องโหว่ในการแก้ปัญหานี้

ในเดือนมกราคม 2563 พอดี รวบรวมข้อมูลทุติยภูมิ เพื่อตรวจสอบนโยบายของรัฐบาล โดยตรวจสอบผลกระทบของนโยบายใหม่นี้ การตรวจสอบข้อมูล การกำหนดความไม่แน่นอนของข้อมูล และการวิเคราะห์ภาพรวมของแผนการจัดการขยะพลาสติก 20 ปี

หลังจากทำความเข้าใจแผนงานและการดำเนินนโยบายอย่างละเอียดแล้ว พอดีได้สร้างทางเลือก 2 ทางสำหรับการตัดสินใจของเขา ตัวเลือกแรกหากแผนงานและการดำเนินนโยบายสอดคล้องกัน พอดีจะสนับสนุนนโยบายปัจจุบันอย่างแข็งขันและต่อเนื่อง ตัวเลือกที่สองหากแผนงานและการดำเนินนโยบาย

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ไม่สอดคล้องกัน พอดี จะเสนอแผนปฏิบัติการเพิ่มเติมเพื่อให้เป็นไปตามเป้าหมายของแผนงานต่อหน่วยงานภาครัฐที่เกี่ยวข้อง

คำสำคัญ : นโยบายห้ามใช้ถุงพลาสติกในประเทศไทย แผนการจัดการขยะพลาสติก 20 ปี การจัดการของเสีย

Plastic Bag Ban Policy in Thailand: A Step into the 20-Year Roadmap for Plastic Waste Management

On one fine day in August 2019, Pordee, the Environmentalist and Policy analyst NGO, watched the news on national television about the Mariam, the baby dugong, died from an infection exacerbated by plastic bags lining in her stomach. Mariam passing was publicly announced by the Department of Marine and Coastal Resources. The post attracted more than 11,000 shares and thousands of comments mourning the loss. This news created an awareness of plastic waste leaking to the sea. Pordee felt sorry and would like to do something for this situation. He started searching and compiling more data about plastic bag waste generation and management in Thailand.

He found that, according to the Ocean Conservancy report in 2017, Thailand is listed on the top five Asian countries, together with China, Indonesia, Vietnam, and the Philippines, responsible for more than 50 % of the 8.0 million metric tons of plastic waste leaked into the oceans annually (Marks, 2018). When plastic bag is leaked to the ocean, it may be transferred through the food web. The term is called microplastics. Microplastics can contaminate at every level of aquatic food chains (Tokhun & Somparn, 2020). Methee Muangkaew sampled mackerel from coastal fishermen near the Hat Chao Mai National Park. The researcher found an average of 78 pieces of microplastic, 1-5 millimetres across, in mackerel (Muangkaew, 2019).

Five months after the dead of Mariam, 75 retailers in Thailand stopped giving out free plastic bags in the first step of the government's plan to eradicate single-use plastic bags by 2022. These voluntary retailers have previously experienced limited use of plastic bags. In some cases, extra points were given to shoppers who refused plastic bags or who brought their own reusable bags. In some case, these retailers set one or two designated no-plastic days a month. The most notable names on this list of department stores, supermarkets, and convenience stores are The Mall Group, Central Group, and Tesco Lotus, as well as other retailers like 7-Eleven, Big C Supercenter, Makro, Foodland Supermarket, Max value, Family Mart, and Index Living Mall. Campaigns have been launched mainly through an online media platform for the public's participation in reducing and stopping the use of plastic.

Pordee was excited about this policy movement and would like to understand more about the impact of this policy. He searched and found that the Ministry of Natural Resources and Environment, who proposed the roadmap, expects this policy framework to reduce the volume of plastic waste by 0.78 million tons a year and save THB 3.9 billion in annual waste management costs. In addition, the roadmap is expected to help reducing the emission of greenhouse gases up to 1.2 million tons of CO_2e (The Government Public Relations Department, 2019).

Another source, the Department of Pollution Control, has stated it hopes this pilot program will reduce plastic bag usage by 13.5 billion or 30% of annual plastic bag usage (Boonbandit, 2019). Pordee still confused about the claim from these two government agencies. Then he started to list all the related issues that needed to be considered for decision making.

1. Realizing The Facts

1.1 What Is The Reliable Data For Plastic Waste Generation And Management?

Pordee searched data from reliable data sources e.g. government agencies, NGOs, academic paper about plastic production and waste generation in Thailand. Figure E1 in Exhibit 2 shows the plastic waste cycle based on 2017 data (Pollution Control Department, 2019). Domestic plastic pellet production was 8.518 million tons. Of these, 5.199 million plastic pallets were exported and Thailand imported 1.962 million tons. Thus, domestic plastic pellet consumption was 5.281 million tons. Plastic bag production was 1.11 million tons; plastic bottles, 0.4; plastic cups and boxes, 0.23; plastic cups, 0.05; plastic forks and spoons, 0.03; straws, 0.003; net, 0.10; shoe, 0.009 million tons. All included, plastic waste totaled 1.930 million tons/year. However, only 0.39 million tons of plastic waste was recycled, on average, (20% of total plastic wastes). The rest of 1.51 million tons of waste was not reused and 0.03 million tons leaked into the environment.

Pordee called **Adam**, the Government officer and longtime friend to confirm the data. **Adam** shared additional information from other sources. One source mentioned

that Thailand produces 45,000 million plastic bags per year for consumption in three sectors: convenience stores and department stores, 13,500 million; grocery stores, 13,500 million; and fresh markets, 18,000 million (Rakrod, 2020). Another source stated that average Bangkok citizen uses eight plastic bags per day—that is 80 million bags daily in the capital alone. Thailand uses a total of around 45 billion plastic bags every year (Pisuthipan, 2019).

These different data sources provide different numbers and units, thus making it difficult to keep track which numbers are more reliable. Consequently, it is important to verify these numbers based on the available data.

1.2 Free Plastic Bag Ban Implemented in January 2020

Pordee realized that this policy cannot be proceeded if no partners volunteer to participate in this program. Several partners have vowed to cease offering plastic bags with purchases starting on January 1, 2020. Among the list of participating retailers were those who had already pledged to reduce plastic use: The Mall Group, Central Group, and Tesco Lotus, as well as other retailers 7-Eleven, Big C Supercenter, Makro, Foodland Supermarket, Max value, Family Mart, and Index Living Mall.

According to the new policy, no free plastic bag will be offered and prices for the bags are marked as decided by each market. Paid use of plastic bags is believed to be an effective measure to regulate and control the quantity of consumers' purchasing plastic bags, giving the fact that people tend to consume more when something is free and calculate when need to pay for bags.

After a few months of this policy's implementation, **Pordee** observed that most consumers have not yet developed the custom of bringing their own shopping bags. The retailers were strict for the first couple weeks that no plastic bags would be given or sold. Later, though, due to customers' complaints, these retailers tended to be more relaxed about providing plastic bags for sale at the checkout counters at approximately THB 2-5 per plastic bag. In addition, people were still able to get free plastic bags from other places such as restaurants, fresh markets, and farmers' markets.

One reporter mentioned that this policy was implemented too early. The Cabinet shortened the roadmap by two years from January 1st, 2022 to January 1st, 2020, thus affecting plastic industries and causing lay-off. However, many countries worldwide have been applying this policy for more than 10 years.

1.3 Why Are Retail Markets The First Phrase For The Free Plastic Bag Ban?

This policy is derived from retailers' voluntary actions and cannot be successful without major retailers participation. The data from **Adam**, even though the data seem underestimated, stated that Thailand produces 45,000 million plastic bags per year for consumption in three sectors: convenience and department stores, 13,500 million; groceries, 13,500 million; and fresh markets, 18,000 million. Fresh markets account for the highest portion of plastic bag usage. The government did not choose fresh markets for the pilot because the enforcement of the policy's implementation among major retailers is easier than fresh and farmers market where many local owners are involved. Although the policy has a satisfactory effect, it still has a long way to go to enforce the plastic bag ban at farmers' markets.These markets should be one of the key area for enforcing a plastic bag ban. Efforts should be made to make the ban long-lasting and an in-depth effect to promote the development of a circular economy in farmers' wholesale markets (Zhu, 2011).

1.4 Will The Country Meet The 20-Year Roadmap for Plastic Waste Management target?

After compiling all data mentioned above, **Pordee** called his friend, **Adam**, to discuss about the concerns over government actions. **Adam** believed that the plastic waste management roadmap and action are aligned.

Adam provided the Roadmap on Plastic Waste Management, 2018-2030 for use as a policy framework to deal with the plastic waste problem in Thailand. The objective of this roadmap is to reduce and eventually stop the use of plastic and replace it with environmentally friendly materials.

According to the roadmap, three plastic products—cap seals on water bottles, oxo-degradable plastics, and plastic microbeads—were total banned in 2019. The use

of four other types of plastic (plastic bags less than 36 microns in thickness, Styrofoam food boxes, plastic straws, and single-use plastic cups) will gradually be reduced and completely stopped by 2022. By 2027, 100% of plastic waste will be reusable (see Table 1, more detail can be seen in Exhibit 1, Table E1).

After reading the roadmap, **Pordee** had different opinion from **Adam. Pordee** did not believed that the government actions at this current stage and speed cannot meet the roadmap. In addition, **Pordee** wondered is it possible to 100% ban the usage of seven plastic packaging in 2019 and 2022. In addition, how the free plastic bag ban campaign launched in January 2020 contribute plastic waste reduction of the country.

These two friends agreed that further analysis is needed to understand the roadmap and the actions.

Table 1: Thailand's 20-year Roadmap of Plastic Waste Management

Goals	Baseline	2018	2019	2020	2021	2022	2027
1. Waste plastics return into the manufacturing system—a circular economy	21%	22%	25%	30%	40%	50%	100%
2. Reduce the usage of seven plastic packaging targets:							
2.1 Plastic microbeads 2.2 Cap seals 2.3 OXO bags			100% 100% 100%				
2.4 < 36 micron shopping bags 2.5 Styrofoam food packing 2.6 Single-use plastic cups 2.7 Straws			25% 25% 25% 25%	50% 50% 50% 50%	75% 75% 75% 75%	100% 100% 100% 100%	

2. Look Around: International Actions Against the Use of Plastic Bags

Pordee contacted his longtime friend from China, **Ping Ping**, asking about the plastic bag waste management policy in China. **Ping** stated that China has adopted the free bag policy for more than a decade. However, according to an increasing trends of food delivery, it seems that plastic bag waste has not reduced. **Ping** send related data regarding this issue for **Pordee** to study. Many countries and states are taking actions and/or implementing policies against the use of plastic bags. Each country adopts different approaches of reducing litter and pollution. More detail on plastic waste of selected country is described below.

China

On June 1st, 2008, the "Restriction on the Production and Sale of Plastic Shopping Bags" (also known as the Plastic Restriction Order) was officially implemented in China. Before the order, retailers in China spent more than CNY 24 billion (or THB 110 billion) per year on plastic bags (Zhang, 2008 cited in He, 2012). Supermarkets use 25% of all plastic bags, while open markets, roadside stores, department stores, and all other retailers use the remaining 75% (Wang, 2008 cited in He, 2012).

In relation to this regulation, free plastic bags are banned in all supermarkets, stores, and all other retailers across the country. This policy excluded plastic bags used for separating foods and other products for hygiene and food safety purposes These retail stores should be fully compliant with the plastic bag identification, the thickness must not be less than 0.025 mm, and they must not be provided free of charge. The shop can set up the prices of plastic bag but have to mark the price clearly and separately from other items.

At present, China's annual consumption of plastic bags exceeds four million tons (Xinhua News, 2019). Since the implementation of China's 2008 ban on free plastic bags, the use of plastic bags in supermarkets and shopping malls has generally been reduced by more than two-thirds, with a cumulative reduction of about 1.4 million tons of plastic bags. This reduction is equivalent to saving 8.4 million tons of oil, 12 million tons of coal, and 30 million tons of CO_2e (Ngo, 2017).

Only small proportion of retail sites fully met the requirements of the new plastic restriction order. According to the China Zero Waste Alliance (2018), a non-profit environmental organization that in 2018 investigated more than 10 cities, including Beijing and Shenzhen, with 979 stores as samples, and found that only 9.1% of the retail stores had achieved all the three requirements at the same time (China Zero Waste Alliance, 2018). The rest did not meet all three criteria. Table 2 shows the details.

Table 2: Assessment of 979 Stores' Implementation of the Plastic Restriction Order Policy (2018 Data)

	Identification Qualification Rate	**Thickness**	**Charge for Plastic Bags**
Average	30%	62%	17%
City	Big cities have a higher thickness pass rate than small-medium cities.	Big cities have a higher thickness pass rate than small-medium cities	Big cities: less than, 40% Small-medium cities, 10%
Store category	Superstore, 69% Convenience store, 43% National chain store, 81% Clothing & boutique, 5%	Superstore, 85% Clothing, 85% Convenience store, 81%	Superstore 85% Convenience store, 42% National chain store, 88% Others: less than 5%
Store location	Shops in shopping malls are better than street shops	Shops in shopping malls are better than street shops	No difference

Source: China Zero Waste Alliance (2018)

Although the plastic restriction seems effective, China has still been facing problems caused by the fast-growing takeaway food and express delivery industries. The takeaway food industry receives nearly 20 million food orders online every day (Davies & Westgate, 2018). In 2016, the takeaway food industry used approximately 7.3 billion plastic bags, and the express delivery industry used about 14.7 billion plastic bags (State Post Bureau, 2017). In 2017, China's express delivery market recorded over 40 billion orders or approximately more than 100 million packages each day, increased by 28% from last year (State Post Bureau of China, 2018).

In response, China is strengthening restrictions on the production, sale, and use of single-use plastic products. On January 19th, 2020, The National Development and Reform Commission issued a more stringent controls over plastic wastes. The main contents were extended to restrict more than just plastic bags. By the end of 2020, non-degradable disposable plastic straws will be banned in restaurants. Hotels nationwide will no longer offer disposable plastic products. Postal delivery outlets in Beijing, Shanghai, Jiangsu, Zhejiang, Fujian, and Guangdong provinces and cities will first ban the use of non-biodegradable plastic packaging bags and single-use plastic bags to reduce the use of non-biodegradable plastic tape. By the end of 2025, non-biodegradable plastic bags, plastic tapes, and single-use plastic bags will be banned from postal delivery outlets nationwide.

In European countries, **Pordee** cannot access much data. A quick information form **Ping** can be summarized as follows: The Federal Republic of Germany collects recycling taxes from all stores that provide plastic bags to customers. This includes a deposit system on plastic bottles to encourage consumers to return the bottles for recycling. This policy has caused beverage companies to choose bottles that can be reused in the market to help reduce CO_2 emissions. Since the implementation of the policy, plastic bottles in the market have been produced as reusable bottles (multi-use bottles) accounting for 64% of all bottles. The use of the plastic bottles was reduced to 46% of all bottles. The Danish government has taxed plastic bag used by retailers since 2003 to pressure various retailers to charge customers for plastic bags. This policy has significantly reduced plastic bag use and encouraged consumers to use bags that can be reused. As a result of the policy, the use of plastic bags declined 66%. The plastic

bottle fee is added to the product price, which encourages consumers to return the bottles to collect the fee. Plastic bottles can be recycled up to 90% of the total. For the United Kingdom, in 2015, England collected plastic bag fees from consumers in large stores at 5 pence per bag, which reduced the use of plastic bags by more than 80%. This policy is expected to reduce the use of plastic bags and will have significant economic benefits, such as reducing the waste disposal budget by 60 million pounds and reduce CO_2 emissions by 13 million pounds.

3. Consequences after Plastic Bag Consumption Reduction

Of course, plastic bag consumption reduction would be good for environment. This issue get more complicate. **Pordee** asked his team to complete data to understand more in detail about the environmental benefits from the campaign. Most of the bags were heavy, single-trip polyethylene bags, which were subsequently used as trash liners. Following the government's roadmap of plastic waste management, plastic waste could be reduced and can reduce waste management costs, landfill areas, CO_2e emissions and, in the meantime, generate electricity.

CO_2 emissions: During the production process, one ton of PE will release 1.675 tons CO_2e; PP, 1.550 tons; PET, 2.275 tons; PVC, 2.095 tons; and PS, 3.200 tons (Hamilton et al., 2019). If the plastic bag consumption is expected to decline, CO_2e emissions can also be expected to decrease.

Plastic waste management: There are 3 major approaches of managing plastic waste and each of which has clear implications for the environment. The first approach is waste-to-energy. Incineration creates the most CO_2e emissions among the plastic waste management methods. Approximately, one metric ton of plastic burned results in 0.898 tons of CO_2e emissions. This estimated number has already taken electricity generation into account by the combustion process. In addition, waste collection, hauling, and processing also produce greenhouse gas emissions, mainly due to energy use (Hamilton et al., 2019) (see Figure 1). For comparison, landfills produce CO_2e emissions 60 kg CO_2e/ton while recycling reduces CO_2e emissions to 1.3 tons of CO_2e.

Climate Impacts of Plastic Packaging Waste Disposal Options (kg CO_2e/metric ton)

Activities/Processes	Recycling	Landfill	Incineration
Collection/Self-Haul	45	35	35
Material Handling	650	25	38
Virgin Material Offset	-2,090		
Biodegradation		0	
Incineration			2,894
With Energy Recovery			
Natural Gas Offsets			-2,040
Renewable Energy Offsets			-30
Total	**-1,395**	**60**	**898**

Note: This analysis assumes that all incineration is conducted with energy recovery, as exact data on the ratio of incineration without energy recovery is currently not available. While incineration without energy recovery does exist, it results in 2,894 kg CO_2e of greenhouse gases per Mt of plastic burned, which is the same as open burning. US EIA, International Energy Outlook, 2017 (data for 2015) estimates that renewable energy accounted for 17 percent of worldwide electricity generation in 2015.

Source: Sound Resource Management Group, Inc provided this analysis based on the sources available at *https://www.no-burn.org/plastic-climate-appendix*.

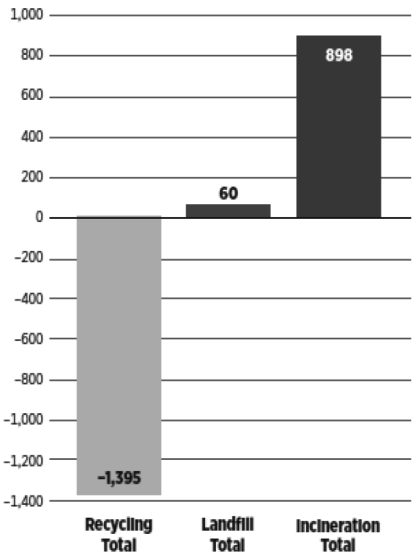

Figure 1: Climate Impacts of Plastic Packaging Waste Dispocal Options (Kg CO_2e/Metric Ton)

Source: Hamilton et al. (2019)

Reduce costs of waste management: According to the Minister of Natural Resources and Environment, he expects this campaign will reduce plastic waste by 0.78 million tons and save up to THB 3.9 billion per year or approximately 5,000 THB/ton and landfill areas by 2,500 rai or 3.2 rai/1,000 tons of plastic bags (Thailand Environment Insitute, 2020).

Plastic industry: Naphat Thipthanakit, vice president of the Thai Plastic Industries Association, says the plastic industry has been hurt financially by the government's rush to ban single-use plastic bags. In fact, of the 86 plastic-bag producing factories that are members of the association have been affected by this sudden ban. The association estimates the ban has cost the industry THB 24.3 billion and placed 6,030 workers at risk of losing their jobs (Wipatayotin & Kongrut, 2020).

Trash bags: In Taylor (2019) study of the impact of the plastic bags ban on the behavior of people in California, she reported that when the government issued a policy to ban plastic bags then consumption decreased considerably. On the other hand, the number of people using trash bags or bin bags has increased by an impressive 120%.

The study reported that the elimination of 40 million pounds of plastic carryout bags was offset by a 12 million pound increase in trash bag purchases. The sales of trash bag of small, medium, and tall increase 120%, 64%, and 6%, respectively (Taylor, 2019).

4. Are Plastic Bags the Worse Choice among All?

The alternative choice for plastic bag is important and it has to be more environmentally friendly. Customers must make choices for their plastic bag replacement. **Pordee** saw many shops replace plastic bag with paper bag. Are Paper bags as environmentally friendly as many people believe? Trees have to be cut to produce the bags, and deforestation is one of the main causes of global warming. Thailand has campaigned to stop using paper bags instead of plastic bags for more than two decades. Will it go back to using paper bags again?

When looking closely at the resources used for plastic and paper bags, based on the study of California State University, 1,500 bags of polyethylene plastic bags (mass = 6 kg) for one-time use require non-renewable energy of 763 GJ that produces CO_2e of 0.040 tons and 58 gals of freshwater consumption. One thousand paper bags (mass = 52 kg) for one-time use require non-renewable energy of 2,620 GJ and produce CO_2e of 0.080 tons and require 1,000 gals of freshwater consumption (see Figure 2).

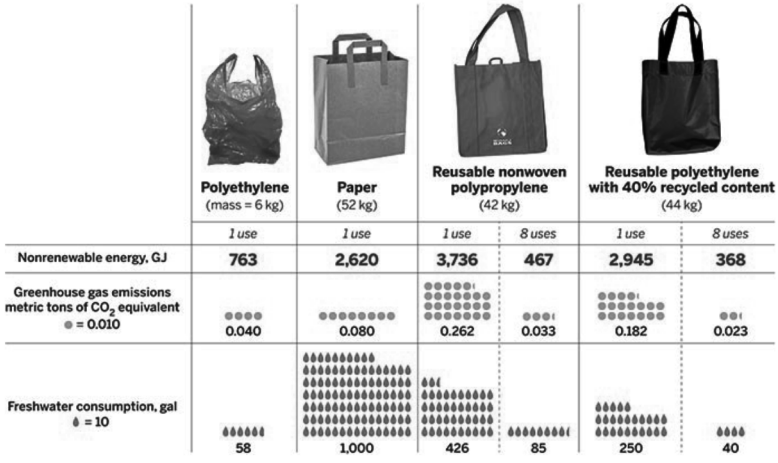

Figure 2: Life-cycle of Resources Used for Plastic and Paper Bags

Source: California State University, Chico, Research Foundation; Joseph Greene cited in (Tullo, 2014)

According to these data, one-time use of paper bags introduces more environmental impacts than plastic bags. It appears that the best choice for the environment is to bring plastic bags for reuse as many times as possible. In general, most Thais reuse plastic bags as trash liners. The real problem is that before the policy prohibited their use, we had too many plastic bags in the cycle making it hard to fold and reuse them.

5. Challenges to the Free Plastic Ban Policy: Food Delivery Generates a Lot of Plastic Waste Per Delivery

Many countries that have been implementing a free plastic bag ban for more than 10 years have reported that the use of plastic bags has not actually been reduced. Many factors have caused an increasing number of wasted plastic bags, even though these free plastic bags were banned in major retailers. Further from **Ping** warning about tremendous amount of plastic bad used in food delivering that could challenging of plastic bag consumption reduction roadmap. **Pordee** and his team deeply searched more information on this issue.

The boom of e-commerce and the fast-paced lifestyle has led to an increasing food delivery services in cities. This, in turn, has resulted in significant environmental concerns especially on the waste packaging materials.

The *New York Times* published a report that showed how food delivery services are drowning China in plastic. The report found that online delivery services in that country were responsible for 1.6 million tons of packaging waste in 2017, a nine-fold increase from 2015. To be more specific, there were 175,000 tons of disposable chopsticks, 164,000 tons of plastic bags, and 44,000 tons of plastic spoons (Wattanasukchai, 2019).

Another source reported quite similar numbers on food delivery packaging waste in China. The total amount of packaging waste was increased from 0.2 million tons in 2015 to 1.5 million tons in 2017 (Song, Zhang, Duan, & Xu, 2018). Interestingly, the report found that most restaurant owners wanted to impress their customers with heavier containers or an extra layer of plastic wrap to avoid risking negative reviews because of a torn box or food spillage.

In Thailand, an official study on the amount of waste generated by food delivery services showed an increasing trend for food delivery. GET one of the big players in food delivery industry has 20,000 shops under its network. According to the data in 2019, GET sold and delivered more than 300,000 glasses of bubble tea and 190,000 loaves of bread per month. Meanwhile, Grab Food, another big player, reported data of the first 10 months in 2019 that approximately 120 million orders were placed from services areas within 18 provinces. The most popular items sold are bubble tea, noodles, fried chicken, somtam, and pizza (Wattanasukchai, 2019).

Based on **Pordee** and his team experiences, ordering food through an application one time for one menu item results in the use of more than five pieces of plastic waste, such as one box of chicken rice may include plastic rice boxes, plastic forks, plastic fork bags, sauce bags, and a big plastic bag for carrying all food packages. Ordering drinks may cause more waste than one plastic glass because take out preparations separate the ice into another plastic glass that requires a cover, straws, and bags for carrying. Delivery services through online applications have grown so fast that the amount of plastic waste is increases while there is no serious policy to handle this increase.

6. Discussion Questions

Whether a plastic bag ban could be implemented successfully not only depends on effective publicity by policy makers but also on the right guidance and incorporation between public and private sectors.

Pordee and his team would like to understand the roadmap and policy implementation, **Pordee** generated 2 options for his decision-making. The first option, if the roadmap and policy implementation are aligned, **Pordee** will actively and continuously support the current policy. The second option, if the roadmap and policy implantation are not aligned, **Pordee** will purpose additional action plans to meet the roadmap target. Before he can make decisions, these following questions should be addressed.

1. This policy has many estimated numbers for plastic waste reduction. What number is the correct one? Develop you own model of estimation. How big is the impact of this policy? Provide quantitative and qualitative assessments of this policy.
2. Who are the stakeholders in this issue? What are the pros and cons of each stakeholder? Please quantify. What are the costs and benefits of this policy?
3. What would the government recommend as an alternative for plastic bags?
4. Does this policy will succeed in the long run or not? If not, propose policy recommendations to meet the 20-year roadmap target.

References

Boonbandit, T. (2019). Big retailers pledge to drop plastic bags by 2020. *Khaosod*. Retrieved from https://www.khaosodenglish.com/life/2019/09/10/big-retailers-pledge-to-drop-plastic-bags-by-2020/

China Zero Waste Alliance. (2018). Ten years from the Plastic Restriction Policy. Retrieved from http://www.lingfeiqi.org/sites/default/files/datadoc/shi_nian_xian_su_ling_shang_jia_zhi_xing_qing_kuang_diao_yan_bao_gao_.pdf

Davies, P. A., & Westgate, R. A. (2018). China's Action Against Plastic Pollution. Retrieved from https://www.globalelr.com/2018/04/chinas-action-against-plastic-pollution/

Hamilton, L. A., Feit, S., Muffett, C., Kelso, M., Rubright, S. M., Bernhardt, C., . . . Labbe-Bellas, R. (2019). *Plastic and Climate: The Hidden Costs of a Plastic Planet*. Retrieved from www.ciel.org/plasticandclimate

He, H. (2012). Effects of Environmental Policy on Consumption: Lessons from the Chinese Plastic Bag Regulation. *Environment and Developmetn Economics, 17*, 407-431.

Marks, D. (2018). What Thailand needs to do to kick its plastic addiction. *Bangkok Post*. Retrieved from https://www.bangkokpost.com/opinion/opinion/1587290/what-thailand-needs-to-do-to-kick-its-plastic-addiction

Muangkaew, M. (2019). Mackerel study points to plastics crisis. *Bangkok Post*. Retrieved from https://www.bangkokpost.com/thailand/general/1748099/mackerel-study-points-to-plastics-crisis

Ngo, W. (2017). Environmental Reform in Africa: A Comparative Continental Union Solution Through Plastic Reform Legislation. . *Brooklyn Journal of International Law*, *43*(2), 691-715.

Pisuthipan, A. (2019). This time, it's serious. *Bangkok Post*. Retrieved from https://www.bangkokpost.com/life/social-and-lifestyle/1801524/this-time-its-serious

Pollution Control Department. (2019). *Thailand's Roadmap on Plastic Waste Management 2018-2030*. Retrieved from Bangkok, Thailand: http://www.pcd.go.th/Info_serv/File/Plastic%20Roadmap.pdf

Rakrod, P. (2020). 'Do not give away a hand bag voluntarily' Does it really help to reduce plastic pollution!?! Retrieved from https://www.greenpeace.org/thailand/story/11099/plastic-no-single-use-plastic-bag/

Song, G., Zhang, H., Duan, H., & Xu, M. (2018). Packaging waste from food delivery in China's mega cities. *Resources, Conservation and Recycling, 130*, 226-227.

State Post Bureau. (2017). 2017 China Express Delivery Green Packaging Development Status and Trend Report. Retrieved from http://www.spb.gov.cn/ztgz/gjyzjzt/lskd/dtyw/201709/t20170915_1326415.html

State Post Bureau of China. (2018). Chinese Statistic Bulletin of Post Business in 2017 Retrieved from http://www.spb.gov.cn/xw/dtxx_15079/201806/t20180604_1581131.html

Taylor, R. L. C. (2019). Bag leakage: The effect of disposable carryout bag regulations on unregulated bags. *Journal of Environmental Economics and Management, 93*, 254-271.

Thailand Environment Insitute. (2020). Roadmap on plastic waste management. Retrieved from http://www.tei.or.th/th/area_infographic_detail.php?area_id=9&event_id=556

The Government Public Relations Department. (2019). Roadmap on Plastic Waste Management. Retrieved from https://thailand.prd.go.th/1700/ewt/thailand/ewt_news.php?nid=7831&filename=index

Tokhun, N., & Somparn, A. (2020). Microplastic contaminations in buffet food from local markets. *Naresuan University Journal, 28*(4).

Tullo, A. H. (2014). Breaking the Plastic Bag Habit. Retrieved from https://cen.acs.org/articles/92/i37/Breaking-Plastic-Bag-Habit.html

Wattanasukchai, S. (2019). Food apps trade convenience for plastic waste. *Bangkok Post*. Retrieved from https://www.bangkokpost.com/opinion/opinion/1799699/food-apps-trade-convenience-for-plastic-waste

Wipatayotin, A., & Kongrut, A. (2020). Plastics factories feel bag ban pain. *Bangkok Post*. Retrieved from https://www.bangkokpost.com/business/1850854/plastics-factories-feel-bag-ban-pain

Xinhua News. (2019). 11-year implementation of the ban on free plastic bag Retrieved from http://www.xinhuanet.com/politics/2019-09/12/c_1124988515.html

Zhu, Q. (2011). An Appraisal and Analysis of the Law of "Plastic-Bag Ban". *Energy Procedia, 5*, 2516-2521.

Exhibit 1: The 20-Year Road Map of Plastic Waste Management in Thailand (2018-2030)

Plastic was invented in 1868. Plastics are produced by the conversion of natural products or by the synthesis from primary chemicals generally coming from oil, natural gas, or coal. Over the past 50 years, plastic has become a product that plays a huge role in daily life. Many countries around the world are experiencing an enormous amount of plastic waste due to the use of plastic to replace other products.

In the last 10 years, Thailand has generated about 12% of the total plastic waste or about two million tons per year. Plastic waste is recycled at an average of 0.5 million tons per year. The other 1.5 million tons are single-use plastics, for example, hot and cold food bags, plastic cups, straws, and foam containers. Even though plastic has long lifetime its usage is very short. Plastic waste is dumped in landfills with other types of waste and plastic waste requires more space when dumping than other waste. Thus, the government requires a budget to prepare landfills. The improper management of plastic bags blocks drainage pipes in the city thus causing flooding during heavy rains and floating garbage in rivers and canals into the sea.

The government acknowledged the importance of the environmental pollution caused by waste at a Cabinet meeting on April 17th, 2018. Collaboration among all sectors is needed to accelerate the implementation of and integrated plastic waste prevention program and a solution for the government and private sectors.

Developing plastic management was needed from production commercialization to consumption and waste management. Therefore, *the 20-Year Road Map for Plastic Waste Management in Thailand* (2018-2030) was developed. The process of developing this roadmap involved many stakeholders, including government agencies, private sector, international institutions, academics, and other people. A meeting was held three times and five sub-meeting were arranged with companies in the plastic industrial sectors and the Federation of Thai Industries.

The objective of the roadmap is to show the framework and direction of plastic waste management of the country by integrating public and private sectors.

The roadmap is the plastic waste management framework from 2018 to 2030, which is in line with a sustainable development goal 14 to conserve and sustainably use the oceans, seas, and other marine resources for sustainable development. This SDG has two targets:

1. A 100% ban on the use of cap seals plastic that contain Oxo and microbeads and a 100% ban on the use of plastic bags with thickness of less than 36 microns, foam containers, plastic cups, straws.
2. A one hundred percent rate of reusing or recycling by 2027. The technology will gear towards waste to energy or RDF (see Table E1).

Table E1: The 20-year Roadmap of Waste Management

Goals	Time frame												
	Phrase 1		Phrase 2			Phrase 3							
	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
1. Reduce the usage of seven plastic packaging targets													
2.1 Plastic microbead 2.2 Cap seal 2.3 OXO bag	80%	100% 100% 100%											
2.4 < 36 micron shopping 2.5 Styrofoam food packing 2.6 Single-use plastic cups 2.7 Straws		25% 25% 25% 25%	50% 50% 50% 50%	75% 75% 75% 75%	100% 100% 100% 100%								
2. Waste plastics return into the manufacturing system—a circular economy	22%	25%	30%	40%	50%	60%	70%	80%	90%	100%			

Action Plan for Plastic Waste Management (2018-2030)

Phrase 1: 2018-2019

Strategies to reduce plastic bags in the production process:

- Develop criteria or regulations for environmentally friendly products
- Develop standard grades for the plastic industry for recycling and environmentally friendly products
- Collaborate on project between government, retailers, and brand owners to improve and adapt to a circular economy
- Encourage the integration of eco-designs for plastic products for 100% reuse
- Develop signs or logos for eco-designs of plastic products to enable collection and recycling processes
- Encourage consumers to purchase eco-design products
- Develop a database of plastic material flows

Reduce or Ban Plastic Consumption

- Ban cap seals and plastic bagthat contain Oxo and microbeads
- Encourage waste separation
- Limit the use of plastic ban and ban foam food containers at the national parks (154 parks and 8 zoos)
- Reduce waste spillover into the sea

Phrase 2: 2020-2022

- Campaign to reduce straws and single-use plastic unless the customer makes a request
- Develop courses on adopting a circular economy and waste management
- Educate the younger generation in collaborating in waste management from the cradle to the grave
- Develop regulations and guidelines for businesses related to tourism and water transportation services in reducing waste dumped into the sea

As for the strategy on plastic waste management after consumption

- Encourage waste recycling and moves towards a circular economy
- Develop new regulations under the "Quick win" national strategy
- Act on the Maintenance of the Cleanliness and Orderliness of the Country, B.E. 2535 and edited version 2017
- Promote higher management standards at the waste collection spots
- Promote RDF for local plastic waste management
- Promote waste separation units in local communities
- Promote upcycling in large, medium, and small business
- Apply extended producer responsibility of plastic products from collecting system, recycling, and management until the end of life.

Exhibit 2: Plastic Waste Management Problems

From the past to present, Thailand has had five methods for plastic waste management.

1) *Landfills:* Mostly dirty plastic bags that are not cost-effective for reuse or recycling, PP, HDPE, and LDPE for hot and cold food plastic bags. These plastic bags were dumped in the landfill or open areas prepared by a local municipality.
2) *Recycle and reuse* is the best choice for the environment. However, plastic recycling requires processes and related costs. A plastic bag that is contaminated with organic waste makes the process more difficult. In addition, plastic bags of different types need to be separated before recycling. Thus, several types are left unrecycled.
3) *Refuse derived fuel (RDF)* is also a good option for the environment. Since plastic bags have a high heat value, certain industries (cement and others) have adopted RDF technology to generate energy for use in their industry.
4) *Incineration:* There are two types of incineration 1) waste to energy and 2) incineration. There are only six waste to energy incinerators and 37 other incinerators that meet standards. There are 57 incinerators that do not meet standards and 93 incinerators are open-area burners.

5) *Pyrolysis:* Plastic bags can be converted to oil by pyrolysis technology. However, this method does not show real implications for Thailand.

Problems with Plastic Waste Management

1) Problems with the design and production:

- Most of the products were not designed to be environmentally friendly.
- No regulations cover single-use plastic bags.

2) Problem with consumption:

- Thais are used to plastic bags for carrying food and then these plastic bags are difficult to reuse and recycle.

3) Problems with waste management:

- Lack of participation by the people.
- Collection system does not cover the whole area.
- Lack of integrating a circular economy that reuses and recycles plastic bag waste.
- Lack of strict regulations for recycling.

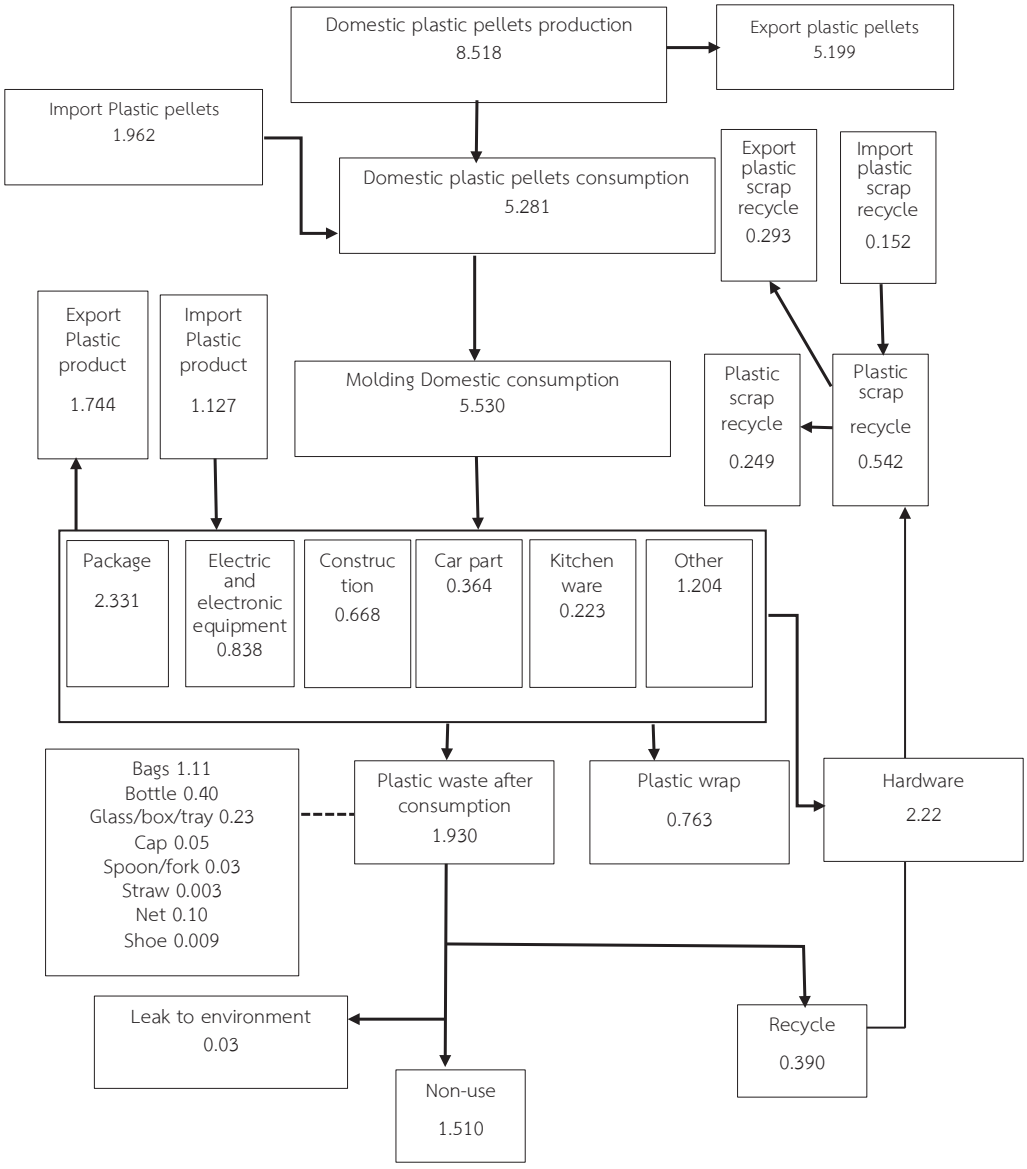

Figure E1: Plastic Waste Cycle (Million Tons in 2017) (Pollution Control Department, 2019)