Final Report

Integrating Small and Medium-sized Enterprises (SMEs) in Eco-friendly Packaging to the Global Value Chain Project **2021**

Present to

Trade Policy and Strategy Office,
Ministry of Commerce

By

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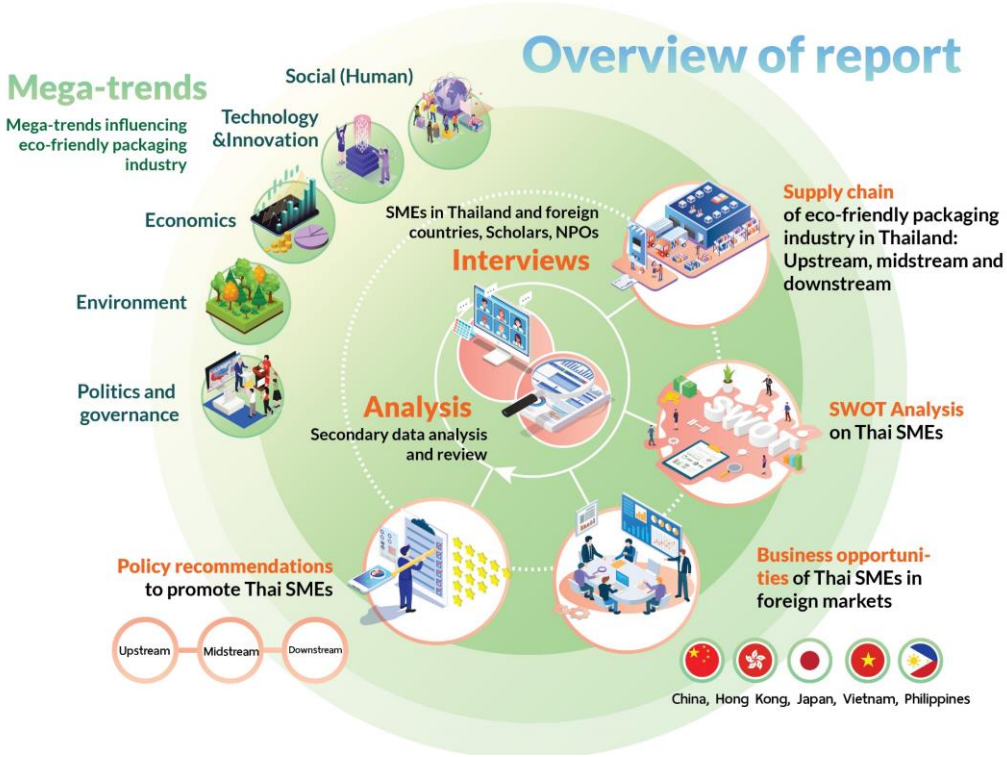
Executive summary



This report is a study on the ecosystem of emerging eco-friendly packaging industry. It aims to collect primary data and secondary data on ASEAN and foreign stakeholders from China, Japan, Vietnam, Philippines, and Hong Kong. The report includes an analysis on mega-trends which influence the demand and supply of eco-friendly packaging, supply chain of eco-friendly packaging in ASEAN ranging from upstream, midstream, to downstream, the SWOT analysis on Small and Medium Enterprises (SMEs), the industry potential in the global market and guidelines for governmental support to sustainably promote ASEAN SMEs in this emerging industry. The review of mega-trends reveals that there are positive driving factors which would contribute to the increase of demand in eco-friendly packaging. Key driving forces are the world population growth which, in particular, the rising number of middle-class population in Asia. The new population group has greater purchasing power and willingness to pay higher prices for products and service that are eco-friendly and sustainable. Such consumption behavior is known as Green Consumerism. In addition, the development of innovation and technology has remarkable effects throughout every

operation line. Sustainable development trends, including the invention of fiber-based materials from agricultural crops, the production of plastic pellets from recycling processes, as well as the design of smart packaging provide useful information to consumers and promote better understanding in Eco-friendly packaging. These developments, spurred by the awareness of the environmental impact of plastic waste, especially those in the oceans, have led many governments to enact laws and regulations to ban single-use plastic bags, such as the European Union, China and 16 states in the United States.

SMEs in ASEAN have greater competitiveness due to the region's richness in diverse agricultural crops, which have a year-round supply. Furthermore, researchers from universities in ASEAN have well-established collaboration with the business sector. This resulted in good partnership between academics and the business sector in R&D and the commercializing of new products, both bioplastic and fiber-based material from agricultural wastes. However, in order for ASEAN SMEs to export to foreign markets, businesses must have sufficient understanding on standards and regulations imposed by those countries. Governments should promote online marketing and e-commerce competency training among ASEAN SMEs.

Business opportunities in foreign markets for ASEAN SMEs in eco-friendly packaging industry are very promising. Vietnamese companies have been a strong distributor of bagasse-based food container products. China is looking for raw materials for eco-friendly packaging products that can be obtained large quantity and available year-round, such as rice straw. Japan's aging society offers business opportunities for SMEs as gifts given to elderly people are customary requires proper wrapping natural materials and without plastic. Hong Kong enterprises pay more attention in buying and selling eco-friendly packaging products to ASEAN countries.

However, government policy is important and needed in order to better support SMES in eco-friendly packaging industry. Governments should start with educating people on the types and quality eco-friendly packaging products. The study shows that the public currently has misinformation on bioplastic products. It is urgent that governments endorse and establish industrial standards, especially on food containers. It is vital for ASEAN countries to establish their own laboratory and official institutes which provide standard product testing service and labelling for eco-friendly packaging

products. This will provide certificates and labels which assure consumers on the quality of eco-friendly packaging and prevent frauds. The tasks of inspecting and monitoring quality eco-friendly packaging can also be decentralized to local administrative offices. Lastly, it is fundamentally important that ASEAN countries should undertake waste segregation and implement strict reuse and recycle process. This will a bring genuine reduction of municipal waste and other environmental issues.

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Chapter 1
Introduction

1.1 Background

The Trade Policy and Strategy Office, Thailand's Ministry of Commerce initiated the project "Integration of Small and Medium Enterprises (SMEs) in Eco-Friendly Packaging to the Global Value Chain" as a part of the Economic and Technical Cooperation Agreement of ASEAN-Hong Kong Free Trade Agreement. The project aims to promote the participation of ASEAN SMEs and farmers in the eco-friendly packaging industry, which will not only stimulate the growth in sector, but also enhance the grassroots economy which is important for reducing social disparity between the urban and the rural areas. Furthermore, this eco-friendly packaging promotion will help address waste and plastic waste problems. The consultant, the Food Innovation and Packaging Center, Chiang Mai University, collected the primary and secondary data and evaluated factors and trends which will help the policy makers design and implement the policy to support ASEAN SMEs in emerging eco-friendly packaging industry both domestically and globally.

1.2 Objectives

1. To provide businesses with better understanding of the situation, important factors, trends in demand and the growth direction of the eco-friendly packaging market
2. To provide information on the opportunities and challenges in the eco-friendly packaging industry.
3. To identify potential of SMEs in ASEAN to integrate into the global value chain of the eco-packaging industry.
4. To provide policy recommendation for the ASEAN government on how to best support SMEs and farmers to access the global value chain and reap the benefits of eco-friendly packaging demand, as well as how to promote eco-friendly packaging adoption.

1.3 Methodology

The report collected primary data from in-depth interviews and reviewed secondary data from official documents, reports, and academic literatures. The content included in this report comprises of the production process of eco-friendly packaging products, potentials of ASEAN SMEs in global market, opportunities and challenges for SMEs, and mega-trends that influence the demand and supply of the eco-friendly packaging industry. Interviews were carried out through online platform, zoom application, between June to August 2021. Participants included business companies, researchers and scholars, nonprofit organization (NPOs) in Thailand, China, Hong Kong, Japan, Vietnam, and the Philippines.

Chapter 2
Situations and Key Factors in the Eco-friendly Packaging Market and Mega-trends Affecting the Eco-friendly Packaging Industry

The research team reviewed whitepapers from leading consulting firms such as McKinsey and IBM, as well as academic papers and news outlets to analyze mega-trends affecting the packaging industry by dividing the content of the mega-trends into five aspects according to STEEP principles as follows:

2.1 Social and Demographic Change

2.1.1 Demographic Change

According to the European agency report, the European Strategy and Policy Analysis System (ESPAS) titled, Mega-Trends: Global Trends to 2030 Challenges and Choices for Europe (ESPAS, 2019) and the United Nations report titled, Population 2030: Demographic Challenges and Opportunities for Sustainable Development Planning (UN, 2015) the world's population is projected to be in the range of 8.3-8.6 billion people by 2030. Africa has a higher birth rate than any other continent, especially West African countries, where, on average, one woman bears 7.2 children (Brookings Institution, 2020). This increase in population means that the demand for food and consumer goods will increase and could extend to more packaging. This is especially true in Fast-Moving Consumer Goods (FMCG), or consumer goods that consumers spend on a daily basis, at low prices, sold in large quantities and with a short shelf life, according to McKinsey (2019). Food products are accounted for the highest volume, with 50% of all packaged goods in the North America market, while beverages saw less growth. As a result, the overall consumption of beverage packaging has been decreased as the consumption of soft drinks or carbonated drinks has been declining due to health concerns.

In addition to the number of the world's population that will increase, the current demographic change is also characterized by the increasing number of aging population. An article from the website Global Ageing Times in 2021, states that between 2015 to 2030, the number of people with age above 60 will increase by 56%, or from 901 million

to 1.4 billion. By 2050, the global aging population will reach 2.1 billion, with Asia being the continent with the most aging populations. Superpowers like China could still face the impact of the former One Child-Policy, causing the number of new generations' populations to decline. In the same report, China's aging population could increase from 15.2% in 2015 to 25.3% in 2030. For Thailand, according to the National Bureau of Statistics, it is predicted that Thailand will enter a fully aged society in 2022 and by 2030, 26.9% of the country's population will be categorized as an aging population. This elderly group is considered an important target consumer group as they have relatively high savings and purchasing power due to their economic position and income in their 50-60s. This aging consumer group is therefore more likely to incur expenditure on leisure, beauty care, medical services, including premium products and services.

2.1.2 Consumer Awareness

Economic growth and higher education contributed to the rise of the middle class, where they play an important role both politically and economically. They have purchasing power and has better well-being along with bargaining power which can determine the direction of new products and services. With the Information and Communication Technology (ICT) advancement, consumers are able to influence manufacturers to adapt to changing tastes and values. Between 2017 to 2020, the consumption behavior of the middle class has changed direction. There is a growing demand for food, goods, and services that are eco-friendly. Collectively, the middle class has a growing concept of sustainability. Consumption of goods and services has reversed in the direction of eco-friendly, also known as Green Consumerism. This is similar to Ecological consumers, the results reported by IBM survey of consumer opinion titled, "Meet the 2020 Consumers Driving Change: Why Brands Must Deliver on Omnipresence, Agility, and Sustainability" with accumulating poll results of 18,980 respondents from 28 countries worldwide. The survey found that 40% of consumers surveyed, looked for products that meet their values and those that offered health and well-being benefits. They are willing to change their product selection behavior to mitigate environmental impact concerns about sustainability and recycling issues. Most

of these consumers are from Europe, some Southeast Asian countries, and Latin America, with over 51% of them earning middle or above middle income.

Green Consumerism is more focused on purchasing products and services with the least impact on the environment. Some notable behaviors include utilization of biodegradable paint, Chlorofluorocarbon (CFC) -free hairspray, reusable cloth bag, as well as behaviors at home such as turning off the faucet while brushing teeth, turning on the air conditioner to the right temperature, etc. At present, technology helps disseminate knowledge on Green Consumerism, with the exchange of information on products, sources and raw materials and whether the production process pollute the environment. If the goods consumed are found to be incorrectly sourced, violated labor laws or misused resources, there could be a ban on that product or a boycott among consumers. They are also willing to buy products that are more eco-friendly at a higher price (willingness to pay). It can be seen that consumers have more bargaining power nowadays and are also the ones who determine the market direction or consumption trend.

Another change in public awareness that affects the eco-friendly packaging industry, is the awareness of plastic waste. Especially on the seas and oceans, causing a trend to campaign and social movement to reduce the use of plastic, which will be further discussed in Section 2.4. However, a report by McKinsey titled, "Sustainability in Packaging: Consumer Views in Emerging Asia (David et al., 2021)", surveyed consumer opinions in 10 countries on concerns about packaging sustainability and willingness to pay for sustainable packaging. Consumers in China, Indonesia and India were more concerned with sustainability and have more willingness to pay for products with sustainable packaging than consumers from other countries surveyed. While developed countries like Japan, Germany and the UK, however, have a lower attention to sustainability and the willingness to pay than the developing countries included in the survey. There are additional findings that consumers in China focus on the packaging of fresh food products such as vegetables, fruits, meat, and milk. Consumers in India are interested in fast food dairy products, and pet food. These are compared with Indonesian consumers who are particularly interested in beverages, followed by dairy products, and fresh vegetables and fruits.

2.2 Technology and Innovation

According to the report by McKinsey (2021), "Sustainability in Packaging: Investable themes", the demand for eco-friendly packaging has increased because of the current economic climate. Many countries have regulations on the use of packaging. In addition, consumers are becoming more aware of the environmental impact. This has provided the impulsion for researchers and packaging product producers to work together in developing eco-friendly packaging. For example, there are many companies that have developed machines and functional systems that can decrease energy consumption and waste in the production process. By using technology to produce eco-friendly packaging, which includes active packaging, molded packaging, multipurpose packaging, and alternative fiber packaging.

For upstream innovations, new materials for packaging have been developed as follows:

- Selective use of only the same type of plastic and avoid mixing it with different plastics. For example, Polyethylene (PE) or Polypropylene (PP), which are high quality plastics with good performance and recyclability.
- Production of plastic pellets from the recycling plant to enhance the use of recycled plastic in packaging, as Post-Consumer Recycled Resin (PCRR), which is a plastic resin made from consumer-grade plastics, that contributes to the circular economy idea.
- Utilization of non-polymer raw materials such as, paper or fiber-based materials, for instance, bagasse, water hyacinth, etc. This allows for the ability to compost or biodegrade at home or in the community. The packaging should be able to replace foam or plastic packaging.
- Implementation of smart packaging, which is a novel packaging that focuses also on consumer convenience, defies traditional packaging standards that solely serve to protect the product or to enhance its appearance. Smart packaging has combined modern technology with packaging to extend the shelf life of the fruit or food in the package to extend storage time.
- The Green Network Issue 55 (July, 2014) discussed the next-generation packaging design, which should be designed to minimize unnecessary packaging

components, conserve natural resources and reduce environmental impact. Modern packaging is generally intended to be lightweight and utilizes fewer materials while continue to protect the products conventionally. An example of eco-friendly packaging improvements is to have a label that displays the level of CO_2 emissions so that consumers are aware of the issue or decrease the use of plastic labels.

The last decade has been a period of transformation from analog to digital. Technology has become a value-added and communication route for customers in the digital world, including the packaging industry, as well as the labor market has resulted in rapid technological progress. These include the Internet of Things (IoT), Artificial Intelligence (AI), and robotics that aim to increase product values and expand new businesses. The insights report by the Customer Innovation Center (CIC) of Tetrapak Ltd., states that digital technology will be the first wave to transform the operations of manufacturers in the food and beverage industries. According to the report, the trend of incorporating digital technology into package materials would significantly alter how customers interact with packaging. As a platform for providing information and messaging to consumers, digital devices can add value to packaging. There are various technologies currently available to help consumers, such as Quick Response (QR) codes, (Radio Frequency Identification (RFID), and Near-Field Communication (NFC) which allow devices to share information by positioning them close together. Over the next decade, we expect to see packaging leverage technology to communicate with consumers more information about the packaging, such as where it is manufactured, where the raw material is grown, and where the packaging can be delivered for recycling.

2.3 Economics

According to the Fior Markets company's market situation assessment report of the eco-friendly packaging product titled, "Report: Global Eco-friendly Food Packaging Market Insights Forecast to 2028" which collected data between 2018 to 2020 and calculated to forecast market trends from 2021 to 2028, when considering the Revenues graph of each continent and comparing the global gross revenue of green packaging in 2020 and 2028, it can be seen that in 2020 the continent with the largest share of market

revenue was North America, followed by Europe, Asia-Pacific, Middle East, Africa, and South America respectively. In 2028, the order of continents by revenue ratio is expected to remain unchanged with dropping percentage in Americas while the opposite may be true for Europe and Asia. As for the outlook for the global market's total revenue of 2020, the revenue will be more than double in 2028 with the market average growth rate from 2021 to 2028 at 9.26%. The detailed analysis of revenue for each continent between 2020 and 2028 is carried out with the average growth rate from 2021 to 2028 of the eco-friendly packaging revenues for each continent. The growth of the market revenue on every continent will be more than doubled in 2028, with North America has the highest revenue, Asia-Pacific with the highest average growth rate at 10.68% follows by Europe at 9.48%, which is higher than North America.

When considering the Compound Annual Growth Rate (CAGR) graph of 2021-2028 and the revenue of each type of eco-friendly packaging in 2020 and 2028, the average product revenue and growth rate of eco-friendly packaging for all three groups has increased drastically in all groups. The recyclable packaging group had the highest average revenue and growth rate, followed by reusable packaging, and compostable packaging respectively. In this recyclable packaging group, plastic packaging and recyclable paper are also included, both of which are inexpensive. This could be one reason for their popularity among businesses and consumers than other groups.

Figure 1 shows the relationship between the revenue during 2020 and the average growth rates from 2021 to 2028 for each country in Asia-Pacific, United States and Europe. The market revenue of eco-friendly packaging products in Thailand is very low and has a lower average growth rate than many countries in Asia, the United States and Europe. Most high-income countries, in addition of having large population and large demand for packaging products, have a supporting policy to promote the use of eco-friendly packaging. The government policy is another crucial factor that exerts a huge impact on the packaging market. Although the Thai domestic market still has a relatively small demand, the much larger size of overseas markets like the United States and Europe can provide opportunities for Thai eco-friendly packaging entrepreneurs to export packaging to these countries rather than relying on domestic sales.

Southeast Asia is seeing an increase in the use of eco-friendly packaging. Consumer awareness of sustainability is driving this trend. Despite this growing knowledge, customers in the region are largely price-conscious and are unwilling to pay extra for eco - friendly packaging. Governments in Southeast Asia are encouraging changes to a circular economy. The "3 Rs" – reduction, reuse, and recycling – are the primary focus of sustainable and eco-friendly packaging strategies. Many ASEAN governments have implemented policies to encourage garbage disposal and resource reuse through recycling incentives. For example, in Surabaya - an Indonesian city - there was a planned activities in 2018 for residents to pay for bus fares with plastic bottles. In Singapore, the National Environment Agency has collaborated with a beverage manufacturer - F&N to launch 50 vending machines around the country where customers could return plastic bottles and metal cans in exchange for supermarket discount vouchers. Hong Kong Special Administrative Region of the People's Republic of China also manufactures a wide range of packaging materials. According to the Hong Kong Census and Statistics Department, in 2020, Hong Kong's export value of packaging to mainland China was HK$18.849 million (65.4% - the largest market). This was followed by exports to the ASEAN region at 10.5%, with Vietnam accounting for 4.8% and Indonesia accounting for 1.1%.

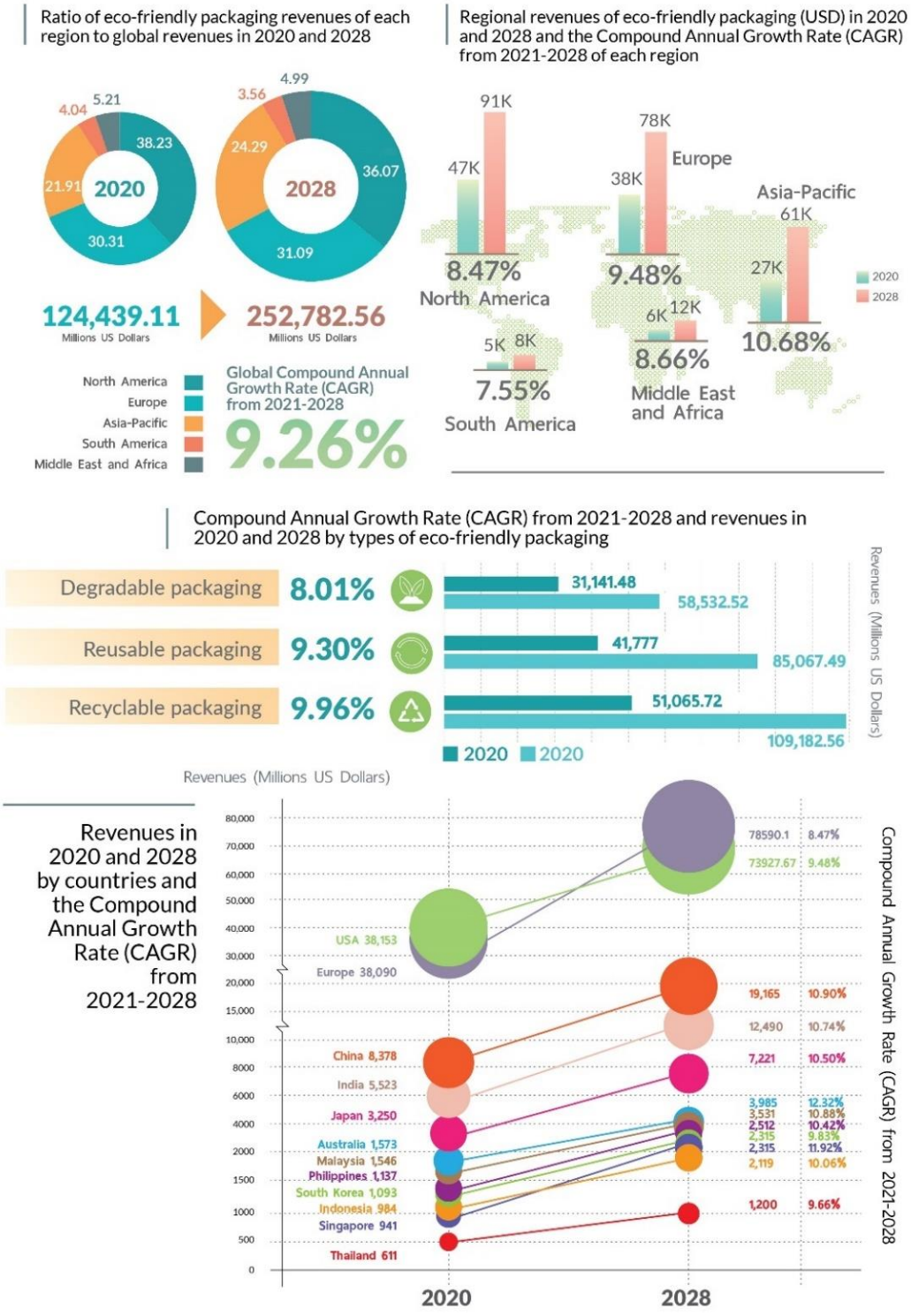

Figure 1 The relationship between revenue during 2020 and expected average growth rates from 2021 to 2028

As can be seen from the above information, the eco-friendly packaging industry is rising in both ASEAN and Hong Kong. This provides a great opportunity for new entrepreneurs and small businesses to enter the eco-friendly packaging business.

For Thailand, the "2020 Annual Packaging Industry Conditions Report" by the Office of Industrial Economics, Ministry of Industry, Thailand and an analysis by the Department of Packaging and Materials Technology, Faculty of Agro - Industry, Kasetsart University revealed the following information

- Plastic packaging is the most in demand types of plastic as the need for plastic packaging for personal hygiene and protection grows throughout the outbreak of COVID-19. Furthermore, the number of food orders for home consumption has significantly grown. As a result, single-use plastic packaging is used more frequently, making the issue of reducing plastic consumption among consumers temporarily less important.
- In terms of paper packaging. In 2020, compared to the previous year, the amount of paper packaging manufacturing and distribution fell slightly. This was due to the overall recession in the economy, which impacted manufacturing volumes, as well as a decrease in the use of corrugated boxes for various industrial items and a reduction in export output. Meanwhile, the value of imports of paper packaging increased by 21.88%, while exports dropped by 7.60%.
- Glass packaging production and sales volumes are expected to increase. The demand for glass bottles for pharmaceutical and medical products increased by 9.68%.
- The amount of metal packaging manufactured and distributed in 2020 increased in comparison to the previous year due to a rise in canned food consumption, particularly during the Covid-19 outbreak. Meanwhile, metal packaging imports increased by 18.91% in 2019, the value of exports dropped by around 3.20%. This stems from the ability of ASEAN countries to manufacture metal packaging and related parts. Furthermore, the price of steel sheets, metal cans, and parts for domestic operators is quite high, which has an impact on the overall economy.

The trend of eco-friendly packaging demand is expanding, according to the above data. Following the progress in the development of the COVID-19 vaccines, the economy should begin to improve. Strict regulatory measures on plastic-reduction measures such as plastic bags, various wrapping films, labels, straws, and single-use plastic-packaged products will resurface. On the other hand, domestic package manufacturers should look for new and innovative alternatives, such as packaging that meets the demands of health, convenience, safety, and environmental impact reduction.

2.4 Environment

Plastic waste is an environmental problem that has a huge impact on the trend towards eco-friendly packaging. Over 300 million tons of plastic are produced each year, of which 8 million tons end up in the seas and oceans. It is considered very dangerous to aquatic life with possible harmful effects on human who ingested aquatic animals that consume plastic. The impact of marine debris does not only create health problems for people and animals, but also affect the coastal tourism industry (IUCN, 2021).

The problem of plastic waste is an urgent issue of global importance. For example, in 2017 the United Nations Resolution to end ocean plastic pollution was signed, in 2018 the European Parliament supported a ban on single-use plastics (BBC, 2018), in 2019, Thailand as the ASEAN chair proposed the first ASEAN cooperation motion to decrease marine waste. However, since 2020, the world has faced a health crisis caused by the spread of the COVID-19 virus. Masks, PPE, plastic gloves, and other disposable items have been introduced as important parts in the fight against COVID-19. This can eventually result in an increase in marine waste and microplastics, especially in countries with inefficient waste management infrastructure. In addition to government management in the form of regulations banning single-use plastic bags in many countries, civil society organizations have also contributed to help tackle pollution from marine debris. For example, the Ocean Cleanup is a non-profit organization featured in designing and developing cleaning systems to tackle ocean pollution. They campaign to eliminate plastic waste that enters the seas and oceans to keep them clean and pollution free. At the same time, Greenpeace, as an International Organization for Environmental Conservation agency, is campaigning and raising public awareness of the plastic use dangers by

launching a Stop Single-Use campaign with nearly three million participants around the world. This activity is part of a voice to motivate companies in ceasing usage of disposable plastic packaging (Greenpeace, 2021).

2.5 Politics and governance

2.5.1 Sustainable Development Goals (SDGs)

The Sustainable Development Goals (SDGs) consist of 17 goals, 169 objectives, and 232 indicators. The SDGs have been implemented since 2015 and will be until 2030. Four of the 17 targets are related to eco-friendly packaging products, namely:

- **Goal 8:** Promote sustainable, inclusive, and sustainable economic growth, full employment, productive and affordable jobs for all.
- **Goal 9:** Build durable infrastructure, promote inclusive and sustainable industrial development, and foster innovation.
- **Goal 12:** Ensure a production model and sustainable consumption.
- **Goal 13:** Accelerate the fight against climate change and impacts occurred.

2.5.2 National regulations on the reduction of waste from used packaging

According to "The Drive Toward Sustainability in Packaging-Beyond the Quick Wins" report (Berg et al., 2020), over the past decade, the packaging industry has grown tremendously along with increasing usage of plastic in packaging as a replacement for other types of materials so that the convenience of customers is met. However, the massive use of packaging, especially single-use packing containers, has led to the accumulating serious problems of overflowing waste and contaminating natural water sources such as rivers, canals, as well as seas and oceans. The examples of countries that have implemented regulations on packaging waste are 16 states in the United States that have issued state-level regulations aims to mitigate the number of single-use plastics such as a bun of plastic grocery bags from supermarkets and increase waste recycling. In Europe, a new regulation was issued in July 2019, titled the New EU Directive for Single-Use Plastics (EU Commission, 2020) to decrease the use of over 10 types of single-use plastics that are commonly found on European beaches. These are (1) cotton bud sticks;

(2) cutlery, plates, straws and stirrers; (3) balloons and sticks for balloons; (4) food containers; (5) cups for beverages; (6) beverage containers; (7) cigarette butts; (8) plastic bags; (9) packets and wrappers; (10) wet wipes and sanitary items.

Moreover, Germany, France and the UK have issued the Extended Producer Responsibilities (EPRs) guidelines that allow product manufacturers or importers to be physically and financially responsible for their products at all stages of the product life cycle. This would cover upstream process such as the selection of raw materials in the production process to downstream including waste disposal or recycling. This EPRs principle exerts penalty fees to companies that do not implement reusable packaging. Other countries that have enacted regulations to decrease packaging waste include:

- **China:** banned and restricted imports of packaging waste in 2017, with plans to ban single-use plastic bags in 2022.
- **Australia:** optimized recovery and recycling of packaging.
- **Canada:** launched a national strategy on sustainable packaging and is launching a Zero Plastic Waste strategy with a set 2030 goal.
- **India:** issued regulations promoting the use of renewable materials and promoting awareness of waste separation.

Chapter 3

Trend and Business Structure

Environmental issues are crucial topics with ever increasing attention these days. More and more people are opting for eco-friendly packaging due to their increased environmental awareness and concerns. The rise in the willingness of customers to pay more for eco-friendly packaging is evident. This includes the growing trend among small businesses to incorporate eco-friendly packaging to enhance sales from environmentally conscious customers. Another stimulant that causes higher demand for eco-friendly packaging are the factors generated by policies and standards. ASEAN countries have a wide range of policies and legislation but are focused on issues that contribute to the achievement of the UN sustainable development goals. Each ASEAN country has its own general waste management regulations and specific packaging rules, according to the UNEP (2019) report, "The Role of Packaging Regulations and Standards in Driving the Circular Economy". Despite the fact that some legal laws do not mention packaging specifically. For example, in Malaysia, where types of plastics will be phased out by 2018 and 2030, and in the Philippines, where littering is prohibited, fines or community service will be imposed if waste is illegally disposed of. Some legislations also intend to solve the packaging waste problem by addressing the various motives that have driven consumers to become increasingly interested in using eco-friendly packaging.

ASEAN countries possess resources, knowledge, and capabilities for production of eco-friendly packaging. In addition, the geography of these countries also permits year-round agricultural activities with a diversity of crops. The eco-friendly packaging can be produced from plant pulp to replace or minimize the usage of petroleum-based polymers alternative plastics.

The article “Demand for Plastic Packaging in ASEAN Region” by Wisconsin Economic Development Corporation stated that ASEAN countries have the potential for plastic packaging production, especially, in the beverage and food industries, such as:

- With over 100,000 locations, Thailand is considered an important food and beverage production industrial hub. It provides 20% of the country's GDP and is the third largest industry in the country. Thailand has great potential to be a crucial bioplastics hub in this region.
- Indonesia is another market leader in plastics and packaging, particularly food packaging, with $1 billion in annual revenue and a 6.25% rise in 2016.
- More than 1,500 plastic manufacturers in Malaysia produce food and beverage packaging with an estimated value of $261 million in 2019. Plastic packaging is also being driven by Malaysia's pharmaceutical industry, in addition to food and beverages.
- Vietnam is a major food producer and exporter with more than 5,500 food processing companies. The food processing industry accounts for around 15% of its GDP and is regarded as one of the country's most important industries.
- According to interviews, more conventional packaging companies have added eco-friendly packaging lines to their production plants. The cooperation and assistance of research agencies in each country, as well as the cooperation of research groups in ASEAN countries, have contributed to the addition of manufacturing lines. Experts from universities and government agencies compensate each country's research team on ecofriendly packaging. These technical knowledge sources are ready to be transferred to the private sector. As a result, ASEAN's eco-friendly packaging growth path has ample potential for exporting to the global market.

In 2021, the Ministry of Commerce's Trade Policy and Strategy Office has analyzed the packaging market during the Covid-19 period with obvious rising demands in the global market (Bangkok Business, 2021). This could be a result of the e-commerce trend and the rising awareness for consumer towards health products following the economic recovery in many countries. In the first quarter of 2021, global packaging

commerce increased by 13% to $110,985.7 million, with exporting values of $57,813.5 million (14% increase) and imports of $53,172.2 million (12% increase). The United States, Germany, and China are the largest global exporters and importers. Thailand is the largest exporter of packaging in ASEAN. Export values in the first quarter of 2020 totaled 844.8 million USD, an increase of 11.2%, followed by Malaysia, Vietnam, Singapore, and Indonesia, respectively. According to the information provided above, packaging demands have continued to expand. The global packaging market is expected to grow at a 7.5% annual rate between 2019 and 2027. Consequently, ASEAN businesses should prepare to improve their competitiveness. The change in consumer behavior as a result of the Covid-19 epidemic, which consists of three concerns, is a significant topic to consider.

1. Consumers, particularly in developing countries such as India, Indonesia, and Brazil, prefer safe packaging.
2. Customers pay more attention to eco-friendly packaging that has a relatively lower environmental impact. European and Japanese consumers are concerned about marine litter, whereas Asian consumers are concerned about water and air pollution. Additionally, more than 50% of consumers in China, Indonesia, US, Brazil, Germany, Italy, India, and the UK are willing to pay more for eco-friendly food packaging. This contrasts with Japan and France, where less than 50% of consumers are willing to pay more.
3. Consumers in different countries have different opinions towards a type of eco-friendly packaging. Paper boxes, glass bottles, and glass jars are seen as eco-friendly packaging by consumers in United States and Europe. Compostable plastic film and paper packaging are seen as eco-friendly packaging by consumers in China, Brazil, and Indonesia. It is revealed that consumers in all countries considered packaging, which is a combination of plastic, paper and aluminum foil, or flexible packaging such as snack bags, frozen food bags and a bag containing a cleaning solution as items that could negatively impact the environment.

As a result, modern packaging is dominated by environmental hygiene and sustainability. For the global economy to thrive, Thai and ASEAN entrepreneurs must comprehend the changes in consumer behavior to build up market strength and pursue company growth opportunities. The innovation of packaging should focus on safety, recyclability, or compostability. To add value to the products and attract consumer attention, manufacturers may take actions such as utilizing recycled plastic pellets and labeling the product as sustainable packaging.

The interviews with stakeholders in Thailand, including agencies and related personnel in each step enabled collection of process data up to management level regarding implementation of packaging products. This data can be categorized into three phases along the production supply chain: upstream, mid-stream and downstream, as shown in Figure 2-4.

3.1 Upstream

The upstream phase starts from raw materials sourcing to packaging production. The agricultural industry in Thailand provides a wide range of resources such as cassava, corn, sugarcane, rubber, wood pulp, and other items. These are used as raw materials by packaging manufacturers who adopt agricultural waste such as rice straw, sugarcane leaves, pineapple leaves and corks, banana plants, etc. Furthermore, industrial waste from starch manufacturers, sugar factories, canned pineapple companies, sawmills, and other sources can also be utilized in the packaging production process.

In Thailand, packaging production uses mainly plant based raw materials that are by-products of agriculture and other industries. Raw materials are sent directly or processed into plant fiber semi products. The required knowledge and technology are relatively uncomplicated to valorize agricultural and industrial waste. Mae Fah Luang University and Burapha University are currently working on the commercialization of these wastes through their research institutes. The further development of SMEs and farmer groups has potential.

In the bioplastic section, pellets are imported by most entrepreneurs. Polylactic Acid (PLA) is made from the process of combining starch and sugar products such as

corn starch, tapioca starch, and sugar cane to produce bioplastic pellets. Currently, a factory in Rayong called Total Corbion PLA can produce and sell bioplastic pellets. The entrepreneurs usually collaborate with both Thai and international research institutes with required machineries for production process being imported from abroad. The government-supported agencies also provide support for start-ups in the packaging manufacturing business.

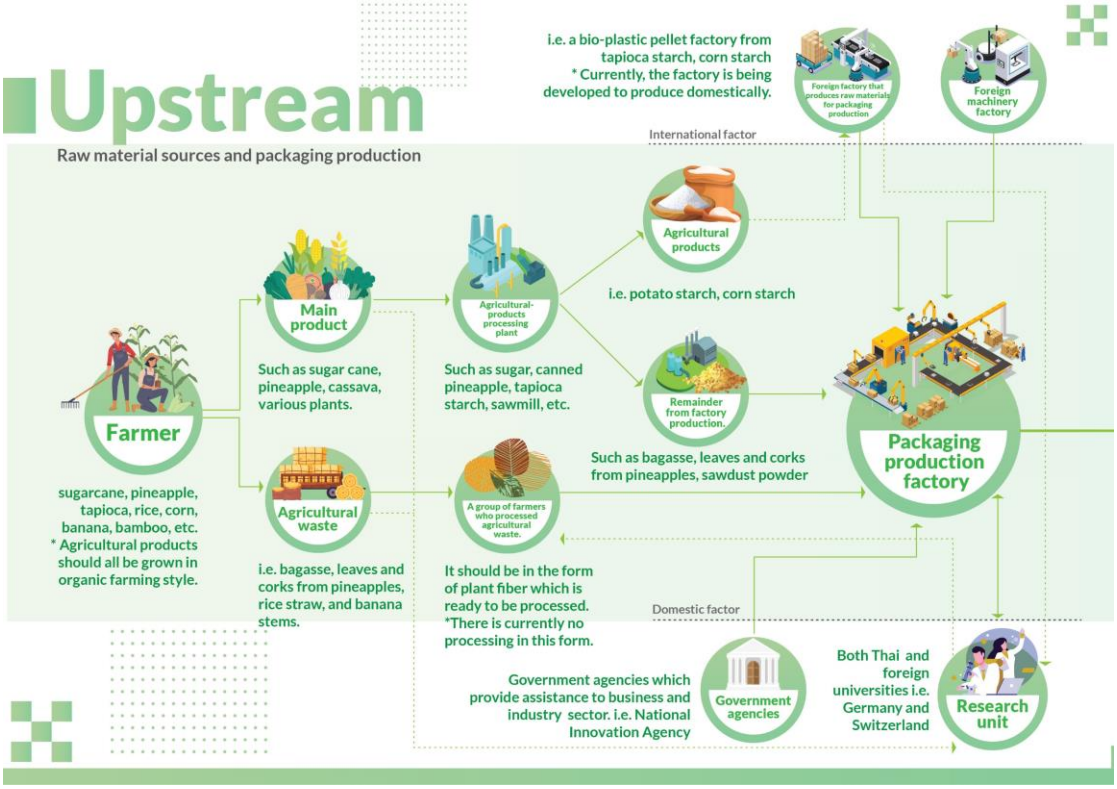

Figure 2 Upstream production supply chain

According to data from the Office of Industry, the Ministry of Industry, currently there are the following packaging and supply chain operators:

Number of packaging types and manufacturers in Thailand	
Packaging types	Manufacturers (cases)
Glass	131
Paper	583
Plastic	1,075
Metal	192

Number of packaging supply chain type and manufacturers in Thailand	
Supply chain types	Manufacturers (cases)
raw materials	115
label manufacturer	105
contract packers	43
coating/additives	71
ink manufacture	59
others	173

Regarding the current situation in the upstream sector of bioplastic packaging, marketing report done by Nova Institute (2019) revealed that the global productivity of bioplastic increased from 2.11 million tons in 2018 to 2.62 million tons in 2023. The trading value increased from 4,000 million US dollars in 2017 to 14,000 million US dollars in 2023. Asia is reported to be the global hub of bioplastic production, accounting for 45% of global production in 2021 (The ASEAN Post, 2020). China is the world's largest bioplastic producer (Mordor Intelligence, 2019). Since the Chinese government implemented the ban on single-use and non-biodegradable plastic, plastic production companies who contributed to 29% total global plastic production have converted the conventional plastic factories to new bioplastic factories. Their efforts corresponded to the Chinese government's policy on banning plastic bag, straw and utensils which were implemented since 1 January 2021 nationwide. Those who failed to comply with the new regulation will be fined ranging from 10,000 to 100,000 RMB or approximately 1,545 to 15,460 US dollars (Library of Congress, 2021).

The market survey reveals that Chinese companies actively produce compostable plastic, for example, the China BBCA Group has planned to increase PLA production from 50,000 tons/year to 700,000 tons/year by 2023. This attempted endeavor is almost twice the predicted global production in 2023, which is forecast to be only 370,000 tons, a big increase from only 200,000 tons in 2019. Such ambitious increase of bioplastic production would exceed the overall global production (Asia Nikkei, 2021).

Bioplastic production in ASEAN has continued to expand. This was evident from the report of Thailand's Board of Investment (BOI) who stated that the Cabinet of Thailand has approved a tax reduction plan up to 12.5% for private companies who purchase and use bioplastic in their products. This financial incentive aims to induce 10% of plastic companies in Thailand to convert their conventional plastic products to bioplastic. Thailand has high potential to be a bioplastic hub thanks to the abundant availability of raw materials. Thailand is notable as the world's top exporter of cassava, producing over 30 million tons/year and the world's second exporter of sugarcane with the volume of 13 million tons/year or 13% of the global market. Avani Eco, based in Bali, is an Indonesian company produces bioplastic from cassava roots. Their bioplastic products can be readily dissolved in water and are compostable. Another start-up company – Evoware, also from Indonesia, produces food packaging from seaweed. The seaweed has advantages over other raw materials as they can be cultivated in the sea thus requiring less land area for cultivation (Barrett, 2020).

3.2 Midstream

The midstream phase goes from product distribution to companies that use packaging for goods to end consumers. There are four main target groups, namely:

1. Fast-Moving Consumer Goods (FMCG) manufacturing companies who produce agricultural products, frozen foods, and consumer goods that require packaging for both domestic and international sales to foreign countries. These entrepreneurs are aware of the consumers' demands to protect the environment. A number of enterprises also employ eco-friendly packaging to improve the image of their products. Most of them have not been successful due to price issues where packaging costs are still too

high while some products also require further development due to technical issues such as bags for cleaning agents which require chemical resistant packaging, and etc.

2. Distributors of products both domestically and internationally including large supermarkets such as Makro or Lotus and convenience stores like 7/11 or Family Mart. These distributors provide important sources of distribution to consumers for eco-friendly packaging products in both food and beverage businesses.

3. Stores with food and beverage outlets that would like to switch to more eco-friendly packaging due to the introduction of no plastic bag policy in 2020 and the Thai Plastic Waste Policy Plan which will commence in 2022.

4. End-consumers who are concerned about waste and environmental issues and would like to adopt eco-friendly packaging.

Figure 3 Midstream distribution of packaging to end-consumers

3.3 Downstream

The downstream phase is the process of handling wastes from used packaging. Local governments, such as municipalities and sub-district administrative organizations collect most of the eco-friendly packaging wastes which can be divided into two categories, as follows:

1. Organic waste: These are plant-based packaging products such as paper boxes, cups and dishes from bagasse. It is considered compostable, biodegradable, and can be utilized by plants after the decomposition process. These wastes can be mixed with other types of organic waste to serve as mulch and fertilizer.

2. Waste packaging products made from bioplastics: The external appearance of this waste may look similar to synthetic plastic in appearance with relatively lower levels of degradation rate as they may contain components which are not recyclable. The appropriate management options besides disposing in landfill might include utilization as a fuel source for electricity generation and setting up of specialized industrial waste decomposition facility for this type of waste.

3. Waste problems stemming from Covid-19 pandemic: Governments around the world have launched social distancing measures during the Covid-19 pandemic resulting in people spending extended periods of time at home to minimize the chance of people contracting the Covid-19 virus. The article written by Klemes et al. (2020) pointed out the increase of plastic and other types of wastes which can exacerbate existing waste management issues prior to the Covid-19 pandemic. According to the authors, the rising demand for personal protection equipment such as masks, gloves, and medical equipment i.e., syringes as well as plastic tubes have increased drastically as these products are generally single-use. Moreover, these products are also considered as medical contaminated waste which require separate waste management strategies. Attitude of consumers is also the major cause for the increase of waste as they prefer single-use products for hygienic reasons. These include single-use plastic catering equipment (spoons, forks, knives, plates, wooden chopsticks, etc.). According to a survey in France conducted in July 2020, 5% of French citizens or around 2 million people littered single-use masks and gloves in public spaces, for example, streets, rivers, beaches, seas, and oceans (European Environmental Agency, 2021). Due to this irresponsible behavior, this

plastic waste breaks down into microplastics and enters seas and oceans causing negative impacts on marine life and ecosystems as a whole. In fact, food delivery service is another important cause of increasing amounts of plastic waste and packaging. Online shopping activities have led to the demand for additional packaging to wrap and transport the products safely and securely from producers or distributors to customers. The Covid-19 pandemic highlights the highly dependent nature of society towards plastic products. It could also reflect society's belief that plastic products are cleaner and more hygienic than other materials. Kampf et al. (2020) presented evidence that is contradictory to this belief as the Covid-19 virus can accumulate effectively on plastic surfaces similar to other materials. In conclusion, the increase of plastic waste due to the Covid-19 pandemic will remain a critical social and environmental problem in many years to come.

Figure 4 Downstream waste management of used packaging

3.4 Additional recommendations for eco-friendly plastic packaging

The following unanimous opinions to tackle plastic waste problems in Thailand were evident after interviews with various sectors relating to eco-friendly packaging products. The plastic packaging manufacturer must use only one type of recyclable plastic, as combination with another type of plastics such as polyethylene terephthalate (PET) will render recycling processes ineffective. The impacts of banned usage of all plastics will be far reaching to all sectors there are also a number of personnel involved from upstream to downstream. The selection of the right type of plastic, utilization of only one plastic type for a specific product, and implementation of effective waste separation strategies are all considered crucial steps to solve this waste problem.

From Figure 5, raw materials used in the manufacturing of plastics are produced through the gasification and fuel refining process. The desirable properties of plastics are tough, durable, lightweight, water-air impermeable, and easy to clean have led to popularity in its preferred usage in the packaging industry. Many types of plastics are also relatively inert when subjected to chemicals with heat resistant properties and are difficult to decompose. The single-use plastics in products containing food, beverages, straws, and carrying bags should be discouraged as they are harmful to both the environment and health. Furthermore, the usage of plastic Fast Moving Consumers Goods (FMCG) products could generate a significant amount of plastic waste. If plastic waste is not properly separated and recycled, some deposited waste to the landfills will eventually leak and result in contamination of natural waterways, rivers, seas, and oceans with detrimental effects to marine ecosystems.

Figure 5 Plastic packaging products

Chapter 4
Opportunities and Challenges for SMEs in the Eco-Friendly Packaging Industry

The opportunities and challenges of SMEs conducting business in Thailand's eco-friendly packaging supply chain were compiled from interviews in this research. The analysis also covered perspectives from all relevant sectors using SWOT analysis, which consists of four aspects, namely, Strengths, Weaknesses, Opportunities and Threats. The following details are presented:

4.1 Strengths

- Domestic entrepreneurs who produce various types of consumer goods are aware of environmental issues and are already interested in using eco-friendly packaging products. Overall, it can be concluded that eco-friendly packaging is in demand of domestic markets under the support of both ASEAN and Asia-Pacific.
- Thai SMEs have many natural resources due to the nature of Thailand as an agricultural country. Agricultural raw materials are relatively in abundance and inexpensive in Thailand. In fact, unusable agricultural waste can readily be used as a raw material for the manufacture of eco-friendly packaging. This will provide farmers with more income while mitigating the problem of air pollution caused by agricultural waste burning.
- Thai SMEs excels at delicate and elegant handicrafts that are well-known and welcomed by the Thai domestic and the international markets.
- Farmers or small-scale entrepreneurs can process raw materials by themselves at home and sell them to the packaging companies. This will create added value for raw materials by using simple technology and knowledge.
- SMEs who are interested in the production of eco-friendly packaging often have experience in packaging production. Thus, there is a high chance of success if they expand and develop their businesses to create eco-friendly packaging products.

4.2 Weaknesses

- SMEs are unable to compete with large corporations in the mass-production markets, which can lower the price per unit.
- SMEs still pay more attention on the domestic markets rather than the international market. Many SMEs still lack knowledge and skills in online business and e-commerce.
- Standards and rules for exporting goods to overseas markets are still unknown to many SMEs.
- Some SMEs use imported machines; however, they lack technicians with the skills to adjust or repair them. As such, existing machines cannot be adapted to produce eco-friendly packaging products.

4.3 Opportunities

- Handcrafted or handmade packaging is still highly sought after in the high-end market.
- Increasing concern in global environmental conservation.
- Consumers are already aware of the environmental benefits of using eco-friendly packaging.
- There are government agencies that are ready to provide funding, such as the National Innovation Agency (NIA). Similar agencies also exist in Cambodia, namely, the National Science and Technology Council.
- There are private agencies that are supporting SMEs in networking with other industrial partners such as, Thailand Institute of Packaging and Recycling Management for Sustainable Environment (TIPMSE).
- Universities across the country have research units on eco-friendly packaging that possesses the knowledge and technology to be developed and transferred to the industrial sector. Government agencies support these research units in order to generate more products in response to market demands. Examples of agencies that provide support, for example, Biodiversity-based Economic Development Office (Public Organization) or BEDO, National Research Council of Thailand (NRCT). Furthermore, universities themselves have set up internal units that

provide research grants to researchers and have co-invested with private companies.

- There are significant opportunities in foreign markets such as the United States, Europe, China, and Japan, which have passed laws to decrease the usage of plastic packaging items. Eco-friendly packaging is in high demand in these markets with an increasing growth rate every year.
- Online sales make it easier to reach a larger size of customers ranging from domestic websites such as Shopee, Lazada, Facebook or foreign websites i.e., Amazon, eBay, Alibaba, etc. These online shopping websites enables SMEs to reach out to international consumers.
- The ASEAN country's market for eco-friendly packaging is expected to highly grow. The government has a goal to reduce plastic packaging usage and expects to ban some plastics entirely by 2030.
- Throughout the supply chain of the eco-friendly packaging industry, there are many steps and processes which SMEs can be involved. SMEs do not necessarily produce eco-friendly packaging themselves, but can also choose to provide service in the downstream process.
- The activity of producing eco-friendly packaging products align well with the local and national policy to decrease the burning of agricultural wastes which cause air pollution from PM 2.5. As a result, many governments and local authorities are available to provide incentives and support to SMEs. Thailand local community entrepreneurs are financially supported to run businesses in converting leaves or coconut husks into containers such as cups, plates, and other food containers.
- The Thai Ministry of Industry has announced the Notification of the Ministry of Industry No. 4421 (B.E. 2555, 2012 A.D.) regarding the establishment of industrial product standards on biodegradable plastic specification Standard No. TIS. 17088 – 2555 which was published in the Royal Thai Government Gazette on May 2, B.E. 2555 (2012). The standard identified scope, definition, quality, characteristics, and labels based on ISO 14855-1, ISO 16929, ISO 20200 or TIS 2509. Once the products have passed the test, the permission would be granted

to display statements on their products, for example, “degradable”, “degradable in a local fertilizer factory or industrial fertilizing factory” and “biodegradable during fertilizing process”. SMEs can follow such standards when producing products.

4.4 Threats

- Covid-19 pandemic has caused a rise in the use of plastic, especially food products in food delivery services. It also raises the price of eco-friendly packaging more than that of conventional packaging. This is due to economic challenges caused by the government's epidemic mitigation measures; sales of eco-friendly packaging have decreased because consumers have less income and thus lower purchasing power.
- The handicraft-focused market has a small number of niche consumers.
- One criterion of exporting eco-friendly packaging is that the products must be tested and qualified by the foreign country's rules and standards. At present, Thailand lacks governmental departments or non-profit organizations which provide information on international and national standards on eco-friendly packaging. This includes ASEAN, which lacks a central authority to provide information on eco-friendly packaging standards.
- There is also no government safety regulation for food packaging. Significantly less expensive plastic packaging is now available on the market, but consumers are unaware of the health risks associated with the usage of substandard plastic packaging for food.
- SMEs have difficulty in producing products according to the demands of consumers. Mass production of handicraft items might encounter problems in consistency of product quality.
- There is still misunderstanding regarding the types of bioplastics among SMEs and general customers. For example, some bioplastics cannot be biodegraded within a reasonable timeframe or recycled with other conventional plastic products. There is a strong need for raising awareness and providing accurate information to the public on types of acceptable bioplastics.

- The variation of plantation and harvesting seasons might affect the availability of some agricultural materials
- Some raw materials, such as cassava, sugarcane, and corn, are also food crops. The problem of food security threats on these food crops may rise due to competition with packaging production that can lead to shortages.
- Agricultural waste has already been used for other purposes such as, rice straw for planting mushroom, onion, and garlic. This could raise competition in raw materials and induce the higher prices.
- The supply of biodegradable polymers like PLA is insufficient to fulfill the demand.

Chapter 5
Integrating SMEs into the Eco-friendly Packaging Global Value Chain

5.1 Overview of ASEAN Countries and Key Partners of ASEAN

5.1.1 China

According to report by GlobalData (2020), "China Packaging Industry - Trends and Opportunities", it is forecast that packaging industry in China will reach 1,004.9 billion units by 2024. China's CAGR from 2019-2024 is 1.8%. Rigid metal packaging has the most CAGR (5.9%) among all types of packaging materials. Rigid plastic packaging has CAGR for the same period of 2.8%. Chinese consumers have changed their consumption patterns due to a changing lifestyle that required more speed and conveniences. Consumers preferred packaged food which can be carried conveniently with them. The awareness and concerns on environmental issues among Chinese people have led to the rising demands for eco-friendly packaging and recycling of used materials. The concerns in health issues also encourage many Chinese consumers to pay attention to serving size. Many consumers would rather choose smaller portions. Thus, individually packaged food is a growing trend for food and beverage in China.

China is the highest plastic waste producer in the world, particularly for single-use plastic. Landfills in the country are all filled up and cannot be used despite the previously forecast end of use time period of 25 more years (Wernick, 2020). In 2017, the Chinese government attempted to solve plastic waste by banning plastic waste import to the country. On 1 January 2020, single-use plastic banning law was implemented. On 6 January 2020, two parties, namely, National Development and Reform Commission (NDRC) and the Ministry of Ecology and Environment, signed an endorsement to the single-use plastic banning regulation. The details are summarized below:

- Banning use of non-degradable plastic bags in the department stores, supermarkets, pharmacy, bookstores, and take-away restaurants. This regulation has started in large cities since late 2020. The smaller cities will implement this ban in 2022, while fresh market produces will be subjected to the ban in 2025.

- In 2020, all restaurants in China were prohibited from providing non-degradable plastic straws to customers. In 2022, plastic utensils such as spoon and fork will be banned in restaurants nationwide, and in 2025 a similar ban will take effect on all take-away restaurants regarding plastic utensils.
- For parcel and delivery products in Beijing, Shanghai, Jiangsu, Zhejiang, Fujian, Guangdong, it is prohibited to use non-degradable packaging by 2022. This regulation will be implemented nationwide in 2025.
- Penalties for the violation of the regulation on single-use and non-degradable plastic and packaging are between 10,000 to 100,000 RMB.

5.1.2 Vietnam

Packaging industry in Vietnam began in 1990s, with a focus on paper and carton materials. Until the 21st century, Vietnamese trades and marketing has enormously expanded as a result of foreign direct investment. A number of private companies of all sizes are rising. Packaging industry accounts for 2% of the total Vietnamese economy. The Vietnamese government has actively established trading partnership with foreign countries including ASEAN countries, the United States, European countries, Japan, and Russia. Vietnam recently has become an investment hub of foreign companies, which allows for a great business opportunity for the packaging industry. World class department stores have opened their branches in Vietnam, for example, Aeon and Lotte. Moreover, due to the rise of e-commerce, Vietnam has emerged as one of the fastest e-commerce economies in the Asia-Pacific. Such expansion is attributed to the emergence of the middle class, young generation, and the wider usage of smart phones and internet. According to a report by GlobalData (2020), online business in Vietnam is forecast to have grown as high as 18.8% between 2020-2024. The market value of online market is expected to increase from 9.4 billion USD in 2019 to 26.1 billion USD in 2024. The COVID-19 pandemic also accelerated the growth of Vietnam's e-commerce. In 2020, online business reached the value of 13.100 billion USD. Foreign companies have also deployed various strategies to start business operation in Vietnam. The most popular method is the Merger and Acquisitions (M&A) technique between foreign companies and domestic ones (Van, 2021). For example, Siam Cement Group PLC (SCGP) from

Thailand purchased 70% of shares from Duy Tan Plastic JSC in order to expand their business in packaging industry to meet rising demand in Vietnam. SCGP also jointly invested in the paper industry with Vina Kraft Paper Co. Ltd. in Vietnam. Damgwon System of South Korea acquired two domestic companies, namely, Tan Tien Packaging (TTP) and Minh Viet Packaging, giving them a leverage in product prices from their competitors. Japan' Sojitz Pla-Net Corporation entered Vietnam's packaging industry via an acquisition of 20% shares in Rang Dong Long An Plastic JSC, which is a subsidiary of Rang Dong Long Plastic JSC, a major plastic producer in Vietnam. An interview with Mr. Ho Duc Lam, the chairman of the Vietnam Plastic Association revealed that Vietnam's packaging industry and plastic industry are attractive to foreign investors from Asia. Asian companies generally prefer utilizing M&A techniques to enter the Vietnamese market while Western investors usually open their own manufacturing factories in the country.

Vietnam's packaging industry is mostly tied with polymer products and responses to exporting market rather than domestic one. At present, there is rising awareness of the public and rising awareness of environmental protection. As a result, many companies started to produce more biodegradable and eco-friendly packaging in response to the changed consumers' preference. For example, Phat Bioplastics, Biostarch, Phu My Plastic Production, and JSC have developed technology to produce bio-degradable plastic bag, gloves, utensils, and straw. Branded department stores and supermarkets such as Co. opmart, VinMart, Big C, Mega Market and Lotte decreased the usage of single-use plastic bags and changed to eco-friendly packages. The report from VNA (2021) stated that by 2025, Vietnam will require over 80,00 tons per year of biodegradable plastic.

5.1.3 Hong Kong

There are large numbers of packaging industries in Hong Kong who produce diverse types of packaging ranging from cartons, paper bag, paper food container, PE packaging for a variety of products such as food, clothes, food wrapping, and polyvinyl chloride (PVC) as well as metal packaging for beverage and edible oil. Data from the Hong Kong Census and Statistics Department revealed that in 2020 exported packaging was at 18.849 billion HKD. Among this export, 65.4% was in China while 10.5% went

to ASEAN countries with 4.8% and 1.1% went to Vietnam and Indonesia respectively. Hong Kong companies are well-recognized and highly regarded for quick response and capable of rapid adjustment of their businesses to align with diverse demands and preferences of customers. They are also specialized in developing fast delivery products to the customers. Packaging industry also receives strong supports from the printing industry in Hong Kong. Consequently, the values of packaging products can be augmented by patterns and designs on the products. China is the largest market for Hong Kong companies as they are a manufacturing hub for commodity goods which require packaging. E-commerce also keeps expanding in China, leading to rising demands for packaging products (paper, cardboard, box, bubble plastic) that serve their function of secure wrapping and containing of the products.

In 2003, China and Hong Kong signed a Mainland and Hong Kong Closer Economic Partnership Arrangement (CEPA) allowing products made in Hong Kong to be exported to China without custom charges (Ho, 2021).

However, similar to other countries, Hong Kong has seen the increased concerns for environmental protection, particularly from plastic waste. The Green Sense, a local NGO, carried out a study and revealed that in 2020 there were over 780 million pieces of plastic packaging used for online delivery products. On average, one online product would require 2.32 pieces of packaging, which causes a huge amount of waste (Heung, 2021). In 2019, the Environmental Protection Department (EPD) launched a plastic-free campaign aiming to mitigate single-use plastic utensils. The campaign was a success, as around 1.2 million pieces of plastic waste were decreased. In order to comply with pressure from the public, the Hong Kong government decided to endorse a plastic ban policy in all restaurants (South China Morning Post, 2021). Stage 1 of this policy prohibits all restaurants from providing single-use plastic utensils for customers dining in the restaurants. This first stage will commence in 2025. The second stage will further expand the regulation to include take-away customers as well.

5.1.4 Overview of current situation in Japan

The "Japan Packaging Industry - Trend and Opportunities" report from GlobalData in 2020 reveals that packaging industry in Japan will reach 164.7 billion units in 2024, in which the CAGR from 2019-2024 is 0.5%. Among all types of packaging, rigid plastic packaging has the largest growth rate, accounting for 2.2% during the period 2019-2024. Flexible plastic packaging ranked the second and have CAGR of 0.6% in the same period. Being convenient when transported, cheap and resalable causes increase in popularity and usage of rigid plastic package among non-alcoholic beverages. Rigid plastic packaging has the largest market share of 31.9% in 2019, followed by flexible plastic packaging which holds 25% of market shares. Despite the fact that 84% of plastic waste in Japan are recycled, there are still some wastes that enter the ocean and become microplastic that contaminate the marine ecosystem. Japanese seas have microplastic at 27 times higher than the average world amount, which corresponds to the usage of over 30 billion plastic bags per year in Japan. Japanese culture emphasizes customer service is an important contributing factor to plastic waste. For example, convenience stores usually provide single - use utensils to customers which cause unnecessary waste. Since 1 July 2020, convenient stores have begun charging five yen for large plastic bags and three yen for small and medium bags. This measure aims to induce behavior changes of consumers to protect the environment. On 9 March 2021, Japanese cabinet approved an Act prohibiting restaurants from distributing plastic utensils to customers, which will be implemented in April 2022. Restaurants failing to comply will be fined up to 500,000 yen (Steen, 2021).

5.1.5 The Philippines

The "Philippines Packaging Industry-Trends and Opportunities" report from GlobalData shows that packaging industry in the Philippines will reach 69 billion units in 2024, with the CAGR from 2019-2024 at 3.3%. The demand of rigid plastic packaging remains the fastest increase among all types of packaging. It has CAGR of 6.4% between 2019-2024. This is followed by rigid metal packaging with CAGR at 4%. Major demand for packaging stemmed from processed food products, followed by beverages, which require easy to transport packaging. Such demands cause the rise in popularity of rigid

plastic packaging. Metal cans are widely used in non-alcoholic beverages. Elixir (2019), a company producing packaging machinery, forecast trends in the Philippines' packaging industry that packaging companies are likely to produce multi-sizes containers to meet various demands of the consumers.

Food and beverage products are more likely to have smaller packaging sizes to facilitate the hand holding of the products, i.e., 200 ml container of soft drink. Condensed milk and sandwich spread are usually filled in sachet packaging. Cleaning products are more likely to use a relatively larger container, such as a 4- kg detergent. In the Philippines, paper has been recycled the most while plastic waste did not follow this trend. Over 80% of plastic waste are used sachets and single-use plastic bags. There are some research and development spending on a biodegradable food container made from starch and clay (domestic resources). The Technological Institute of the Philippines has developed alternative materials from corn husk and chicken feathers. In July 2021, the parliament passed the final draft of plastic ban regulation called House Bill 9147 (Cervantes, 2021). The Bill will control and limit the import, usage, distribution, recycling and waste management of single-use plastic. Shops now charge 5.00 PHP from customers for a single-use plastic bag. Those who fail to comply with the Bill will be fined between 50,000 PHP up to 500,000 PHP for small size companies and 250,000 PHP to 1,000,000 PHP for large size companies.

5.2 Lessons Learned

This report includes in-depth interviews with selected businesses from China, Hong Kong, Japan, and the Philippines. The participants are as followed:

1. Prof. Zhu jing
   Lecturer, Ningbo Institute of Materials Technology & Engineering
   Chinese Academy of Sciences
   China
2. Mr. Hồ Minh Sang
   Managing Director
   JOY Food Co., Ltd.
   Vietnam

3. Mr. Flavien Chaussegros
   Co-founder of Invisible Company
   Invisible Company
   Hong Kong
4. Prof. Masahiko Hirao
   Lecturer, Department of Chemical System Engineering
   The University of Tokyo
   Japan
5. Mr. Pocholo Miguel M. Espina
   Chief Executive Officer
   Sip PH
   The Philippines

5.2.1 China

- Professor Jin Zhu has published research works for entrepreneurs and other stakeholders and disseminate knowledge from the academic sector to the social business sector through organizing academic seminars. This event allows bridging contacts between investors and researchers that may lead to a joint opening of the company in the end.
- Extension of research work into the establishment of their own companies is possible by using the opportunity of the comprehensive supports from the Chinese government. The business can be set up with a supporting agency that provides product quality inspection and certification services.

5.2.2 Vietnam

- Originally, the business of Mr. Hồ Minh Sang planned the launch of the new products in the Vietnamese market first with a focus on understanding consumers while at the same time educating them about the negative effects of plastics and new eco-friendly options. He also collaborates with NGOs as the medium of transferring knowledge to society.
- In 2019, the company signed a contract with Grab Food in Vietnam for the distribution of eco-friendly packaging. This included business plans and projects supporting Grab Food's Eco-Campaign on Green Food Green Living. Currently, the company's products are distributed directly to Grab Food.
- The middle and high-end restaurant customers can easily adjust to the rising food prices from the use of eco-friendly packaging from bagasse at higher production costs due to affordability of consumers in this upper market. This is compared to street food restaurants where consumption of conventional plastic is still in place due to price-sensitive consumers.
- The company also sort out low-quality products after thorough selection and inspection of product quality prior purchase decision. This includes certain products containing chemicals exceeding the acceptable standards.

5.2.3 Hong Kong

- In the research and development of the product, the interviewee has cooperated with the government. Hong Kong government has set up research centers such as the Smart Government Innovation Lab, to facilitate access of private sectors to product research services at a relatively low cost. This is because the Hong Kong government would like the private sector to develop products for industry promotion in Hong Kong. The assistance of the company by research institutes was to develop products from raw materials while satisfying the demands of the company. In fact, the products of the company are also tested by researchers in Hong Kong Universities for certifications through FTIR analysis, ASTM D5511, Vitargent, and etc.

- Since Hong Kong does not have resources for raw material for the packaging production, the company hence outsourced the production process to factories in China and Indonesia where the research and development process, both for the form and marketing of the product, are directly controlled by the Invisible Company.
- The founder chose to form a company in Hong Kong based on the experience of having lived in Hong Kong for 9 years and convenience of conducting start-up business. The government policies are also very conducive to setting up a company. Hong Kong is the center of investment between many international companies which allows for the exchange of information between them, flexible tax rates for start-up entrepreneurs, easy business establishment systems in terms of registration and financial systems, including building a network of investors.

5.2.4 Japan

- Professor Masahiko and team noticed that biodegradable plastic is unable to decompose in sea water. Therefore, the initiative of joint invention and development with the company to address and tackle marine plastic problem has been established. In 2018, Japan chaired the G20 meeting and held the Osaka declaration agreement to reduce marine plastic waste.
- A business association's declaration and labeling, which indicating if a particular product is made from biodegradable plastic, will enable customers to distinguish eco-friendly products with increased confidence.

5.2.5 The Philippines

- Sharing ideas with like-minded people using a personal networking such as attending seminars organized by the university and inviting successful and active alumni to attend is a key to start the business. Public relations can be established through social media and boosting view counts or subscription through various strategies such as buying advertisements on Facebook and Instagram.
- Currently, there is no government agency responsible for the use of eco-friendly packaging products as well as no existing standard in product certification.

- The market in the Philippines is changing according to the trend, especially among teenagers, college students and working people.
- Strategy of uploading product photos on the website including specially named products that are attractive, fun, or exotic (cool, unique and humorous nature) will attract a lot of online customers.
- An education module for customers on the use of the new alternative product that should be reused several times to offset the production cost should be provided. In addition, the reusable metal straws are not cost-effective to replace plastic straws as they utilize more energy to produce.
- The focus on the inexpensive and rapid shipping system is quite important. In fact, Chinese entrepreneurs can meet this requirement leading to significant orders from China.

5.3 Opportunity to enter the global value chain

5.3.1 China

- China has discontinuities limitation on the unevenness of biomass crops during harsh winters. This is compared to ASEAN countries where many crops are available all year-round with plentiful raw materials for bioplastic such as rice straw. ASEAN countries can therefore conduct business with Chinese investors in supplying raw materials but should find strategies to pre-process raw materials first to increase value.
- The international cooperation can be built through organization of international academic conferences. For instance, the "2018 Asian Development Forum on Bio-based Materials" academic conference was held in Thailand in 2018. Two Thai funding agencies, namely, National Science and Technology Development Agency (NSTDA, Thailand) and National Innovation Agency (NIA) co-hosted this event with Chinese agencies including, Ningbo Institute of Materials Technology and Engineering, CAS Key Laboratory of Bio-based Polymeric Materials of Zhejiang Province, DT New Materials Bureau of International Co-

operation, Chinese Academy of Sciences, Ministry of Science and Technology. This activity brought investors from China to meet SMEs in Thailand.

5.3.2 Vietnam

- Many entrepreneurs in the industry are trying to develop joint business with those of ASEAN countries using Vietnamese raw materials in eco-friendly packaging production.

5.3.3 Hong Kong

- Due to the COVID-19 situation, the demand for single-use packaging has increased. Eco-friendly packaging market is still hard to access for commercialization. However, this industry has a potential to grow in the future or post COVID-19.
- The products from this company are considered eco-friendly as they do not cause pollution, including a packaging bag that can be used with many types of products such as clothing and handmade products. The company is willing to cooperate with SMEs of Thailand and ASEAN countries with other types of products.

5.3.4 Japan

- According to Japanese tradition, gifts must be wrapped with care, using only paper and wrapping a gift with plastic is considered unacceptable. ASEAN SMEs can open up new business opportunities for the production of gift boxes or wrapping paper based on plant fibers. It is considered as a high-end product with high pricing and large market size since Japan has a large elderly population.
- Japan does not have diverse biomass raw materials, especially when compared with ASEAN countries. Japan mostly imports biomass raw materials from Brazil. Therefore, SMEs can establish trade cooperation with a Japanese company by supplying raw materials from biomass with certain degree of processing to elevate selling price. The example includes exporting palm oil from the southern Thailand to Kaneka corporation who produces biodegradable plastic. Furthermore,

ASEAN can export some processed raw materials from sugar cane, cassava and starch for bio-plastic production to Japan.

To qualify for import. eco-friendly packaging products made by biodegradable plastic must be accredited and certified by Japan BioPlastic Association.

5.3.5 The Philippines

- Philippines is a member of the ASEAN Free Trade Area (AFTA), so there are opportunities within ASEAN and countries with trade agreements with ASEAN.
- Products with strong growth potential in the Philippines include vegan food packaging products, household products, such as natural fiber bedding or linen, etc.

Chapter 6
Business and Policy Suggestions

6.1 Upstream

6.1.1 Research and development

Research funds should be allocated to academics or students to innovate and develop new technologies from the selected raw materials, packaging design, features of packaging that can be used for more types of products, or the management of packaging waste in terms of reusability or recyclability. In addition, the government sector, by relevant agencies, should promote the creation of academic researchers' networks who work on eco-friendly packaging such as establishing Researchers Association so that annual meetings or other relevant activities can be organized. This network could also expand to the global level, such as building a network of ASEAN and foreign researchers through research funding that allows researchers from abroad to join research with ASEAN universities to organize international academic conferences and other relevant activities.

6.1.2 Certification service

The government should encourage the establishment of more laboratories, especially for qualification inspection services or quality measures as well as providing quality certificates for qualified packaging products. Cooperation from the existing laboratories of universities in major provinces in each region may be required to facilitate the formation of these specialized laboratories in the very first step. Furthermore, the government should support the budget for SMEs to test their products. For example, China has two service centers for entrepreneurs in Beijing and Guangzhou with the service fee of about 2000 RMB per product and the inspection period until the certificate is issued has an average timeline of 6months each, depending on the complexity of the material of the product.

6.1.3 Preparation of raw materials database

Collecting information should be prepared in the form of e-database on types, quantities and sources of agricultural waste that can be used to produce eco-friendly packaging by an agency responsible for the collection and dissemination of information to individuals or organizations who seek the information such as entrepreneurs as well as academics. This information is very important because it allows entrepreneurs to make business plans, to estimate investment budgets, to locate factories near the site of raw material sources, and to build local networks for conducting business. For academics, such data will help them understand the potential and challenges of the country's agricultural waste and relevant research inventions that can be solutions for problems faced by society and communities.

6.1.4 Supporting patent registrations

Researchers who can create innovative works should be encouraged to patent their own works with ownership rights rather than transferred to the institutional level so that most inventive works can be profitable.

6.1.5 Encouraging farmers to grow crops that can be used to produce eco-friendly packaging

Currently, crop rotation is popular among farmers as it would help avoiding diseases and insect infestations with beneficial effects on soil improvement. Such agricultural products can be sold in the market whereas agricultural waste can be used as raw materials in the production of eco-friendly packaging. Examples of raw materials are bagasse, bamboo pulp, rice straw, water hyacinth, palm pulp, and pineapple leaf veins, and pineapple corks. There should be a cooperation between farmers by the supports from the local government to educate farmers especially on organic plants, which is safe in terms of consumption and continual use. In addition, knowledge for further development of SMEs should also be provided in order to create a value chain in the market.

6.1.6 Supporting loans for entrepreneurs, SMEs

Loans for entrepreneurs should have the flexibility of low interest rates and repayment to be compatible with the common characteristics of start-up businesses that are not able to break-even or generate profits from the first year of business.

6.1.7 Promotion of education in processing agricultural waste into raw materials for farmers

The value of agricultural waste such as rice straw can be increased by farmers through pre-processing steps such as washing, spinning, and pre-digestion of raw materials prior drying it into sheets. These pretreated materials could then be sold to packaging production factories. Such pre-processing steps usually utilize only simple knowledge and technology which can be operated in household level.

6.1.8 Encouraging the use of Eco-friendly packaging materials

Mulberry paper can be used to produce PM 2.5dust filters while bagasse paper can also be made to produce certain parts of hospital equipment, cases of electronic devices, plastic-free children's toys and other items.

6.2 Midstream

6.2.1 Regulatory measures

Each ministry should issue measures for its agencies to refrain from using foam or plastic containers. For example, the Ministry of Public Health issue regulations prohibiting the use of foam or plastic in hospitals under its governance with the Ministry of Education issues regulations prohibiting the use of foam or plastic in educational institutions within its authority. Thailand’s Ministry of Commerce has issued a memorandum to agencies under its command regarding plastic reduction efforts. The National Park Office of the Ministry of Natural Resources and Environment of Thailand has also issued a notification to employees regarding to stopping and reducing the usage of the foam packaging campaign. Plastic drinking cups and bags with handles for single use are also banned. Furthermore, the Pollution Control Department of Thailand has

released guidelines for reducing and segregating solid waste in government agencies, as well as a plastic waste management strategy for the years 2018 to 2030.

6.2.2 Issuing tax measures based on the polluter pays principle

The government should issue a green tax model to raise the tax rate on pollution-causing goods and services. At the same time, environmental protection tax measures should be implemented such as charging fees on businesses that discharge wastewater or emit pollutants exceeding the required standards as well as enforce fees for environmental restoration. Extended Producer Responsibilities (EPRs) have been issued in Germany, France, and England to enable manufacturers and importers to be physically and financially responsible for their products at all stages of the product life cycle. This includes decentralizing authority to local governments to implement eco-friendly packaging regulations. A legal punishment will be imposed on the operator if the measure is violated.

The principles should include remedial procedures that require the source of pollution that causes or contributes to pollution leakage or spread to be held responsible for damages where compensation or damages shall be paid in accordance with the polluter-pays concept. Furthermore, to avoid and mitigate environmental problems caused by waste and hazardous, the principle of Pollution Payers (PPP: Polluter Pays Principle) should be applied where the content, scope, storage fees, and operator adjustment periods can be adjusted according to each waste product.

6.2.3 Education on the proper use of eco-friendly packaging

People and businesses in a variety of sectors have turned to eco-friendly packaging because of environmental concerns. In fact, many people are still clueless about how to utilize eco-friendly packaging with lacking of awareness on the hazards of using plastic and foam packaging. Particularly, in the case of bioplastics, there is still a misunderstanding of technical terminology. Currently, the term is used for bioplastics can be divided into three types, namely,

1. Degradable plastic: this plastic can break down into small pieces when exposed to the environment via sunlight or soil microbes. Currently, there are products

or packaging that often uses the terms "Degradable Bag" or "OXO Biodegradable". These are simple plastics with additives to make them degrade more quickly, but they also produce more microplastics in the environment.

2. Biodegradable plastic: made from agricultural or natural materials like cassava, corn, sugarcane, soy protein plant cellulose, etc. Organic content is included in these plastics to accelerate the decomposition process.

3. Compostable plastic: plastic that degrades without leaving any toxic chemicals or hazardous residue. Natural resources may or may not be used to make this plastic. The plastic can be totally degraded into water, carbon dioxide, and biomass as organic fertilizer under the appropriate conditions of temperature and humidity.

6.2.4 Establishing standards and labels for eco-friendly packaging products.

Many companies claim that their products are made of non-toxic "Degradable" plastics and are not "OXO Biodegradable" plastics. In fact, there is still an existing process of adding plastic additives such as PE and PP in the packaging. The problem arises from the fact that some countries may not have clear laws and particular penalties to produce degradable plastics. In the case of Thailand, Ministry of Industry has recently announced the formation of industrial degradable plastic specification product standards in the Government Gazette. Since there are no penalties, the government should take steps to establish industry product standards, biodegradable plastic regulations, and a neutral organization to execute quality control in accordance with the standards. Also, products that have passed quality checks should be stamped with a symbol. For example, the Japan Bio-Plastic Association (JBPA) was created by the industrial sector in Japan to investigate goods that are claimed to be eco-friendly and safe for customers. A symbol will be stamped on the product after it has been tested.

In terms of eco-friendly, non-polymer packaging made from raw materials such as fiber-based materials, the government should develop packaging regulations for eco-friendly food packaging through cooperation with stakeholders, academics, and

researchers to design and create standards of packaging products for the consumers' safety and confidence.

6.2.5 Decentralization

Although the Chinese authorities have quality testing centers and certificates to certify packaging product standards according to China's interview data, this is insufficient to prevent imitation or consumer fraud. Many entrepreneurs claim their products are either compostable or biodegradable plastic and thus falsify their symbols. Local governments in China hence have the authority to control and monitor packaging in order to prevent abuse of bio-plastic packaging. The FTIR portable spectrometer is used to determine the range of exposure to measure the amount of plastic mixed into biodegradable plastics. Exceeding the plastic value by more than 2% will be deemed guilty and fined up to 10,000 RMB. To summarize, the ASEAN countries government should encourage usage of this technology and conduct testing on packaging in order to meet biodegradable plastics standard.

6.3 Downstream

6.3.1 Education and tools for waste separation

The government should educate the public on how to properly separate each type of packaging waste in order to gain a better understanding of waste separation. To ensure that waste is correctly sorted, transparent waste bags should be used instead of black ones. Furthermore, governments and local governments should encourage garbage separation since it increases household income.

6.3.2 Promotion of the packaging waste management produced from fiber-based through fertilizer and biogas production

Fiber-based packaging waste is biodegradable which be disposed along with wet waste and natural waste by the household. The degradation process involved mixing the packaging waste with other food or vegetable scraps in a dug hole before refilling. This would allow microorganisms or earthworms in the soil to digest them. The supplementation with effective microorganisms (EM) can speed up digestion and mitigate unpleasant odors during the digestion. The waste pit could be used for plant cultivation after the decomposition process is complete.

6.3.3 Establishing waste management infrastructures and plants to manage bio-plastic packaging waste

Packaging that uses materials from certain types of bioplastics such as polylactic acid (PLA) still require special attention regarding biodegradation. The biodegradation for this type of plastics is challenging due to the method of synthesizing to match properties similar to synthetic plastics. These wastes would require 60ºC with the presence of microorganisms to assist digestion. As the waste for this type of bioplastic cannot be recycled, it has to be separated from conventional plastic before being disposed. The government must offer help by establishing an industrial-scale waste disposal facility, which is still currently unavailable in ASAEN countries. These non-recyclable or non-compostable plastics are currently used for electricity generation with the risk of possible pollutants being emitted into the atmosphere. The installation of air pollution filtration systems for power plants hence should also be implemented as well.

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