FINAL PROJECT – 184833

EVALUATING THE SUITABILITY OF ZERO-WASTE STORES IMPLEMENTATION IN INDONESIAN CONTEXT

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APPROVAL SHEET

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FINAL PROJECT

Submitted in partial fulfillment of the requirements for the bachelor's degree from
Department of Industrial and Systems Engineering
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ABSTRACT

The world have many environmental problems, especially the amount of trashes in landfills or in the oceans. Indonesia is a developing country that is also dealing with this problem. Many are coming up with creative ideas to overcome this problem. One of them is the creation of Zero-Waste Stores that aims to remove plastic packaging waste by selling their goods in bulk and customer can bring their containers when they shop. It has operating fairly well in the European region; however, the situation in Indonesia has not been previously researched. Through extensive interviews with store owners and suppliers in Java and Bali island, current operations of Zero-Waste Stores in Indonesia can be understood and are presented in this study. Customers' perspective about this concept are also captured through questionnaire survey. This research shows that the current operation of Zero-Waste Stores are fairly acceptable by the customers, showing positive response in their experiences. Even though its main goal is to reduce packaging waste, this research shows that they are only able to reduce 2.34% of the plastic packaging waste generated with the present situation. Furthermore, the environmental impact of shopping in Zero-Waste Stores are actually higher compared to shopping in traditional retail due to the very few number of stores available today. Nevertheless, Zero-Waste Stores might be a promising solution in plastic packaging reduction if the stores are able to overcome these existing challenges.

Keywords: Business Process, Life Cycle Assessment, Sustainability, Value Chain, Zero-Waste Stores.

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FOREWORD

The author would like to express her foremost gratitude to the God Almighty for all the blessings throughout her life. It is with all of His blessings that the author can complete this research. This final project is not only as a requirement for finishing the author's undergraduate studies, but also to satisfy her own curiosity in learning about the sustainability, environmental impact assessment, and understanding Zero-Waste Stores. With that in mind, this would not be possible without the help and kindness of the people along the way. The author would like to wholeheartedly thank:

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Surabaya, August 2020

The Author

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Surabaya, August 2020

The Author

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CHAPTER I
INTRODUCTION

This chapter presents the background of the research, problem formulation to obtain research focus, research objectives and its benefits, the boundaries that include the scope and assumption used during this research, as well as the entire report outline.

1.1 BACKGROUND

Our planet has differed from what it was decades ago. The world's population has reached a staggering 7.7 billion people as of the year 2019, and it is forecasted that it will reach 8 billion people by 2025 (Worldometer, 2020). With this number of people, it can be inferred that many human activities have an impact on the environment. If done in moderation and with proper practice, these human activities should not severely damage the environment.

However, with rapid technological development, things have become more comfortable and instant. People are racing to catch up with the current trend without realizing that their actions negatively affect the environment, and therefore are making minimal effort to halt the damages. Numerous environmental issues arise from these activities and have slowly caught the world's attention, but not until these past decades that it has been concerning. One of the environmental issues that have become prevalent nowadays is regarding plastic wastes.

Based on the research conducted by Roland Geyer et al. (2017), around 60% of all plastics ever produced were discarded and are accumulating in landfills or the natural environment. Those plastics come from different sectors. The industrial sector that provides the most plastic is the packaging sector. Packaging contributes 42% of the global plastic waste and is equivalent to 141 million tons in the year 2015 alone. The textile industry also provides a high number of the plastic waste generation that reaches 38 million tons, followed by consumer and institutional products for 37 million tons. The comparison can be seen in Figure 1.1. Geyer also mentioned product lifetime distribution for the industrial use of plastics to show how long they are in use before it is discarded. Plastic packaging is only used in the

span of six months up to a year, and that most of the plastic packaging is discarded during the same year it was produced (Geyer, et al., 2017). This results in a very high number of plastic packaging waste.

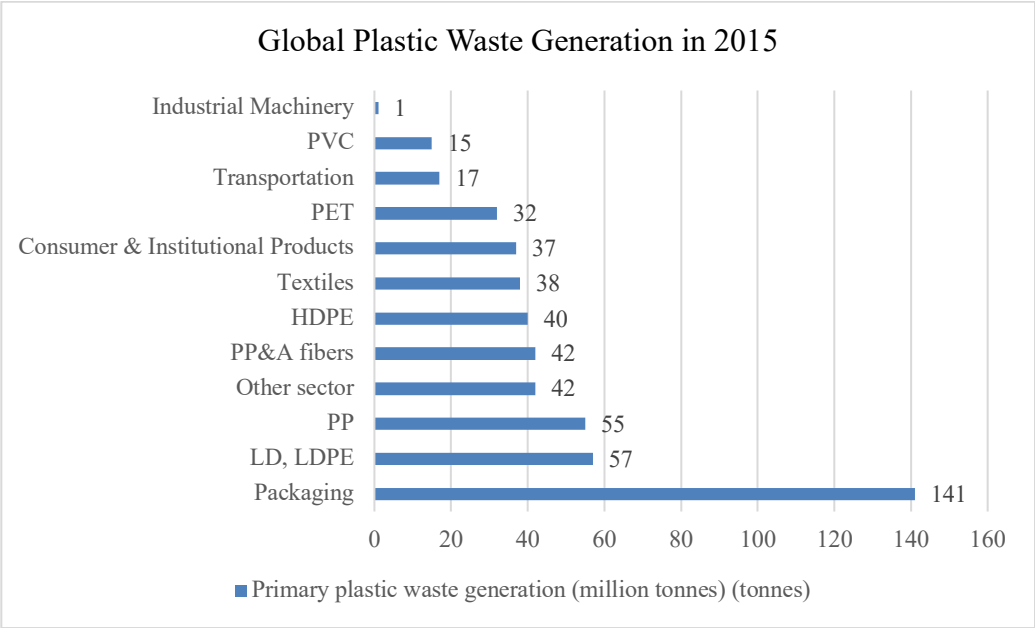

Figure 1.1 Plastic waste generation based on industrial sectors in 2015.
Source: (Geyer, et al. 2017)

Many efforts have been made to reduce the amount of plastic waste, especially for packaging. One of those efforts is the emerging of stores that removes packaging to end customer. This effort is commonly known as *Zero-Waste Stores*. It is a store that sells goods in bulk and encourages customers to bring containers to take their products home. Figure 1.2 shows an example of a Zero-Waste Store that is located in London. What is done in conventional supermarkets provides the convenience of plastic-packaged goods, where the packaging is only used for a short while. Yet it, leaves environmental consequences (Lehmann & Crocker, 2011). These Zero-Waste Stores aim to reduce the amount of packaging waste so that it doesn't leave any additional ecological consequences.

Figure 1.2 Unpackaged, a Zero-Waste Store in London.
Source: (beunpackaged.com, n.d)

This movement has first started in London, followed by many countries in the European region. These stores in the European region are making up 88% of the total number of Zero-Waste Stores as recognized by Bepakt, an open knowledge base on Zero-Waste Stores. The remaining percentages are shared between the United States and Canada, with 7%, countries in Asia with 3%, and others such as in Brazil, Mexico, and South Africa that makeup 2%, as shown in Figure 1.3.

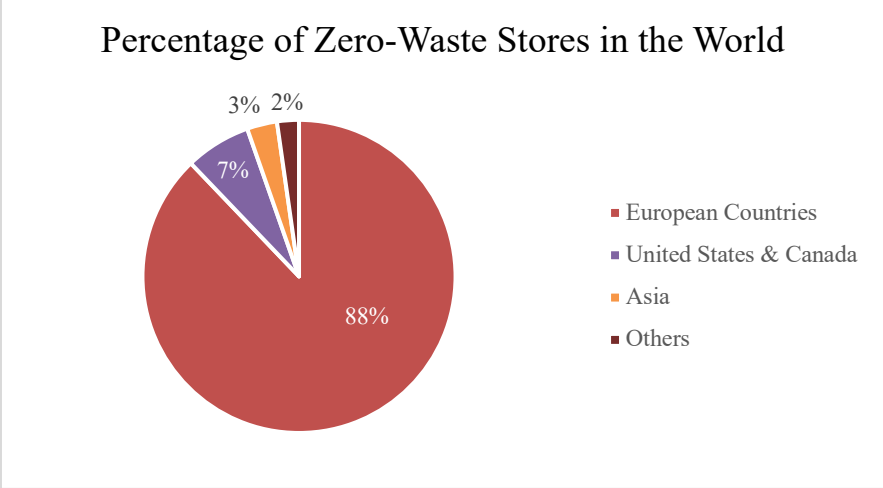

Figure 1.3 The distribution percentage of Zero-Waste Stores in the world.
Source: (Bepakt.com, 2020)

From Figure 1.3, it can be seen that in Asia, the percentage is still fairly low at 3% considering Asia is a really wide continent. In Indonesia alone, there are only four Zero-Waste Stores that are recognized in Bepakt's Zero-Waste Stores list. The stores are located in Jakarta, Surabaya and Bali. The store located in Jakarta is called Saruga Pack Free Store, the one in Surabaya is called Alang-Alang, and the ones in Bali are Zero Waste Bali and Bali Buda.

Indonesia is a developing country with an economic classification of lower middle income as defined by the World Bank's 2019 Gross National Income data. It is still the same level of classification since the year 2010, where the data for a study on plastic waste management was used by Jambeck et al. (2015) in their research. The research shows the top 20 countries with mismanaged plastic waste, in which Indonesia ranks second with approximately 8.82 million metric tons mismanaged plastic waste per year, contributing 10.1% of the total mismanaged plastic waste in the world.

Efforts have been made by the local government to reduce the number of single-use plastic bags in retail stores by creating regional laws in several cities in Indonesia with the hope of reducing the amount of plastic waste. The law is established to focus on reducing plastic waste due to the high usage intensity and the potential of it polluting the environment. The first city to implement this law is Banjarmasin, which is regulated under *Peraturan Walikota (PERWAL) Banjarmasin Nomor 18 Tahun 2016*. Other cities such as Surabaya, Bali, and Jakarta, started to issue a similar law that is regulated under *PERDA Kota Surabaya Nomor 01 Tahun 2019*, *Peraturan Gubernur (PERGUB) Bali Nomor 97 Tahun 2018,* and *PERGUB DKI Jakarta Nomor 142 Tahun 2019* respectively. However, these efforts have not been proven to be an effective way to tackle the plastic waste problem. Not only because it does not reduce the amount of packaging waste, but also it is merely an appeal to the mass and not something that is mandatory. This is where the question of establishing a Zero-Waste Store might seem like a promising solution.

There has not been any research that has proven that the establishment of these Zero-Waste Stores significantly reduces plastic packaging wastes. However, it has believed to cut the chain of creating smaller-sized, more-convenient

packaging to the end customers. Yet, the implementation of a Zero-Waste Store well-established in the European region will differ if it were to be implemented in Indonesia due to its characteristic as a developing country. A study must be conducted to understand the barriers and boundaries for it to be done in Indonesia. Moreover, the reduction of plastic packaging due to the operations of Zero-Waste Stores should also be researched. This is hoped to help Indonesia tackle its plastic waste problem.

1.2 PROBLEM FORMULATION

The problem formulated derived from the background is to estimate significant benefits, understand the operational feasibility, and identifying the barriers from different stakeholders of implementing a Zero-Waste Store in Indonesia through quantitative and qualitative approaches.

1.3 OBJECTIVES

With the formulated problem that is based on the supporting background, this research aims to:

1. Quantify the number of packaging reduction due to Zero-Waste Stores shopping activity.
2. Conducting life cycle assessment for Zero-Waste Stores operations from the customer's shopping activity.
3. Identifies the suitability of Zero-Waste Stores, including common boundaries and barriers of Zero-Waste Stores in Indonesia (from shop and supplier's perspective) and the acceptability of these stores (from the customer's perspective).
4. Recommends future implementation based on an overall understanding of the implementation ability or business process of Zero-Waste Stores in Indonesia.

1.4 BENEFITS

This research will bring benefits to two parties: future researchers who are interested in finding out more regarding these matters, as well as the stakeholders in Indonesian Zero-Waste Stores.

1.4.1 For future researchers

1. This research provides basic information about the operations of a Zero-Waste Store that can be a guidance for future researchers.
2. This early research allows for development, such as bigger scale quantification of the packaging reduction and a more comprehensive LCM assessment.

1.4.2 For Zero-Waste Stores stakeholders

1. Suppliers will be able to understand customer's shopping characteristics and come up with ways to better support their demand.
2. Store owners will understand more about its customer characteristics and demand to improve their Zero-Waste shopping experience.
3. Customers will understand the life cycle assessment on whether or not this zero-waste shopping activity is beneficial for them in terms of the impact to the environment.

1.5 RESEARCH SCOPE

To gain a more comprehensive result, the scope of this research will follow the following points:

1. Suitability used in this research is the definition of suitability to see whether it is acceptable or right for something or someone (Cambridge Dictionary).
2. This research will investigate the offline operation Zero-Waste Stores, while acknowledging that during the COVID-19 pandemic situation, these stores can offer online services.
3. The data that are not able to be obtained primarily will be taken from a proxy. This proxy will be based on credible data, cross-referenced to journals, magazines or other surveys.

4. The data for quantifying the packaging reduction will only be for items sold in the observed Zero-Waste Stores since only those items that are substitutable.

1.6 REPORT OUTLINE

The following framework in Figure 1.4 shows the general outline of ideas that are going to be tackled in this report.

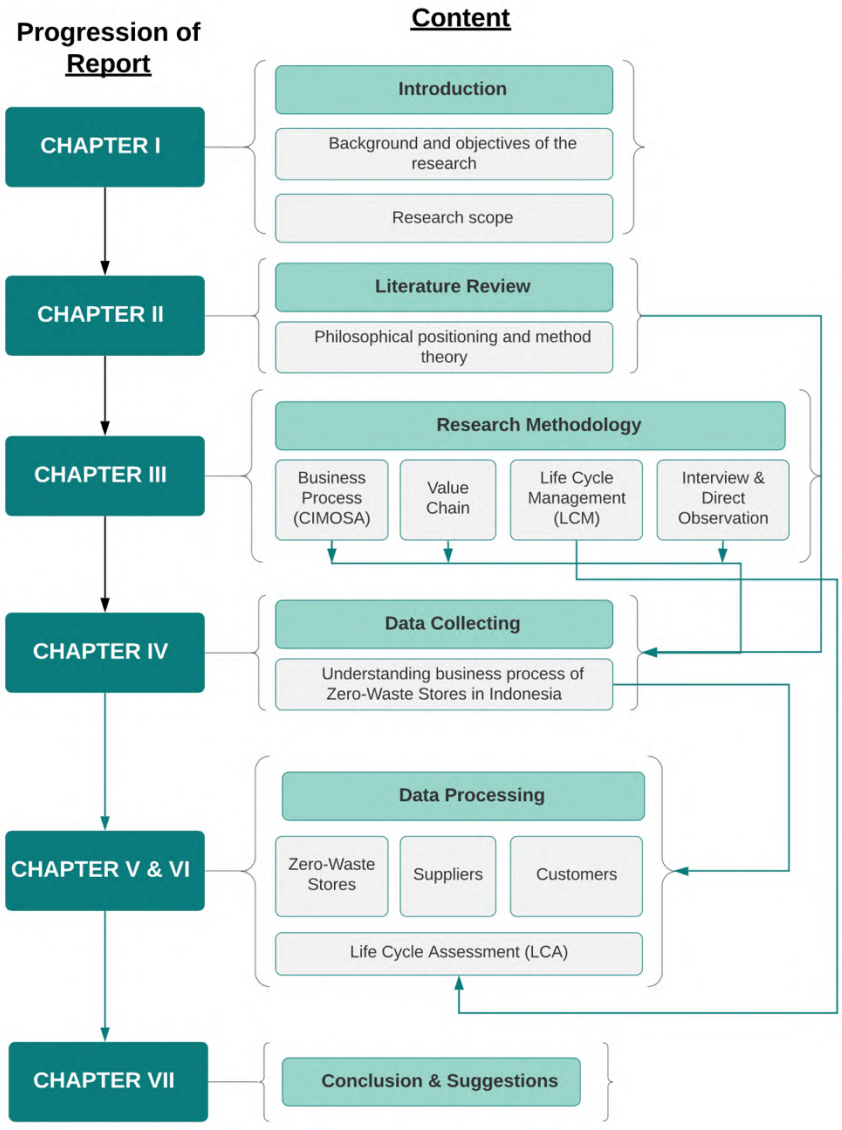

Figure 1.4 Report content and progression outline.

CHAPTER I: **INTRODUCTION** presents the background on why this research is conducted and the objectives that are hoped to be achieved from this research.

CHAPTER II: LITERATURE REVIEW presents the various theories used to support this research, as well as the methods that are going to be used to process the data obtained.

CHAPTER III: RESEARCH METHODOLOGY presents the flowchart of how the research is framed, with a detailed explanation of the methods that are going to be used during this research.

CHAPTER IV: ZERO-WASTE STORES IN INDONESIA presents the general findings of the Zero-Waste Stores across Indonesia, especially Java and Bali island, through direct observation and interview with the store owners.

CHAPTER V: ZERO-WASTE STORES STAKEHOLDERS presents the understanding of Zero-Waste Stores classified into the main stakeholders' point of view: stores, suppliers and customers. In this chapter, boundaries for the stores and suppliers' operation will also be discussed, as well as understanding the acceptability level from the customer for them to shop in Zero-Waste Stores.

CHAPTER VI: LIFE CYCLE ASSESSMENT OF CUSTOMERS' SHOPPING ACTIVITY presents the life cycle assessment to see whether Zero-Waste Stores are indeed environmentally friendly in practice. This chapter will compare the environmental impact resulted from packaging in traditional shopping and maintenance of containers that are reused for Zero-Waste Store shopping.

CHAPTER VII: CONCLUSION AND SUGGESTIONS summarizes the findings and results obtained from conducting this research and giving suggestions for Zero-Waste Stores' stakeholders as well as future researchers.

CHAPTER II
LITERATURE REVIEW

This chapter presents supporting works of literature that are used for the basis of this research. The topics covered in this chapter are about Sustainability, Waste in Indonesia, Role of Packaging, Shopping Behavior, Zero-Waste Stores, and Business Process & Value Chain, which are all theories connected to the subject for this research. There is also a section regarding Life Cycle Management as well as Descriptive and Inferential Statistics, which are the methods used for the study.

2.1 SUSTAINABILITY

Cambridge Dictionary defines the word *sustainability* as the quality of being able to continue over some time, or in specific relation to the environment, it is the quality of causing little or no damage to the environment and therefore, able to continue for a long time. The United Nations also has pioneered a movement to achieve a sustainable world by establishing Sustainable Development Goals (SDGs). Sustainable development is famously known to have the meaning of development that meets the needs of the present without compromising the ability of future generations to meet their own needs (Bruntland, 1987). Goals such as eliminating poverty and hunger, concerning responsible consumption and production, taking climate actions and protect life below water and on land, are all the targets under the SDGs.

As understood from the definition, sustainability can be viewed as an intersection of three main parts: environmental, economic, and social, with any two parts' intersection also supports the main idea of sustainability (Rosen & Kishawy, 2012). This is presented in Figure 2.1.

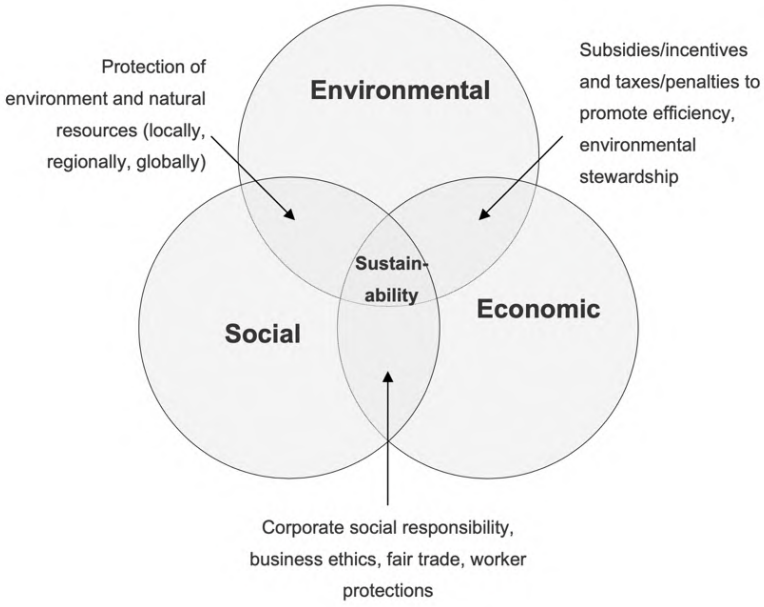

Figure 2.1 Sustainability intersection venn diagram.
Source: (Rosen & Kishawy, 2012)

It shows that sustainability in practice is a combination of two each aspect, such as the act of a corporate social responsibility, which is a combination of economic and social aspects. Sustainability has been interpreted in many ways, according to its different applications and objectives. Many companies have incorporated sustainability into their business. One of the examples is the *triple bottom line* framework introduced by John Elkington in the mid-1990s (Slaper & Hall, 2011). It is also known as 3Ps: people, planet, and profit. This emphasizes that sustainability is indeed concerning many aspects in order for it to continue for a long time.

Before it was popularized with the definition of meeting the needs of the present without compromising future generations' needs, it was initially known as the action to do more with less (Fitzgerald, 2013). Doing more with less means making use of the materials that are already available in our hands.

One way to do that is by implementing the reuse concept. Reuse means the product is used for more than once, used again and again. On the other hand, it is also essential to balance reuse with the reduce concept. Reduce means using lesser materials to produce products, which can be achieved by coming up with innovative ways in manufacturing to ensure lesser waste as generated from the process. Reduce can also mean to minimize consumption, opting to use the product when it is

indispensable. When reducing is not possible and reusing has brought it to its end of life, there's another approach to sustainability under the goal of doing more with less, which is to recycle. Recycle means that the used product is converted into materials that can be reused as an input to create a new one, or following the life cycle paradigm, it is returning the material into a previous stage in the cyclic process.

2.2 WASTE IN INDONESIA

Waste problem is a global issue. The number of population and the quality of waste management systems in a country largely determines how much they contribute uncaptured waste available to potentially become plastic marine debris (Jambeck, et al., 2015). The East Asia and the Pacific, consisting of 37 countries, is considered to be the region that generates the highest number of waste globally. In the year 2016, the waste generated equals to 468 million tons (Kaza, et al., 2018).

From the same report by Kaza, et al., Indonesia's waste generation rates in kg/capita/day is equals to 0.68. This means that every citizen in Indonesia generates 0.68 kg of trash per day in the year of 2016. Seeing a more specific and updated data in 2018, based on the report by Badan Pusat Statistik Indonesia (2019), the total number of Indonesia's population is equal to 265,015,300 in the year 2018. Noting that according to the report of Statistik Lingkungan Hidup Indonesia (2019), the approximate total solid waste generated is equal to 400,186,104 kg/day for the whole population in the same year of 2018.

The composition of the solid waste generated by can be classified into several categories as seen in Figure 2.2 below. The data is obtained from Hotspot Sampah Laut Indonesia (2018) report by the World Bank.

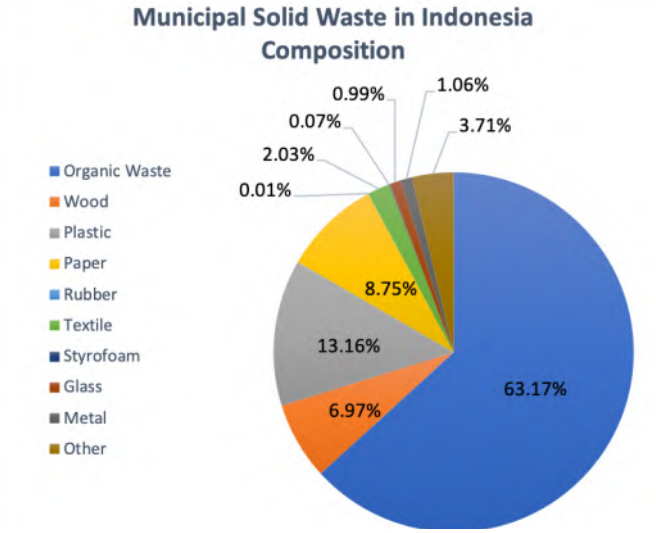

Figure 2.2 Composition of Municipal Solid Waste (MSW) in Indonesia
Source: (Hotspot Sampah Laut Indonesia report, 2018)

Seen in Figure 2.2, organic waste is actually the biggest type of solid waste in Indonesia, amounting to 63.17%. The other solid waste that are present in Indonesia are paper, rubber, textile, Styrofoam, glass, metal, and other types of wastes. This biggest type of solid waste is followed by plastic waste at 13.16% and wood waste at 6.97%.

These plastic waste are also made up from different plastic categories, based on the materials that are used to make up those items. According to the American Society for Testing Materials (ASTM), there are seven resin classifications for plastic: *polyethylene terephthalate* (1/PET/PETE), *high density polyethylene* (2/HDPE), *polyvinyl chloride* (3/V), *low density polyethylene* (4/LDPE), *polypropylene* (5/PP), *polystyrene* (6/PS), and *other* (7/O) that includes materials made with more than one resin from categories 1-6 (ASTM, n.d.). Since the *other (7)* group is a big group and mostly mixed, it does not specify what plastic it is made out of. This makes it hard to recycle plastic with code 7. Figure 2.3 below shows the logo and the resin classifications based on ASTM standard.

Resin	Resin Indentification Code-Option A	Resin Indentification Code-Option B
Poly(ethylene terephthalate)	1 PETE	01 PET
High density polyethylene	2 HDPE	02 PE-HE
Poly(vinyl chloride)	3 V	03 PVC
Low density polyethylene	4 LDPE	04 PE-LD
Polypropylene	5 PP	05 PP
Polystyrene	6 PS	06 PS
Other resins	7 OTHER	07 O

Figure 2.3 Resin Identification Code by ASTM.
Source: (ASTM, n.d)

2.3 ROLE OF PACKAGING

Delivering goods from manufacturer to end customers is an essential activity within the supply chain. Goods are protected with packaging to reduce damage in transport and handling, as well as prolonging the shelf life of the product (Verghese, et al., 2015). Not only that it provides protection from environmental, chemical, and physical challenges, but packaging also gives convenience to and attraction of consumers when it is placed in retail stores (Risch, 2009). It helps to differentiate products of the same type that comes from different brands.

The role of packaging has evolved throughout different decades and eras, with its primary function to contain, protect, and preserve products. In the early circa 1800, packaging was primarily seen as a way of storage for high-value goods such as jewelry and premium foods. Then, it becomes a way to establish a manufacturer brand's identity in the early 1900s. It focuses more on becoming a way to make the customer buy their product more conveniently, such as a shinier, sturdier, cleaner, more flexible where materials such as plastics and metal cans are used in the late 90s (Gopinathar, et al., 2016).

There are different levels of packaging which serve different functions when the goods are transported throughout the supply chain: primary, secondary, and tertiary packaging. Primary packaging is used to establish selling units such as plastic wrappers of individual items. Secondary packaging is used to create a

logistic handling unit that enables order picking, such as shelf-ready boxes. Tertiary packaging is used to establish the logistics transportation unit for mass transportation, such as palletized cartons (Erceg & Trauzettel, 2016). The use of those packaging is done to ensure products are safely delivered and still maintaining their quality.

With the rising concern about the environment, the role of packaging expands more than just protection for goods and to ease supply chain activities. Minimizing food waste has also become a critical aspect of the life-cycle environmental impacts of the food packaging system. It is possible to find novel packaging solutions that have a lower environmental impact while at the same time, reduce food losses (Wikström & Williams, 2010). It depends on the ratio between the effects of food and packaging, where the packaging impact should be relative to the food's impact. However, it is better to design packaging concerning each regional waste handling situation. It will be different if waste ends up as animal food or in a landfill, or whether the packaging waste is recycled or dumped.

Trade-offs between the amount of packaging and food waste generated have become a huge consideration in this matter. The popularity of convenience foods in this fast-paced world that reduces preparation and cooking time requires more packaging to assure that goods can withstand its shelf life. Many products are sold in smaller packaging, which tackles the reduction of the food waste goal, yet it simultaneously increases the packaging per food unit. (Akkerman, et al., 2010). As a result, this will increase the occurrence of single-use products and disposable packaging and increases plastic debris in the ocean (Thompson, et al., 2009). This causes a further issue in regards to packaging and questions the worthiness of packaging role to the environmental impact that it brings.

2.4 SHOPPING BEHAVIOR

People's shopping behavior of people are affected by marketing efforts. Marketing is a pervasive societal activity that goes beyond selling products, as defined by Kotler and Levy (1969). David J. Luck added on to the definition of Marketing, stating that the statement made by Kotler and Levy was *too far* in the same journal of a different volume (Luck, 1969). He expressed that marketing

cannot be as broad, and that it should be bounded within those processes or activities that has market transaction. Other than concerned with the markets itself, it should also be characterized by buying and selling activity. A marketing mix strategy needs to be applied so that companies or businesses are able to gain market, and therefore create a superior customer value (Sutiksno, 2014).

The widely-known marketing mix by McCarthy that consists of 4Ps are suggested by marketing theorist to be replaced with Booms and Bitner's 7P (Lin, 2011), as marketing theorist suggests that there is a high degree of acceptance as a generic marketing mix.

According to Booms and Bitner (1981), there are 7P of the marketing mix. These are *product, price, place, promotion, people, process and physical evidence.* Product is how the item must provide value to a customer, but doesn't have to be tangible. Price refers to how it must be competitive and entail profit. Place refers to the place where customers can buy product and how the products are available at that place. Promotion is how the company or businesses communicate to customers. People are the stakeholders that are involved, such as customers, employees, management. Process are the methods and process of providing the product. Physical evidence is referring to the experience of using that product or services. These aspects are all interconnected and it all affects the one P and other Ps.

2.5 ZERO-WASTE STORES

The term "Zero-Waste" was originally coined by Paul Palmer back in 1974, the owner of a chemical reuse company in Oakland, California, who uses the phrase for his company called the "Zero Waste Systems Inc." (Palmer, 2013). He stated that it was intended to tackle the problem of how to redesign society's goods and processes so that it can have many ways to be reused perpetually on many levels. This term has now been used in a wider context, such as the Zero-Waste lifestyle movement that was made initiated by Bea Johnson (Johnson, n.d.). She is famous for being a Zero-Waste Lifestyle expert and was declared as "The mother of the Zero-Waste Lifestyle movement" by CNN. It is a concept of aiming to live with exerting waste as less as possible, therefore in an ideal world, it will eventually become zero-waste.

Due to this movement, Zero-Waste Stores concept is introduced. They sell mostly local, organic, and package-free goods. The primary goal of these stores is to reduce or eliminate packaging (Istas, 2019). It still lacks a clear definition, yet Bepakt, a website that collects data on Zero-Waste Stores, published guidelines on defining them (Bepakt, n.d.). Table 2.1 shows the criteria of Zero-Waste Stores according to Bepakt.

Table 2.1 Bepakt's Criteria for Zero-Waste/Zero-Packaging Grocery Stores.

Aspects	Criteria
Primary value	Zero-waste, packaging reduction/abolition
Product assortment	Wide product range, competitive with regular supermarkets.
Product sourcing	Strong focus on local and/or organic products.
Branding design	Modern graphic design, web design, etc.
Marketing	Mainly through social media.
Shop design	In line with zero-waste/minimalist philosophy. Usually wooden second-hand or upcycled furniture, clean and simple design.
Shop financing	Often through crowdfunding.
Knowledge sharing	In the shop by shop assistant, online through web communities or courses, offline through workshops and lectures.
Consumers shopping experience	Serviced (clients are served by shop assistant) or self-service (but still while interacting with the shop assistant).
Additional characteristics	Sociability dimension/human relations between shop owner and (local/small) suppliers as well as between shop owner and clients; limited financial resources, little prior business knowledge, little contact with governments.

Source: (Bepakt, (n.d.))

Bepakt also refers to a document compiled by Nicola and Richard Eckersley as guidance on how to set up a Zero-Waste Store that compiles "Ten Steps to Setting up a Zero-Waste Shop." The components that are included in that list are location, budget, branding, marketing and advertising, equipment, suppliers, targeted customer, what to stock, hygiene and payment methods. Each of the components has an explanation about what is crucial under that topic, such as the importance of selecting scale systems and food dispensers to fit the budget and at the same time choose what is most suitable for the goods the store is selling.

One of the earliest stores that renounce the use of disposable plastic packaging is called Unpackaged from Islington, London, in 2007 (Unpackaged, n.d.). Customers will choose among the bulk items presented in stores in refillable

containers, put it in their self-brought container, and bring it home. As explained simply on their website, beunpackaed.com, the store shopping experience follows five steps: Tare, Fill, Weigh, Label, Pay. Tare meaning that customer first weighs their empty container to make sure that the weight calculated at the end is purely the goods. Then, customers can fill in their containers, weigh it, and put labels on their container about the product and its weight information. Customers then can bring it to the cashier for payment. This way, plastic packaging can be significantly reduced and goods are received directly to the customer's hands.

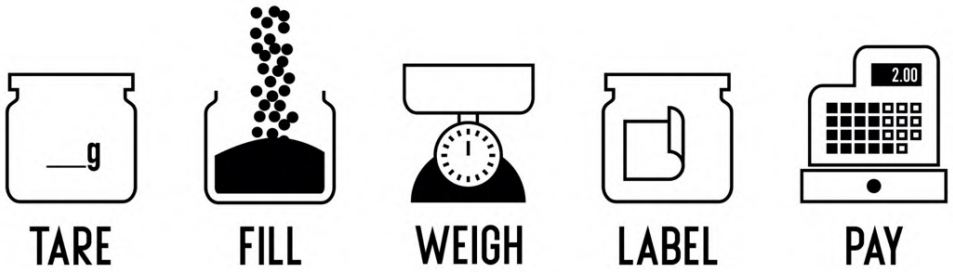

Figure 2.4 Five steps of shopping in Zero-Waste Stores.
Source: (beunpackaged.com, n.d).

It has indeed given better benefits to the environment, by decreasing wastes and emits less emission. Not only that, but the establishment of Zero-Waste Stores also brings more benefits to the community. This type of store promotes a local market distribution, because, to keep products fresh, they need to be delivered quickly (Rapp, et al., 2017).

This concept is now done in many parts of the world as mentioned in Bepakt.com: Unpackaged in London, UK; Original Unverpackt in Berlin, Germany; Precycle in New York City, USA; Bulkstore & Co. and Naked Inc. in Jakarta, Indonesia. Package free shopping like what has been done in these Zero-Waste Stores can be considered as a pro-environmental behavioral change initiative that focuses on removing unsustainable objects rather than *greenwashing* the existing products and objects (Fuentes, et al., 2019).

Figure 2.5 Naked Inc. Store layout located in Jakarta, Indonesia.

Figure 2.6 Original Unverpackt layout located in Berlin, Germany.
Source: (Vivien Sachs, n.d)

Shown in Figure 2.5 and Figure 2.6 are several examples of the existing Zero-Waste Stores that are located in two different countries. The one in Figure 2.5 shows one of the stores in Jakarta, Indonesia. The second one in Figure 2.6 shows one of the biggest Zero-Waste Stores in Berlin, Germany, where it has been established since 2012. As seen from the figures, both of the stores have a minimalist design, clean and simple. Figure 2.7 shows the usual display of the containers and its different shapes in a Zero-Waste Store.

Figure 2.7 Example of the various receptacles used in Naked Inc. store

All of the products are located according to the different goods that they are selling in the stores. The products are displayed in receptacles with different shapes and sizes for different types of commodities, however, they are all clear and transparent; allowing goods to be able to be seen by the customer.

2.6 BUSINESS PROCESS & VALUE CHAIN MODEL

Business process and value chain models are used to understand the activities that are happening inside of a business. The business process discussed below is taken from the manufacturing process perspective of CIMOSA, and the Value Chain model discussed below is taken from Porter and Kramer's shared value concept.

2.6.1 Business Process

A business process is a set of logically related business activities that combine to deliver something of value (e.g., products, goods, services, or information) to a customer. That business process cut across organizational divisions that are sometimes structured in large organizations such as sales or finance departments (Cousins & Stewart, 2002). Adding on to that definition,

Kaniski & Vincek (2018) also mentioned that there are essential elements that made up a business process, such as the goal, available resources, activities, indicators, focus on the buyer, and the process holders.

One of the most common frameworks used to depict a business process is called CIMOSA (Computer Integrated Manufacturing Open System Architecture). Although the main goal is to support process-oriented modeling of manufacturing enterprises and to support systems operations based on enterprise models (Vliestra, 1996), CIMOSA is also implemented in non-manufacturing sectors. CIMOSA allows enterprise modeling done incrementally rather than following a top-down approach, also structures the enterprise operations into sets of an interoperating domain that exchanges results and requests. Latiffianti et al. (2017) adjusted the CIMOSA framework to fit more generally to other types of enterprises, not limiting only to manufacturing firms. The proposed business process architecture was modeled in having three main processes: manage processes, operate processes, and support processes. The framework discussed by Latiffianti et al. (2017) is using the business process architecture proposed by the American Productivity and Quality Centre (APQC) and is shown in Figure 2.8.

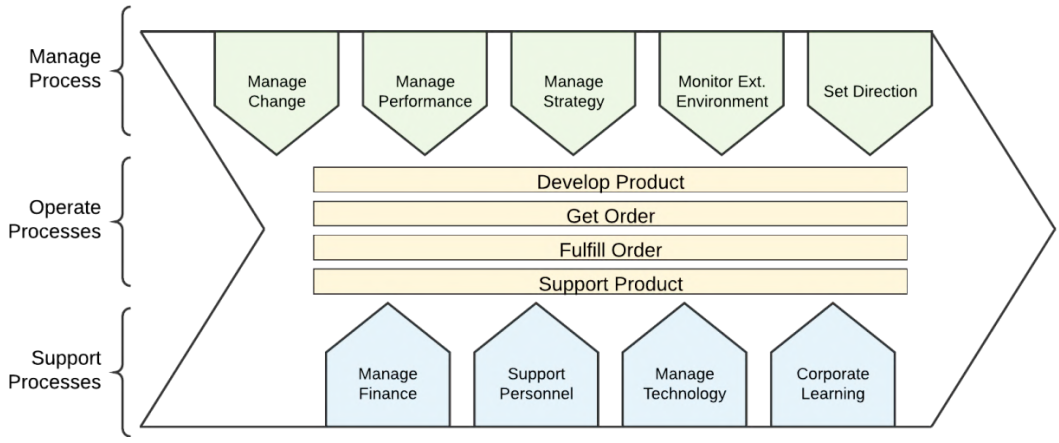

Figure 2.8 Business Process Architecture by APQC.
Source: (Latiffianti, (2017))

Manage process includes set direction, monitor external environment, manage strategy, manage performance, and manage change. Operate processes include activities such as develop product, get order, fulfill order, and support product. Support process consists of manage finance, support personnel, manage technology, and corporate learning.

2.6.2 Value Chain

Firstly coined by Michael Porter in 1985, the term *Value Chain* is introduced as a basic tool to systematically examines the activities of a firm and how they interact to analyze competitive advantages. It is a flexible model that will differ based on the industry types, where it will help identify the principal source of the competitive advantage (Porter, 1985). The value activities can be divided into two types, primary and support activities. Figure 2.9 shows the generic framework of a Value Chain.

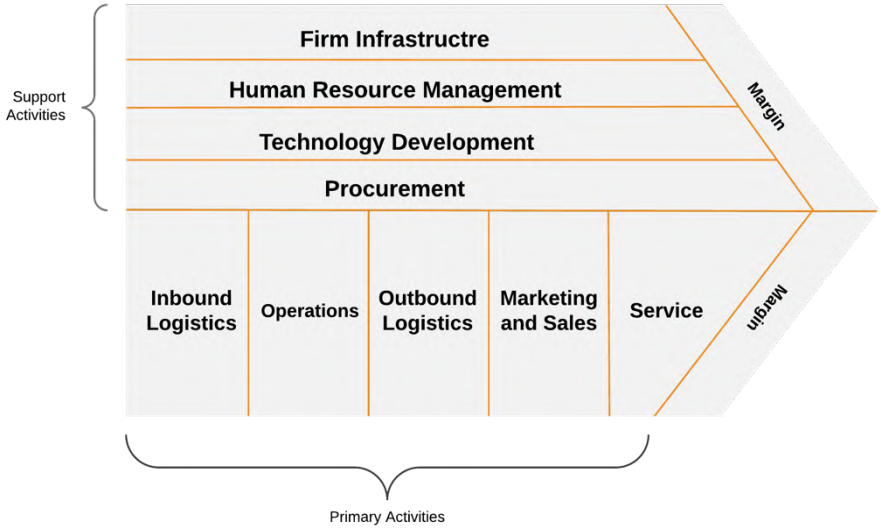

Figure 2.9 Generic Value Chain by Michael Porter.
Source: (Porter, (1985)).

Primary activities are activities that are involved in the main operations or the physical creation of the product and have five categories: inbound logistics, operations, outbound logistics, marketing & sales, and service. Inbound logistics are associated with receiving and storing inputs to the product, such as material handling, warehousing, inventory control, vehicle scheduling. Operations are the activities that are related to transforming the inputs to final form, or the key activities that are happening in the business. Unlike inbound logistics, the outbound are activities that are related to distributing products to buyers. The marketing and sales aspect focuses more on advertising, promotion, and pricing of the products. Lastly, service activities are ways to enhance or maintain the value of the product for the customer, such as giving training and reparation services.

Just like the name, support activities assist the primary activities. Support activities can be grouped into four main categories: procurement, technology development, human resource management, and firm infrastructure. Procurement refers to the function of purchasing inputs that are used in the firm's value chain, supporting the logistical aspects of the primary activity which happens throughout the firm. Technology development supports the activities in the enterprise that incorporates technology. It is one of the most critical competitive advantages in all industries, and even become the key to some industries. Human resource management involves activities such as recruitment, hiring, training, and development of all the personnel in the firm. Firm infrastructure is the section of support activities that deals with general management, planning, finance, legal, as well as government affairs. These support activities work hand-in-hand to complement primary activities.

2.7 FRAMEWORK ON LIFE CYCLE EVALUATION

Life Cycle Management is based on the idea of Life Cycle Thinking. It concerns about the product's entire life from when it is firstly manufactured or created, commonly known from a "cradle" state, until when the product is disposed completely or has reached its end of life in a "grave" state.

2.7.1 Life Cycle Thinking

It is a paradigm of thinking that goes beyond the traditional focus on production and manufacturing processes, concerning the environmental, social, and economic impact of a product life cycle. The main goal of Life Cycle Thinking or LCT is to reduce product resource usage and emissions to the environment, as well as improving socio-economic performance along its life cycle (UNEP, 2007). Source reduction in life cycle thinking has aspects that are similar to the "6 RE Philosophy" (Koroneos, et al., 2013) such as *re-think*, *re-duce*, *re-place*, *re-cycle*, *re-use*, and *re-pair*. The possibility of implementing re-pair, re-cycle, and re-use can be seen in the life cycle in Figure 2.10 below. Recycling the materials and components found in the product to be used in design and production of new products, reusing the product to the point where it cannot perform its function and

has to be disposed of, and repairing (recovery) components that can still be used as raw material for the product.

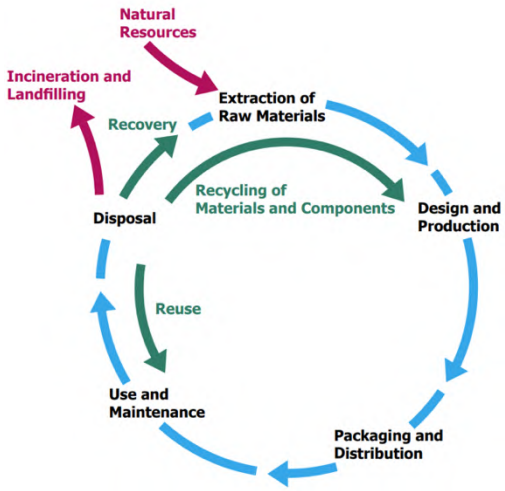

Figure 2.10 Product life cycle diagram.
Source: (UNEP, 2007).

This life cycle thinking has provided a conceptual basis for developing and refining tools in the private and public sectors that are transitioning to a green economy (UNEP, 2007). It has helped in decision-making at all levels of processes, such as product development, production, and final disposal. It can also be used as the basis of examining social and environmental impacts. This life cycle thinking paradigm is implemented on an operational level through Life Cycle Management, which is an approach that puts methodologies of the life cycle thinking into practice.

2.7.2 Life Cycle Management

According to Rebitzer (2015), the term "Life Cycle Management" was firstly discussed in the 1st International Conference on Life Cycle Management organized by Allan Astrup Jensen in 2001, then by David Hunkeler in 2004, and was later extended by Matthias Finkbeiner in 2011 towards life cycle sustainability management. Based on their findings, Life Cycle Management (LCM) can be defined as expanding the scope to address upstream and downstream activities. Sustainability management and performance of organizations should be linked to business values and value creation, therefore it should address not only environmental aspects but also social and economic aspects.

However, the life cycle management concept was first comprehensively explained by Westkämper et al. (2001), underlining why it is considered as 'new orientations and paradigms' that is needed to alleviate emerging problems from the past two centuries of industrialization: rising consumption of limited natural resources, the dramatic increase in world population, and the rapid worldwide globalization. Life cycle management is not a single tool or methodology, but it is a management system that connects various operational concepts and tools (UNEP, 2007) that considers the product life cycle thoroughly. Life cycle engineering (LCE), technical support, life cycle assessment (LCA), life cycle costing (LCC), and product data management (PDM) are considered as the main tools under LCM (Westkämper, et al., 2001).

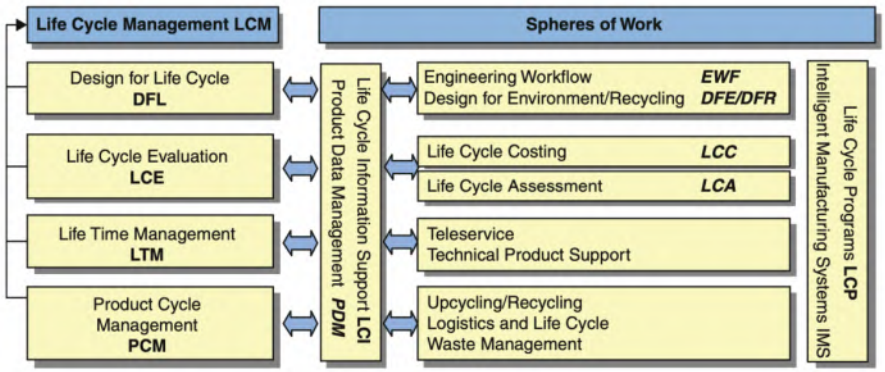

Figure 2.11 Fields under Product Life Cycle Management.
Source: (Westkämper, et al., (2001))

The purpose of LCE is to design products or systems that comply with the main issues under sustainable development. LCA aims to discover the potentials of ecological improvements by assessing the environmental impact using physical product life cycle data. Just like name-wise, LCC assesses the costs of operations in the life cycle of the product or system. It supports the idea where cost-efficient solutions must also have a tremendous environmental impact. To make the most out of the products and systems designed, technical support is crucially needed to ease the process. Some examples of technical support can be modern communication networks, teleservice, and teleoperations. Last but not least, PDM is used to organize data of the entire life cycle of a product or system that will help

in assessing the ecological impact in LCA or economic aspects in LCC. This will allow shorter access time and less redundancy due to a well-organized data.

2.7.2.1 Life Cycle Assessment

According to PRé Sustainability (n.d.), Life Cycle Assessment (LCA) is a factual analysis of a product's entire life cycle in terms of sustainability. Evaluations about a specific product or service can be done from the cradle to the grave. There are four main steps in conducting an LCA, which are goal and scope, inventory analysis (life cycle inventory), impact assessment, and interpretation.

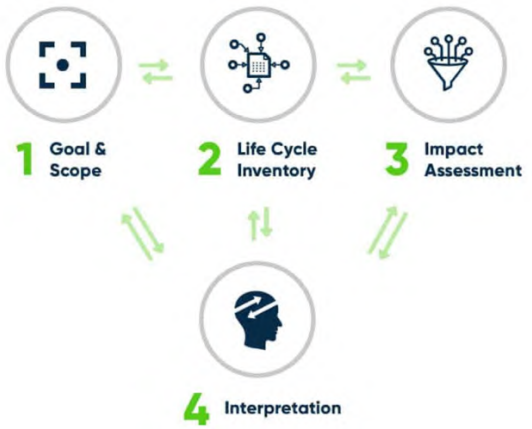

Figure 2.12 Life Cycle Assessment steps.
Source: (Ecochain.com, n.d)

Goal and scope definition helps to ensure that the LCA is performed consistently to avoid simplifications and distortions influence the results too much. Inventory analysis will help to see the environmental inputs and outputs that are associated with the product or service that are being assessed. At the impact assessment stage, evaluations on how the product or service affects the environment are categorized into environmental themes such as global warming or human health. Lastly, in the interpretation phase, conclusions derived from the assessment should be checked, and this can be done by seeing it through ISO 14044 standards.

2.7.2.2 Life Cycle Engineering

The definition of Life Cycle Engineering (LCE) according to Jeswiet (2014) is all "engineering activities which include: the application of technological and scientific principles to the design and manufacture of products, to protect the

environment and conserve resources, while encouraging economic progress, keeping in mind the need for sustainability, and at the same time optimizing the product life cycle and minimizing pollution and waste." Many concerns and aspects to be taken into consideration such as social concern, scientific principles, eco-design, environmental design, economic progress, green design, resource conservation, protecting the environment, optimization, and product & process assessment (Jeswiet, 2014). To succinctly define it, LCE is a system analysis for sustainability and decreasing environmental impact.

2.7.2.3 Life Cycle Costing

Life Cycle Costing (LCC) is a concept for estimating the total cost, which includes acquisition cost (capital costs), ownership costs (installation, operation, repair, service, disposal costs), and other cost components. Conducting an LCC helps to identify the stages in the life cycle where manufacturers can gain revenue during usage and end-of-life stages with appropriate decisions in the design stage (Kara, 2014). This can be used as an engineering decision making to identify the most cost-effective option, as well as a tool for triple-bottom-line assessment of the sustainable development where win-win situations and trade-offs are identified by considering LCC in conjunction with LCA. Figure 2.13 below shows a conceptual framework of LCC and its boundaries that are presented by Brown & Straton (2001).

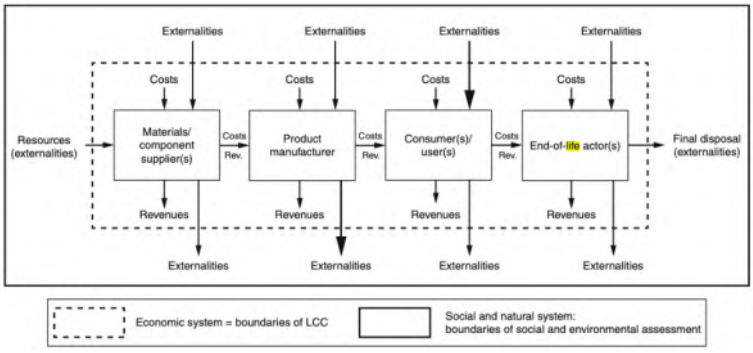

Figure 2.13 Conceptual LCC framework by Brown & Straton (2001).
Source: (Kara, (2014))

The steps to conducting LCC, as defined by Dhillon (2010), can be started by identifying activity and determining the cost driver, or what is known as Cost Breakdown Structure (CBS). This is done to prevent any double counting of the

cost elements. Then, it is followed by estimating the cost, which can use historical data or expert opinion. These costs must all be converted into present values. The discounting process is needed if the value of money changes over time between the present and future. Inflation is often excluded from LCC, and it is only considered when there's more than one commodity.

2.8 DATA COLLECTION AND STATISTICAL PROCEDURES

Statistics are used to learn and understand data. It concerns the collection of data, its subsequent description and the analysis, which in turn leads to concluding. Statistical procedures such as descriptive and inferential statistics help to convert data to information (Groebner, et al., 2011).

2.8.1 Data Collection

In general, there are four types of data: *quantitative, qualitative, time-series,* and *cross-sectional*. Quantitative data is when data are expressed in purely numerical, while qualitative data is data whose measurement scale is inherently categorical. Time-series data is when data values are observed at intervals over time, and cross-sectional data is when a set of consecutive data values are observed at successive points in time (Groebner, et al., 2011).

There are several methods and procedures available for collecting data, such as experiments, written questionnaires and surveys, direct observation, and personal interviews. Different types of questions are used during the interviews or through questionnaires and surveys. *Closed-ended* questions are used to give respondents to select from a shortlist of defined choices, and *demographic* questions aim to understand the respondent's characteristics, backgrounds, and other attributes.

Other important terms in data collection are *population* and *sample*. A population is the set of all objects or individuals of interest for the research, while a sample is the subset of the population. A sample helps to make inferences about the population when doing a census of the whole population is not possible (Groebner, et al., 2011). This sampling can be done using statistical or nonstatistical sampling. Statistical sampling uses techniques based on chance selection, and nonstatistical sampling methods are those methods of selecting samples using convenience, judgment, or other non-chance processes.

2.8.2 Statistical Procedures

After data are collected, it should be processed into information so that it can become useful. These data can be presented in charts and graphs to help describe the data. This type of statistical procedures is called *descriptive* statistics, which concerns the description and summarization of data. After the data are described and summarized, conclusion can be taken from the data. This type of statistical procedure is known as *inferential* statistics. Inferential procedures allow a decision-maker to reach a conclusion about a set of data based on a subset of that data.

There are two primary categories in statistical inference procedures: *estimation* and *hypothesis testing.* Estimation is the means of taking a statistic from the sample data and using it to make an inference of the population. Hypothesis testing is similar to estimation, but a claim is first made, and the test is to see whether the claim made should be accepted or rejected.

Hypothesis testing can be tested by using several parameters, such as the *chi-square statistics.* This test statistic is used to test the statistical significance, whether or not there is an association between the factors that are observed in the cross-tabulation (Malhotra, et al., 2017). This can be used to measure the statistical significance and the strength of association from a cross-tabulated variable.

The testing can be done using a software called SPSS. SPSS is the abbreviation for Statistical Package for the Social Sciences, that consists of program for manipulating, analyzing, and presenting data, that are widely used in the areas of social and behavioral science (Landau & Everitt, 2004). This software is able to present descriptive statistics, inferential statistics, and conduct the hypothesis testing to help researcher gains information about their data.

2.9 PREVIOUS RESEARCH

There has been numerous of research in developed countries, especially European countries, as it was the first region in which Zero-Waste Stores were established. Presented in Table 2.2 below is a list of papers and master thesis that shows previous findings and research about Zero-Waste Stores.

Table 2.2 Selected resources on previous research of Zero-Waste Stores.

No.	Paper/Thesis Title	Author	Year
1.	The Prospects of Zero-Packaging Grocery Stores to Improve the Social and Environmental Impacts of the Food Supply Chain.	Elisa F. Beitzen-Heineke, Nazmiye Balta-Ozkan, Hendrik Reefke	2016
2.	Barriers and Incentives to Zero Packaging Food Retail: A Global Stocktake	Alexia Smits Sandano, Lund University	2016
3.	Unpacking Package Free Shopping: Alternative Retailing and the Reinvention of the Practice of Shopping	Christian Fuentes, Petronella Enarsson, Love Kristoffersson	2019
4.	Expansion of the Local, Organic, and Zero-Packaging Food Concept in Three Contexts: Zero-Packaging Grocery Stores, Conventional Supermarkets, and Ecostores.	Donatienne Istas, Maastricht University	2019
5.	*Determinan Loyalitas Pelanggan Pada Toko Berkonsep Nol Limbah: Studi Kasus Alang-Alang Zero Waste Store*	Annisa Deaneke Prabowo Putri, Institut Teknologi Sepuluh Nopember	2020

One of the earliest research found on Zero-Waste stores was done by Beitzen-Heineke et al. (2016). The study discusses the prospects of Zero-Waste Stores (in which they use the term zero-packaging) and how it improves the social and environmental impacts in the food supply chain. This work by Beitzen-Heineke et al. (2016) also analyzes the Zero-Waste Stores activities using the modified Porter and Kramer's value chain which will be used as guiding questions to understand the business process of Zero-Waste Stores in this research.

Another research related to Zero-Waste Stores was by Fuentes et al. (2019), in which they did their research focusing more on the practice of shopping itself and how it shapes up a new habit, where it requires re-framing of shopping practice, re-skilling of consumer and the re-materialization of the stores.

Similar to the research done by Beitzen-Heineke et al. (2016), Sandano (2016), conducted this research under her thesis at Lund University, discusses the barriers and incentives of these Zero-Waste Stores. It also identifies if any packaging waste reduction practices are done in the Zero-Waste Stores that can be adapted to the mainstream retail stores. It classifies each of the barriers and incentives based on four aspects: regulatory, social, market, and resource factors. This aspect was also used by Istas (2019) from Maastricht University to explore the barriers further to expand these Zero-Waste Stores and how to come up with measures to address those barriers. It also aims to investigate the possibilities for a local economy and more sustainable food supply chains through a Zero-Waste Store.

In Indonesia, since this concept is still relatively new, not many published research has been done. One research about Zero-Waste Stores is done by Putri (2020), to understand the customer's characteristics and loyalty to Zero-Waste Stores. The research focuses more on understanding and identifying the variables that affect customer's loyalty to a local Zero-Waste Store, such as green perceived value and self-brand connection.

However, in this research, the author would like to further focus on the implementation of Zero-Waste Stores or Zero-Packaging Stores in Indonesian context as compared to what has been done in the European countries. The study would like to see how it can be widely accepted locally with the barriers that exist in Indonesia.

CHAPTER III
RESEARCH METHODOLOGY

This chapter will show the research methodology and some explanation about the phases that consists in this research systematically. Presented below in Figure 3.1 is a visualization of the research methodology outline.

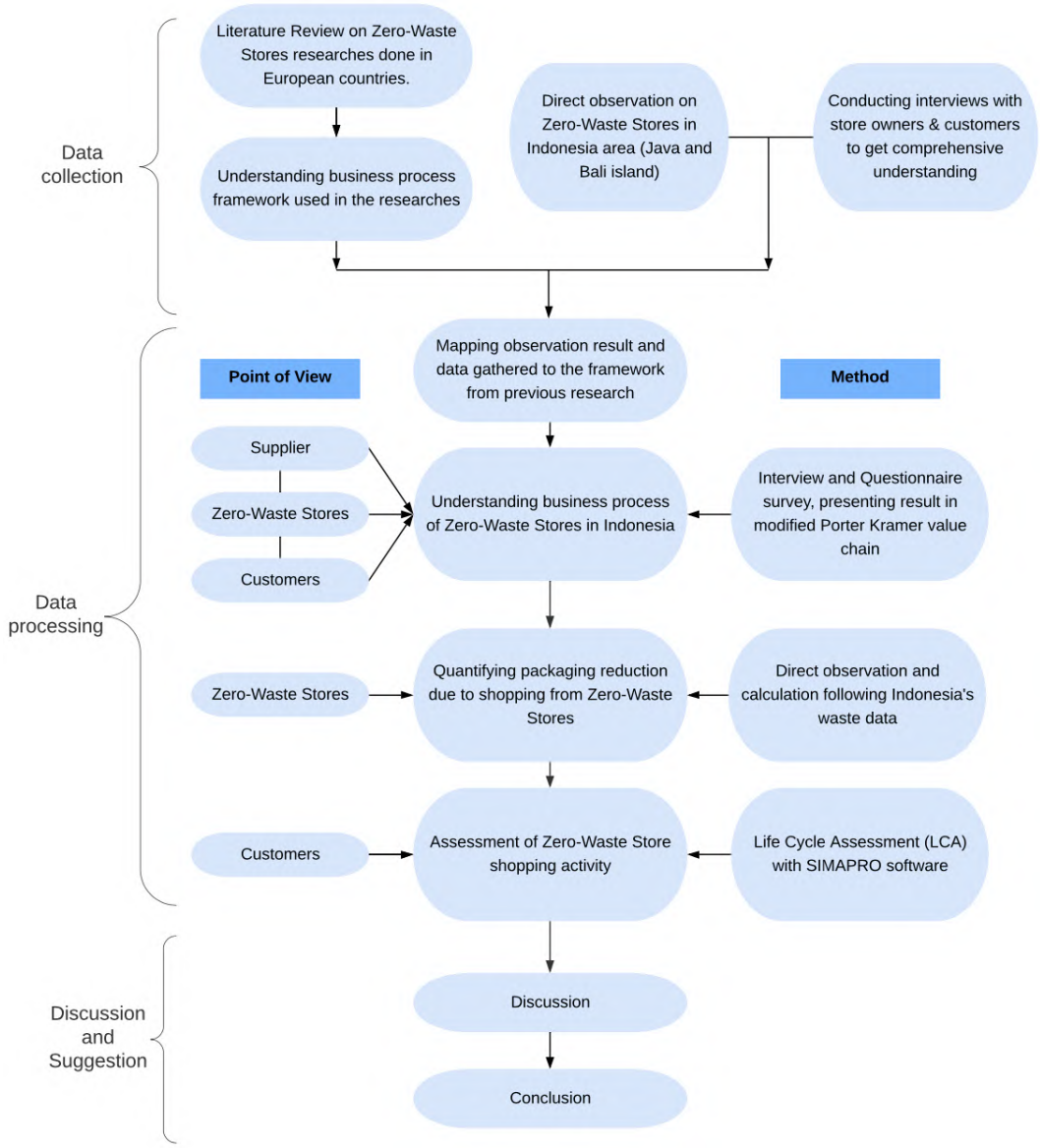

Figure 3.1 Research design outline.

Each of the main process outlined in the flowchart below will be explained in depth below.

3.1 UNDERSTANDING BUSINESS PROCESS USING CIMOSA

Even though no manufacturing processes are happening in the operations of a Zero-Waste Store, the CIMOSA business process map can help identify activities or processes in a business. Shown in Figure 3.2 are the possible questions that are related to the business activities of a Zero-Waste Store, illustrated inside of a CIMOSA framework.

<table>
<tr><th colspan="4">Manage Process</th></tr>
<tr><th>Set Direction</th><th>Set Strategy</th><th colspan="2">Direct Business</th></tr>
<tr><td>What is their vision and mission?</td><td rowspan="3">Values about their stores (sourcing locally, storing organic only)</td><td colspan="2">How their additional services affects customer?</td></tr>
<tr><td>Can it become like regular retailers?</td><td colspan="2">How green is their vision and mission?</td></tr>
<tr><td>How profitable is the business?</td><td colspan="2"></td></tr>
<tr><th colspan="4">Core Business Process</th></tr>
<tr><th>Develop Product</th><th>Get Order</th><th>Fulfill Order</th><th>Support Product</th></tr>
<tr><td>How is the store designed?</td><td colspan="2">How do suppliers deliver goods to the store (Cost-efficient procurement)?</td><td rowspan="3">What are their additional services for customers?</td></tr>
<tr><td>Is it economically feasible?</td><td rowspan="2">How stores display the correct amount?</td><td rowspan="2">How committed are customers in reusing their own containers?</td></tr>
<tr><td rowspan="2">How do they plan an eco-friendly procurement system?</td></tr>
<tr><td>How stores accommodate customers' demand?</td><td>How often does customer visit and how far is their house?</td><td rowspan="2">Do they have tutorial on how to shop in a Zero-Waste Store?</td></tr>
<tr><td>How to market/promote their stores?</td><td>What are the suppliers criteria for the stores?</td><td>What are the customer's characteristics?</td></tr>
<tr><th colspan="4">Support Process</th></tr>
<tr><th>Human Resource</th><th>Finance</th><th>Information Technology</th><th>Maintenance</th></tr>
<tr><td>How they employ staff to work in the store?</td><td>How profitable is the business?</td><td>Do they use I.T for marketing/operations?</td><td rowspan="2">How is the regular maintenance schedule to keep the store clean and in order?</td></tr>
<tr><td>How they manage relations with suppliers and customers?</td><td>How much cheaper is buying from a Zero-Waste store?</td><td>How they manages customers' data?</td></tr>
</table>

Figure 3.2 CIMOSA framework for Zero-Waste Stores.

Shown in Figure 3.2 are questions that are related to the operations of a Zero-Waste Store, based on the activities according to CIMOSA's definition. The questions that are displayed here will become guiding questions for observation and

conducting an interview with Zero-Waste Stores' stakeholders to gain information about the stores.

3.2 UNDERSTANDING BUSINESS PROCESS USING VALUE CHAIN FRAMEWORK

Since a Zero-Waste Store doesn't have any manufacturing activity, another approach can be used to help identify the processes that are happening within the Zero-Waste Stores operation. The research previously done by Beitzen-Heineke et al. (2016) adapted the Porter & Kramer Value Chain framework, focusing on only two of the support activities: technology development and procurement, as well as three of the primary activities: logistics, operations, marketing & sales. The framework is shown in Figure 3.3.

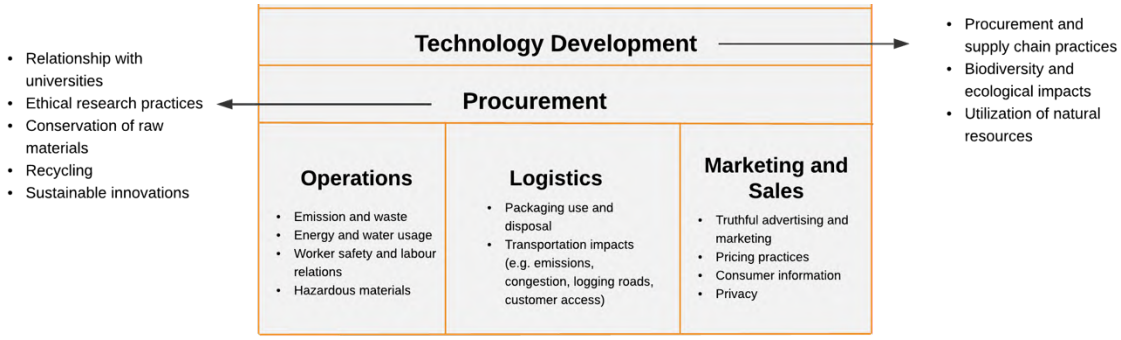

Figure 3.3 Beitzen-Heineke et al. Value Chain adaptation.
Source: (Beitzen-Heineke et al., (2016))

The CIMOSA framework helps to understand the main aspects of a business process, which are manage process, core business process, and the support process aspects. Each of those aspects helps to outline some questions related to the operations of a Zero-Waste Store. Those questions can be further specified and suited to a value chain framework adapted by Beitzen-Heineke et al. (2016) in order to analyze how these stores integrate the environmental and social performance into their business concept since these stores are aiming to have a better environmental impact. The questions that are classified into the value chain framework can be seen below depicted in Figure 3.4.

Technology Development		
How technology affects the operations, logistics, marketing and sales activities.		
Procurement		
How they plan an eco-friendly procurement system and their supplier's criteria		
Operations	**Logistics**	**Marketing and Sales**
• How green is their vision/mission? Values of their stores? • Can it become like regular retailers? • How additional services affects customers? • How is the store deisgned? • How committed are customers in reusing their own containers? • How is the regular maintenance schedule?	• How they accommodate customer's demand? • How suppliers deliver goods to the store? • How stores display the correct amount? • How often does customer visit and how far is their house? • How they provide those additional services to customer?	• How profitable is the business? • How to market/promote their stores? • What are the customers' characteristics? • How much cheaper for customer to buy from Zero-Waste Stores? • Tutorial on how to shop in a Zero-Waste Store? • How they manage supplier and customer data?

Figure 3.4 Questions for Zero-Waste Stores in Value Chain framework.

This value chain framework does not place the questions based on manufacturing firms' order like CIMOSA. However, it helps to classify the questions that are related to each aspect in a firm, more specifically for enterprises that concern the environmental and social impact.

3.3 QUANTIFYING PACKAGING REDUCTION

In order to see if these Zero-Waste Stores actually affects the number of packaging reduction due to the operations of Zero-Waste Stores, a calculation using the waste per capita data from Indonesia's citizen will be done. Assumption simple research will be conducted with one of the Zero-Waste Stores to get previous sales data from the past year. From there, the number of goods purchased will be converted into the usual amount usually sold in packaging in retail stores.

Since many products that are sold in Zero-Waste Stores, the products will be classified according to the goods types. The packaging wrapping that kinds of goods in traditional retail stores will then be defined to quantify the amount of packaging reduction accurately.

3.4 CLASSIFYING QUESTIONS INTO THE LIFE CYCLE MANAGEMENT FRAMEWORK

These types of stores are introduced with the aim to bring a better impact on the environment by reducing the amount of plastic packaging that ends up in the landfill. However, in order to achieve it, the overall process should also be good for the environment. Assessing the impact of shopping activities in a Zero-Waste Store on the environment can be done using the Life Cycle Management aspects.

Each of the questions that were created using the CIMOSA and Value Chain framework is classified under the LCM branches to identify which tools under LCM are suitable to assess the life cycle impact for each question. This will help to limit the scope of the assessment.

3.5 QUESTIONNAIRE AND SURVEY

Understanding the operations of Zero-Waste Stores requires a comprehensive explanation from and observation of the stakeholders. Direct observation will be done by visiting the stores and observing the situation of the stores. Gaining an explanation about the operations will be done by sending questionnaire emails to the store owners and suppliers. However, to understand the customer's perspective on Zero-Waste Stores, a massive survey will be conducted. Table 3.1 below will show the main list of questions to ask the store owners and suppliers. The questions will be asked in Bahasa Indonesia to the respective store owners.

Table 3.1 Questions for Zero-Waste Stores owners.

No.	Questions
1	When was the store established, and what is the reason behind it?
2	What is the main concept of the store, and how is the daily operation?
3	How do you promote your store?
4	What are the types of goods sold? Are they mostly non-branded product?
5	Is it harder to manage the upstream side (finding suppliers) or downstream side (finding customers to shop here)?

Table 3.1 shows questions that will become the main questions for the store owners. However, there will be follow up questions based on the answers given by the store owners to gain a better understanding of their explanation.

The survey will be shared through the shop owners and sustainable or Zero-Waste communities through their social media accounts to be able to reach most of

their customers. This will allow the people who are having an interest in shopping in Zero-Waste Stores and also the people who have bought in Zero-Waste Stores to fill in the survey form.

The questionnaire results will be analyzed using descriptive and inferential statistics to see the opinion and acceptability of the customers about the Zero-Waste Stores. The data will also be analyzed using SPSS software to understand the correlation between some of the factors seen in this research.

3.6 CATEGORIZING OUTPUT BASED ON STAKEHOLDERS

After understanding the framework and the LCM tools that are going to be used to assess the questions and aspects of the research, it can be categorized under an input – process – output scheme. This scheme will help identify what output can be inferred after an input is processed using the tools and framework.

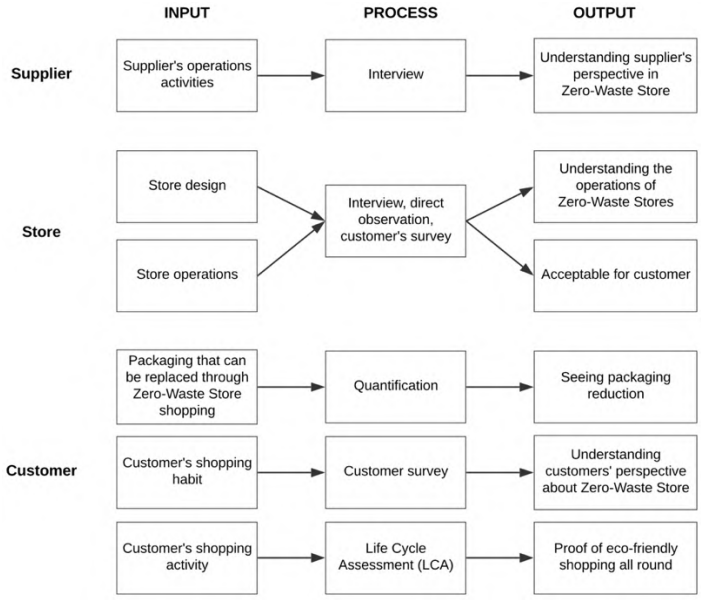

Figure 3.5 Input – Process – Output Framework.

From Figure 3.11, it can be seen that the outputs are the main objectives of the research. In order to answer those objectives, the inputs, such as the store design and product price from the store's point of view, as well as customer's shopping habit and activity, should be processed with the suitable methodologies to obtain the desired output.

CHAPTER IV
ZERO-WASTE STORES IN INDONESIA

Several stores are selected to become the objects for this research to gain information about the current operations of the Zero-Waste Stores in Indonesia. Among the identified stores, the following are selected since they are willing to participate in this research. Direct observations are also done to several stores which are not selected. Table 4.1 shows the list of Zero-Waste Stores, which are found all across Indonesia, with the selected stores for this research highlighted in green.

Table 4.1 List of the identified Zero-Waste Stores in Indonesia

No.	Stores	Location	Year Established	No. of store	Scale
1.	Alang-alang Zerowaste Shop	Mulyorejo, Surabaya	January 2019	1	Small
2.	Bulkstore & Co.	Menteng, Jakarta	May 2019	2	Medium
3.	BYO Bali	Ubud, Bali	November 2019	1	Small
4.	Green Mommy Shop	Blimbing, Malang	November 2018	1	Small
5.	Mamaramah Ecobulk Store	Ketintang, Surabaya	Maret 2019	1	Small
6.	Naked Inc.	Kemang, Jakarta	April 2019	1	Medium
7.	Peony Eco House	Sleman, Yogyakarta	Juni 2019	1	Small
8.	Ranah Bhumi	Mergangsan, Yogyakarta	October 2019	1	Small
9.	Saruga Free Pack Store	Bintaro, Jakarta	November 2018	1	Medium
10.	Wasteless Jakarta	Gandaria, Jakarta	July 2019	1	Small
11.	Zero Waste Bali	Ubud, Bali	August 2018	2	Medium

Table 4.1 also shows rows that are highlighted in red. This indicates the stores that are going to be included in this research; however, the information was taken *partially*. Partially means that it does not have the information derived from the same set of questions. The information for Alang-Alang Zerowaste Shop will be taken from the previous research done by Annisa Deaneke Prabowo Putri (2020). For Zero Waste Bali, even though an interview was conducted, the information

taken from Zero Waste Bali could not answer most of the questions as complete as the other stores.

The rows that are not highlighted are unselected stores. They are not selected because they are unreachable, or they are unwilling to participate. *Unreachable* status meaning that efforts have been made by the author to contact the owner, yet there is no solid answer from the owner. The stores with the *unreachable* status are Naked Inc. and Peony Eco Store. Whereas for the *not willing* status means that the communication and proposal have been offered to the owner, yet they are not willing to participate in this research. The stores with the *not willing* status are Green Mommy Shop and Wasteless Jakarta.

The stores identified are also classified into different scales of businesses, if it were to be compared with the other existing stores in Indonesia. The "small" classification is given to stores that meet the criteria of a Zero-Waste Store but still have a minimal variety of products sold, as well as a small storage size for their products. The "medium" classification is given to the stores that meet the criteria of a Zero-Waste Store, and have more variety in their catalog, have bigger shop space, or even have another branch. Not only that, but the "medium" classification is also given because of their exposure and partnership.

However, the selected stores have been interviewed via email with the same list of questions. The information gathered from the interview and also a direct observation of the stores will be presented in the following subchapters. These subchapters are classified based on Bepakt's Zero-Waste Stores criteria and the questions that were sent to the store owners.

4.1 BACKGROUND & STORE VALUES

Even though these stores identify themselves as a Zero-Waste Store, their primary value does not mean it is the same. It varies between different owners and shops, even though they all have the same main goal: doing better for the environment. A little background story of the store's establishment is also explained in the following paragraphs.

Bulkstore & Co. in Jakarta was established and operating since May 2019, with the shared vision amongst its five female owners to take action and implement

a healthier lifestyle for the sake of the environment. According to Putri, one of the owners, they are inspired by their eco-friendly personal experience from the communities that they joined. Therefore, with Bulkstore & Co., they aim to educate people on how to shop and consume everyday necessities mindfully, more specifically on reducing the amount of single-use plastics. Another store in Jakarta, **Saruga Free Pack Store**, was established in November 2018 with the realization that retail stores should have the awareness to innovate ways to reduce the number of packaging wastes. Their store was a little bit different among the others. They are currently working on a pilot project with Unilever—a company that produces many household products—to see the feasibility of creating refill stations for their goods. This project has been going on for two years now, and the brands that are supplied keeps on thriving. It is hoped to drive more people to start reducing their plastic packaging wastes while still consuming the branded products they used to consume.

In Central Java area, there is a beautiful traditionally-decorated Zero-Waste Store called **Ranah Bhumi**. Even though the store was established in October 2019, it actually goes way back to the year of 2013-2014, where Bukhi Prima Putri (the owner) had a personal revelation about life and society. She initiated a research platform called *Akar Institute* to gain insights and answers to her questions. This journey led her to discover Tri Hita Karana: a concept from a small village in Northern Bali, in which every activity must be done harmonically between oneself and the environment. She initially created a pop-up bulk store in 2017 called Semesta Store to educate the society about the eco-friendly lifestyle. When she moved to Yogyakarta in 2019, she decided to set up a Zero-Waste Store with the hope of providing necessities for the locals and setting a platform for the locals who wanted to sell their goods in Ranah Bhumi. The main values that they hold are friendliness, local, quality, fair, and eco-friendly.

A revelation was also felt by Ogi Dhaneswari, the owner of **Mamaramah Eco Bulk**, however, it was felt from a different experience. She started a vegan lifestyle in early 2017 and had a newfound passion for cooking and exploring spices that were not common. Due to this experience, she realizes that she made quite a lot of food waste from the foods that were not suitable for her taste buds. She

stumbles upon the concept of this zero-waste lifestyle, where it inspires her to 'share' these spices so that people can consume only the amount that they need. She had the idea to set up this Zero-Waste Store, but it was not executed right away. Until she participated in a beach cleanup action in Bali in 2018, where she found out that most of the trash in the shorelines are coming from Java. She felt embarrassed and that fueled her spirit to then establish Mamaramah Eco Bulk, with the value to become an eco-friendly bulk store and the hope to invite more people to quit the unnecessary and shop consciously. The store is then established in April 2019, commemorating Earth Day.

Zero-Waste Stores can also be found in this small island in Indonesia called Bali, which is the first region that explicitly bans the use of plastic bags. **BYO Bali** is one of them. This store was just recently established in November 2019 as an extension of the owner's values. While they wanted to create a space where people can easily find eco-cosmetics and healthy snacks in bulk, they also have a mission to inspire people who want to start a low waste lifestyle by providing the tools for them.

There is also another Zero-Waste Store in Bali, called **Zero Waste Bali**. They opened their store since 2018 and currently have two active stores located in Bali island. Besides Mamaramah Eco Bulk Store in Surabaya, another Zero-Waste Store in the area is **Alang-Alang Zerowaste Shop**. It was established several months earlier than Mamaramah Eco Bulk Store, located in East Surabaya.

4.2 SHOP DESIGN & FUNDING

Referring to Bepakt's criteria, the general shop design for a Zero-Waste Store usually aligns with the minimalist philosophy. This a philosophy that focuses on how to live with as little as possible. This means that the store's interior is not cluttered and cramped with the items they sell; they opt for a clear and clean layout. The majority of the design uses wood and nature-related theme, using second-hand or upcycled furniture with a clean and simple design. Since Zero-Waste is a concept to minimize or even eliminate waste from one's life, the shop aims to showcase that idea well. Shown in Figure 4.1 to Figure 4.7 are pictures that show the stores' interior and design.

Figure 4.1 Store interior of Bulkstore & Co.

Figure 4.2 Store interior of Saruga Free Pack Store.

Figure 4.3 Store interior of Mamaramah Eco Bulk Store

Figure 4.4 Store interior of Ranah Bhumi
Source: (Ranah Bhumi, 2019)

Figure 4.5 Store interior of BYO Bali
Source: (BYO_Bali Instagram acount, 2020)

Figure 4.6 Store interior of Zero-Waste Bali
Source: (Zero Waste Bali's website, 2019)

Figure 4.7 Store interior of Alang-Alang Zerowaste Shop
Source: (Arell Syah, 2019)

The establishment of a shop requires funding and capital for investment. According to Bepakt's criteria, these Zero-Waste Stores usually use crowdfunding to help invest in their businesses. However, through interviews with the owners of all the Zero-Waste Stores identified in this research, the stores in Indonesia doesn't use crowdfunding to fund their businesses. They are all using their owner's personal funds to invest in these stores.

4.3 BRANDING AND MARKETING DESIGN

Current innovation in technology enables effortless marketing through the use of social media. As a new type of business with a niche market, they rely mostly upon through word of mouth and information sharing through social media such as Instagram to promote their shop. All of the Zero-Waste Stores interviewed are identified and contacted by the author through Instagram. Below are their typical marketing posts on Instagram.

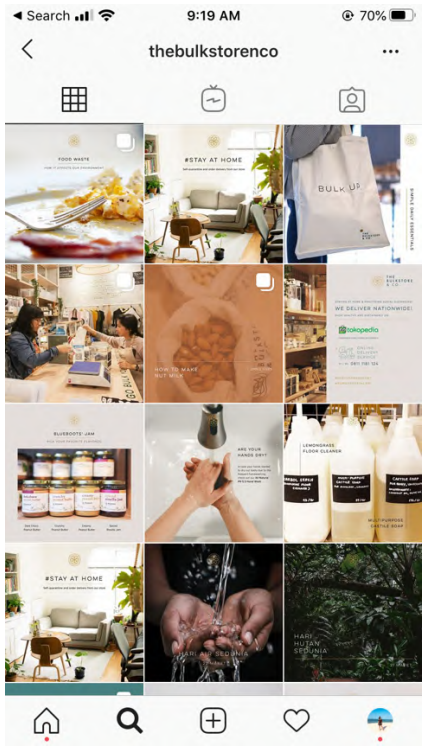

Figure 4.8 Instagram marketing of Bulkstore & Co.

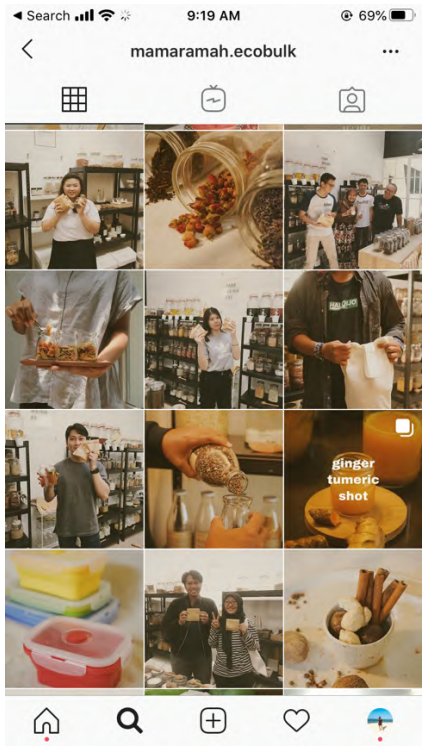

Figure 4.9 Instagram marketing of Mamaramah Eco Bulk Store

Figure 4.10 Instagram marketing of Saruga Free Pack Store

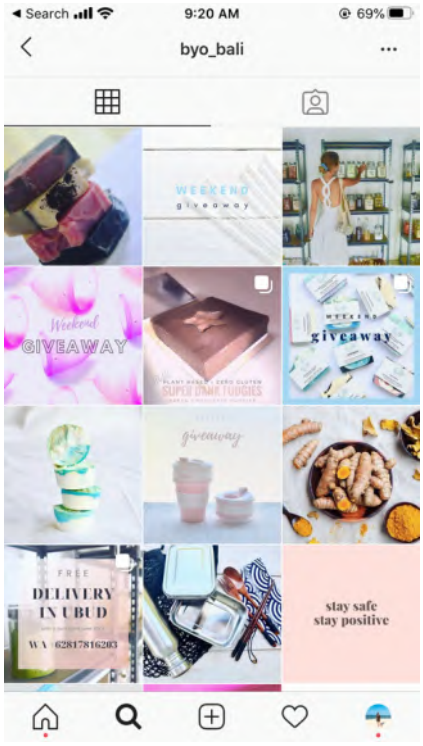

Figure 4.11 Instagram marketing of BYO Bali

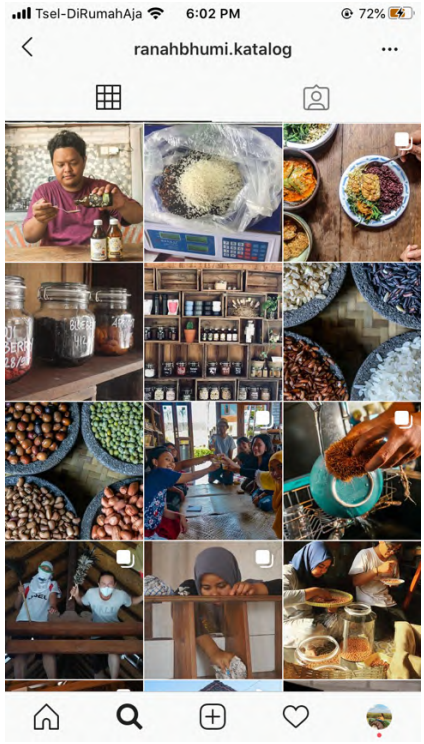

Figure 4.12 Instagram marketing of Ranah Bhumi

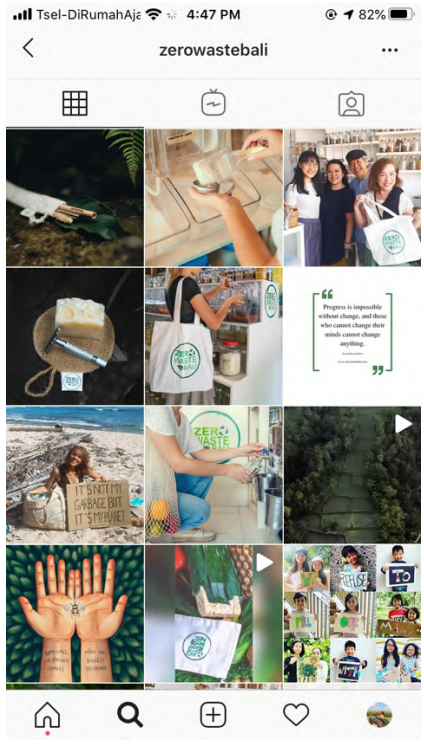

Figure 4.13 Instagram marketing of Zero Waste Bali

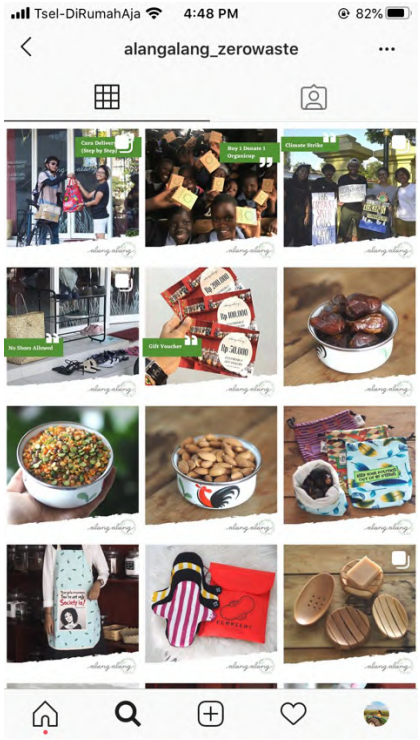

Figure 4.14 Instagram marketing of Alang-Alang Zerowaste Shop

It can be seen that they present a clean layout with simplicity as their main theme. They use modern graphics to help them convey their message through the social media world. The content on their Instagram page mostly shows the variety of products that they sell, information about the products, shop interiors and situations, activities inside of the store, and services that they offer. **Mamaramah Eco Bulk Store** and **Ranah Bhumi** both also focus on interactions with customers who came to visit their store. They believe that word of mouth is key to promoting their stores to gain more exposure and existence for their shop.

4.4 PRODUCT ASSORTMENT & SOURCING

The types of products sold in these Zero-Waste Stores are ranging from different categories. They mostly sell both dry goods and liquid goods. These dry goods include flours, rice, pasta, beans, leaves, powder, dried fruits, granola, cookies, and crackers. Liquid goods include oils, honey, jams, sauces, soaps, shampoos, detergents, and other cleaning chemicals. Adding on to that, they also sell an assortment of reusable items that can help customer live a zero-waste

lifestyle, with items from bamboo or metal cutleries, reusable produce, and shopping bags, to different types of tumblers and cups.

These goods come from many sources too. **Bulkstore & Co**. prioritizes to have their goods sourced domestically and organically. They want to support local businesses and farmers who have worked hard to provide food for the citizens. This does not only apply for edible goods, but also for the hygienic products. Products such as body soap, cleaning detergents and soaps, and shampoos are confirmed only to contain natural ingredients and are certified safe for both the human body and the environment. There are different ways on how to deliver the supplies into Bulkstore & Co's receptacles. Some of the suppliers do not mind using bigger reusable containers sent back and forth from their warehouse to the store, and some are still using packaging, but they request them to be as minimal as possible.

The owner of **Saruga Free Pack Store** mentioned that most of their spices that are not found easily in Indonesia are still imported. However, they prioritize more on sourcing locally from small medium enterprises and local farmers. Alongside several Unilever products, they also sell other brands that can be categorized into three main categories: food, personal, and home care. They create partnerships with suppliers through the persuasive approach, emphasizing on realizing the same goal to make the Earth a better place.

Making sure that each of the products is carefully curated, **Mamaramah Eco Bulk Store** in Surabaya displays an array of superfoods. Even though most of these superfoods are imported, 80% of the goods sold in the store are locally sourced. They also sell a variety of household care, such as detergents and soaps, that supports sustainability living all around. This means that the ingredients used are cruelty-free, therefore it does not harm the environment when it is disposed of. There are no specific brands that they select to become their supplier, but they prioritize the brands with specific criteria that matches their vision. The goods sold in the store are also developing along with the request from the previous customers that have visited their stores. Most of their customers requested mostly household and self-care products, healthy powder drinks, and fresh condiments. To serve their customers, Mamaramah Eco Bulk works together with many distributors and local farmers, which are spread throughout Java island. Some of their suppliers also only

requested a simple minimum purchase rule, and likewise, they also do negotiations with their suppliers to minimize packaging waste. The negotiations are about refilling systems, purchasing in bulk, and only using minimal packaging.

Similarly, **Ranah Bhumi** also implements the bulk purchasing system and minimal packaging if it is indispensable, especially for suppliers located outside of Central Java and Indonesia (imported products). By requesting to send the goods in bulk, it will optimize all square areas of the packaging, rather than sending them in smaller sizes and higher in quantity.

BYO Bali also supplies most of the goods that are sold among those Zero-Waste Stores. They try to source their products as locally as possible, thinking about the carbon footprint that comes with transportation. They mainly collaborate with small local suppliers and other initiatives that support their values. Approaching their suppliers started by looking for a specific item that they want to put in the stores, and sometimes they also got contacted by the small businesses that want to get more exposure. Their suppliers are also flexible when it comes to creating agreements on supplying the store according to the Zero-Waste Store ways. Their effort to eliminate the waste created during the delivery by regularly returning the empty containers to suppliers so that they can refill it.

The other **Zero-Waste Store** in Bali mostly sells the same type of products as what the other stores are selling, only they present more variants. They have almost 100 different items for eco-friendly products, 39 herbs and spices, and almost 50 types of body and hair care products. They also sell many superfoods. These items are imported to Bali using plastic packaging, while products that are sourced locally are delivered in boxes, paper bags, and glass jar containers. For products such as oils are brought in bulk with tin containers, and for soaps, they usually come in 5 to 20-liter jerry cans where they return and reuse.

What differentiates **Alang-Alang Zerowaste Shop** from the other Zero-Waste Stores identified in this research is the fresh organic vegetable pre-order system. Other than supplying what common Zero-Waste Stores have, such as the body soaps, cooking products and spices. They also offer an array of fresh vegetables such as cassava, sweet potato, tomatoes, carrots, tempeh, and many others. They opened this system during the week and let their customer pick up

their veggies unpacked on the weekends. They work together with local farmers to make this happen.

4.5 DAILY OPERATION

When a customer enters the store, it can only come down to two possibilities: whether they bring their containers or they do not. If they don't bring containers from their homes, they can choose to buy reusable containers provided in the store, or buy paper bags (which are sometimes provided in their stores and pay for it). After that, the rest of the shopping sequence is more or less the same in each store.

Every customer will have the right to choose what product they want to buy from the display, which uses transparent receptacles. Once they have decided what to buy and how much they would like to buy it, they can tare their empty containers at the weighing station. They can pour their wanted amount to the container, and it will then be weighed to see how much they need to pay. They can repeat the same progress for the next item that they want to buy. Figures 4.11 and 4.12 shows guidance in two Zero-Waste stores in Indonesia.

Figure 4.15 Shopping guidance in Bulkstore & Co. store

Figure 4.16 Shopping guidance in Naked Inc. store

This general process is done in all of the stores that participated in this research. Figure 2.2 from Chapter 2 shows the basic steps on how to shop from the first Zero-Waste Store, Unpackaged in London. Putting up the instructions on the store will help customer understand how to shop, especially for the newcomers.

4.6 CHALLENGES IDENTIFIED

Coming up with innovation means that there will be challenges and obstacles. Since the Zero-Waste Store is a relatively new concept in Indonesia, there are many challenges identified by the stores.

Bulkstore & Co stated that it is harder to deal with the upstream activity, such as managing the suppliers, rather than dealing with the downstream side. Most of the traditional suppliers do not understand what a bulk store is; therefore, it was hard to establish a partnership with them in the first place. However, now, when they were able to supply many varieties for different products they have in store, it is harder to gain customer that will buy that product because it is becoming unique and specific. They also mentioned that during the creation of this store, it was quite hard to map out the activities happening inside the store because no model can be explicitly followed in Indonesia.

Saruga Free Pack Store mentioned that the main obstacle during the creation of this store was breaking the skeptics who do not believe that Zero-Waste Stores can significantly reduce the total number of trash from single-use packaging.

Similar to what is experienced by Bulkstore & Co, **Mamaramah Eco Bulk Store** felt that it was quite hard to find suppliers who understand their vision with as minimal packaging as possible due to hygiene reasons. Another aspect that was considered as a challenge is that some products deteriorate faster due to being exposed to open air pretty often. This leads to another challenge where they have to always carefully scrutinize the cleanliness of their store to make sure the quality is not compromised. They mentioned that both downstream and upstream areas have their challenges. However, they focus more on customers or downstream side, because they believe that with the changes from the customer side, it will push the market where suppliers will shift to fulfill the customers' wants and needs.

Moreover, **Ranah Bhumi** experiences difficulties procuring goods or products with a very high number of minimum purchases since they do not need that much. Inviting locals to shop in their store was also an obstacle, due to a relatively higher price of products sold in their store. Another thing that was considered a challenge is to see this store from a business perspective since they have little prior knowledge of the business. They put a priority on delivering what is best for the environment.

Even though there is no significant problem in finding suppliers, **BYO Bali** thinks that the main challenge in creating a Zero-Waste Store is inefficient waste management. This effort and innovation will not be effectively successful if there is no complete support from the entire waste chain players. When people are already putting effort into reducing inorganic waste from single-use packaging, it should also be supported by others that help manage waste that cannot be reduced.

4.7 OTHER SERVICES

These Zero-Waste Stores use social media to educate their consumers about the importance of shopping in their store, focusing on minimizing packaging waste. Some examples of this are done by **Bulkstore & Co** and **Saruga Free Pack Store** through their Instagram platform. Figure 4.13 shows Bulkstore & Co's post, highlighting the number of plastic toothbrushes that end in landfills and seas around

the world. Figure 4.14 shows a post about an event from Saruga Free Pack Store, sharing the concept of this Zero-Waste Store.

Figure 4.17 Educating customers through Instagram.
Source: (Bulkstore & Co's Instagram page, 2020)

Figure 4.18 Introducing Zero-Waste Stores concept.
Source: (Saruga Free Pack Store's Instagram page, 2020)

Both of these Zero-Waste Stores also works together with a waste-drop box business that allows customers to bring their recyclables, such as plastic bottles, to be appropriately recycled. They also provide a dropbox for electronic wastes. Figure 4.15 shows the example of the drop boxes located in front of their stores.

Figure 4.19 Drop box for plastic bottle (blue box) and e-waste (white box).

Other services offered by one of the Zero-Waste Store is a delivery system using a "green" carrier. **Mamaramah Eco Bulk** partnered up with **Haloijo**, an eco-delivery service that uses bikes to deliver products all around the Surabaya area. This is also done by **Alang-Alang Zerowaste Shop**. This will also allow Mamaramah Eco Bulk to deliver its products to its customer without using any packaging. The goods delivered by Haloijo are using "borrowed" containers from Mamaramah Eco Bulk, where customers will then transfer it to their own at home, and then the containers are returned to the store. Figure 4.16 shows the partnership information of Mamaramah Eco Bulk and Halojio.

Figure 4.20 Eco-delivery service partnership.

Source: (Bulkstore & Co Instagram page, 2020)

Aiming to make sure that all efforts are made to help reduce the number of wastes, **BYO Bali** partnered up with TriUpCycle to fully support their eco-movement. TriUpCycle is a social enterprise based in Bali to create products, such as handkerchief, using upcycled material to promote conscious consumption. They also plant trees for each product sold.

Those services offered by these Zero-Waste Stores may not directly be linked to their daily activities and operations in their store, but these activities help to support them to realize their vision and goals.

4.8 CONCLUSION ON ZERO-WASTE STORES IN INDONESIA

If these types of stores to be implemented in Indonesia, a comprehensive understanding of their business process must be done. After conducting interviews with the store owners of the these Zero-Waste stores in Indonesia, enough information can be obtained to draw some important conclusions. Table 4.2 below shows the aspects of Zero-Waste Stores based on Bepakt's framework explained in this chapter, summarized in one table. A check mark (√) are given in a column for the store if the statement on the left applies, a dash (-) is given in a column for the store if the statement on the left doesn't apply, and the lowercase letter N (n) is given in a column if it is not identified due to partial information. The (n) mark is specifically for Alang-Alang Zerowaste Shop and Zero Waste Bali.

Table 4.2 Conclusion on interviewed Zero-Waste Stores.

Aspects	**Stores**						
	BC	SFPS	MEB	RB	BYO	AA	ZWB
Background & Store Values							
Driven by personal realization	√	√	√	√	√	n	n
Prioritize local sourcing	√	√	√	√	√	n	n
Shop Design & Funding							
Nature-themed, minimalist	√	√	√	√	√	√	√
Personal funding	√	√	√	√	√	√	√
Branding & Marketing							

Aspects	Stores						
	BC	SFPS	MEB	RB	BYO	AA	ZWB
Relies mostly on social media (Instagram as main online platform)	√	√	√	√	√	√	√
Product Assortment & Sourcing							
Sells dry goods (flours, pasta, beans, granola)	√	√	√	√	√	√	√
Sells Indonesian spices ingredients and vegetables				√		√	
Sells zero-waste kits (other than reusable packaging provided to shop)	√		√	√	√	√	√
Daily Operation							
Shopping routine follows similar pattern of Unpackaged flow (Figure 2.2)	√	√	√	√	√	√	√
Challenges Identified							
Convincing suppliers to reduce packaging	√	-	√	√	-	n	n
Communicating with suppliers to adjust amount of order	-	-	-	√	-	n	n
Other Services							
Educating their customers about importance of waste reduction (related to Zero-Waste Stores principles)	√	√	√	√	√	√	n

It can be seen that most of the Zero-Waste Stores in Indonesia have the basic criteria mentioned by Bepakt in their website. Some of them also specializes or offer something that is not offered by other stores, such as opting to also sell vegetables that are unpackaged with plastics under the *Product Assortment and Sourcing* section which is done by Ranah Bhumi.

The section in *Challenges Identified* shows the challenges that can rise during creating a Zero-Waste Store, and these were identified by the owners of the respective stores. These challenges are also experienced by the other stores in one way or another, since they are all just established their store in less than 2 years.

All of this information is also presented using the framework from Beitzen-Heineke, et al. (2016) which was also modified to fit in the purpose of this research, as elaborated in Chapter 3. This is shown in Table 4.3 below.

Table 4.3 Beitzen-Heineke's framework – Store's Perspective

<table>
<tr><th colspan="3">Technology Development</th></tr>
<tr><td colspan="3">Technology are highly affecting the marketing and sales activity of the Zero-Waste Stores. These niche stores are promoting their stores through social media of Instagram, reaching their audience through that online platform.</td></tr>
<tr><th colspan="3">Procurement</th></tr>
<tr><td colspan="3">Their procurement system requires collaboration and agreement between them and the suppliers. Many of the products are sourced locally, but not a few are imported from even outside of Indonesia. Therefore, packaging are still used to send the products from suppliers to stores.</td></tr>
<tr><th>Operations</th><th>Logistics</th><th>Marketing and Sales</th></tr>
<tr><td>Most of the stores aims to make their vision mission entirely green, by making sure that all the products that they sell are completely eco-friendly.</td><td>The products are delivered locally if located in the same geographical area, but are sent using bulk-sized packaging if it is imported or sent from another area.</td><td>As a business, it does gain profit from the transactions.
The price becomes relatively cheaper since customers can only buy with the amount they desire to purchase.</td></tr>
</table>

CHAPTER V
ZERO-WASTE STORES STAKEHOLDERS

This chapter will present the other stakeholders of the Zero-Waste Stores; customers and suppliers' perspective regarding the operations of this business. Interviews are conducted with suppliers, and questionnaire survey are conducted to gain customer's perspective. This was taken as it is seen as an effective method to gain as many voices from the customer as possible.

5.1 CUSTOMERS' PERSPECTIVE

Understanding the eye of the customer's is also crucial to understand the suitability of these stores in Indonesia. A survey is conducted to get the voices of Indonesian citizen regarding of this concept.

5.1.1 Sample Sizes, Validity, and Reliability

The calculation for the sample sizes is following Cochran's (1963) formula to yield a representative sample of proportion as presented below.

$$n_0 = \frac{Z^2 pq}{e^2}$$

Legend:
n_0 = Sample size
Z = Z value from desired confidence interval
p = Estimated proportion of an attribute present in the population
q = 1 – p
e = Desired level of precision / Margin of Error

Based on the customer's segment in relation to the Zero-Waste Stores activity, there will be two categories of the respondents: the ones who have known about this concept, and those who have not known about this concept. Both of the groups will follow the same confidence interval, 95%, and have the same proportion estimate of 0.5. The value that will defer is the margin of error from both of the group. This value is adjusted due to the goal of each group.

For the "Know" group, the margin of error is set to 5%.

This is set as low as possible since many information are going to be taken from this result. The information obtained from the group of people who have known about this stores will be very useful in evaluating the suitability of these Zero-Waste Stores in Indonesia. More specifically, their shopping experiences in these stores will help to see what key activities are happening inside of the stores, what behaviors possessed by the customers that knows and have visited these stores.

$$n_0 = \frac{(1.96^2)(0.5)(0.5)}{0.05^2}$$

$$n_0 = 385$$

Legend:
n_0 = Sample size
Z = Z value from 95% confidence interval → 1.96
p = Proportion estimate of 0.5
q = 1 – p
e = Margin of error 5% → 0.05

For the "Don't know" group, the margin of error is set to 8%.

According to DataStar (2008), the acceptable margin of error for conducting surveys fall between the value of 4-8% at a 95% confidence level. This group is set at 8% since the population of the people that don't know about this concept is much larger. This is due to the marketing and promotion done by the stores through online platform, especially Instagram accounts. Based on the data from NapoleonCat (2020), there are only 65 million people in Indonesia that uses the Instagram social media. With the latest Indonesia's population data in the year 2018 by BPS which are equals to 265 million, this means that there are only 24.5% of the population that have access to knowing that information. Therefore, the possibility of the errors are higher in this group. However, to keep this result acceptable, 8% is used for this research.

$$n_0 = \frac{(1.96^2)(0.5)(0.5)}{0.08^2}$$

$$n_0 = 150$$

Legend:
n_0 = Sample size
Z = Z value from 95% confidence interval → 1.96
p = Proportion estimate of 0.5
q = 1 – p
e = Margin of error 8% → 0.08

Based on the previous calculations, it is concluded that the required minimum sample respondents for the "Know" and "Don't know" groups are 385 and 150 respectively.

The questionnaire's validity and reliability are tested using SPSS software. The questions included are the ones answered with scale questions, separating it with open ended questions. The result summary is presented in Table 5.1 below.

Table 5.1 Questionnaire Validity and Reliability

Validity			
Questions Aspect		**Pearson's r-value**	**Calculated value**
Zero-Waste Store Perception	**1**	0.423	0.472
	2	0.423	0.589
	3	0.423	0.801
	4	0.423	0.670
	5	0.423	0.541
	6	0.423	0.791
Packaging	**1**	0.423	0.720
	2	0.423	0.622
	3	0.423	0.551
	4	0.423	0.567
	5	0.423	0.554
	6	0.423	0.523
Experience	**1**	0.423	0.562
	2	0.423	0.481
	3	0.423	0.648
	4	0.423	0.625
	5	0.423	0.611
	6	0.423	0.813
	7	0.423	0.777

Validity			
	8	0.423	0.761
Reliability			
Questions Aspect		**Cronbach's Alpha**	**Calculated value**
Zero-Waste Store Perception		0.6	0.706
Packaging		0.6	0.652
Experience		0.6	0.806

From the validity test, for each of the questions' aspect that are able to be analyzed using the SPSS test, it is shown that the calculated value are all > 0.423. When the value are higher than the table value, the questionnaire can be said to be valid (Dewi, 2018). This means that the questions for the questionnaire are valid at significance level of 5%.

The reliability test shows the comparison of the calculated value using SPSS software and the ideal Cronbach's Alpha. A general accepted rule is that the *alpha* value of 0.6 – 0.7 indicates an acceptable level of reliability, and 0.8 or greater a very good level (Ursachi, et al., 2015). This indicates that the questions can be stated as reliable.

5.1.2 Respondents' Demography

The customers' perspective is taken from the survey conducted to a total of 742 respondents, conducted in March to May 2020. The general demography of the respondents are displayed in Table 5.2 below.

Table 5.2 Demography result of all respondents.

Demography Factor	Frequency	Percentage (%)
Gender		
Male	328	44.20%
Female	414	55.80%
Age Range		
< 17 years old	25	3.40%
17 – 20 years old	155	20.90%
21 – 25 years old	336	45.30%

Demography Factor	Frequency	Percentage (%)
26 – 30 years old	77	10.40%
31 – 40 years old	81	10.90%
> 40 years old	68	9.20%
Place of Residence (displayed cities are cities with selected Zero-Waste Stores)		
Jakarta	186	25.07%
Surabaya	231	31.13%
Bali	42	5.66%
Yogyakarta	12	1.62%
Others	271	36.52%
Latest Educational Background		
SMP	3	0.40%
SMA/SMK	130	17.52%
D1	8	1.08%
D2	1	0.13%
D3	20	2.70%
D4	12	1.62%
S1	500	67.39%
S2	60	8.09%
S3	8	1.08%
Occupation		
Student	409	55.12%
Civil Servant	48	6.47%
Private Employee	160	21.56%
Entrepreneur	28	3.77%
Unemployed	8	1.08%
Others	89	11.99%
Monthly Shopping per Month		
1 – 2 times	270	36.39%
3 – 5 times	287	38.68%
> 5 times	185	24.93%
Basic Necessities Expenses per Month (in thousands Rupiah)		
< Rp 500	120	16.17%
Rp 500 – 1,000,	202	27.22%

Demography Factor	Frequency	Percentage (%)
Rp 1,000 – 3,000	246	33.15%
Rp 3,000 – 5,000	93	12.53%
Rp 5,000 – 10,000	61	8.22%
Rp 10,000 – 20,000	13	1.75%
> Rp 20,000	7	0.94%
Expenses Including Family Members		
Yes	278	37.50%
No	464	62.50%

From Table 5.2, the participants demography distribution can be seen. For example, the women are making up 55.80% of the total respondents of this research. The basic necessities expenses per month section shows the expenses incurred by the respondents per month to fulfill their needs. It shows Rp 500 in thousands Rupiah, meaning it is equal to Rp 500,000.

This respondents result are divided into two main groups with a specific intention for each group. The first one is the respondents who have known about this concept, in which their inputs will be useful to understand the current Zero-Waste Stores operation in Indonesia. The second group will be those who doesn't know about this store, in which their responses are used to get an idea about this novel concept.

5.1.1.1 The 'Know' Group

The survey conducted yields 570 respondents for this group, therefore, it is already meets the requirement based on the minimum requirement sample size of 385. These respondents have a demographic profile as presented in Table 5.3 below.

Table 5.3 Demography of the 'Know' group respondents.

Demography Factor	Frequency	Percentage (%)
Gender		
Male	233	40.90%
Female	337	59.10%
Age Range		
< 17 years old	19	3.30%

Demography Factor	Frequency	Percentage (%)
17 – 20 years old	118	20.70%
21 – 25 years old	258	45.30%
26 – 30 years old	68	11.90%
31 – 40 years old	67	11.80%
> 40 years old	40	7.00%
Place of Residence (displayed cities are cities with selected Zero-Waste Stores)		
Jakarta	147	25.79%
Surabaya	185	32.46%
Bali	30	5.26%
Yogyakarta	12	2.11%
Others	196	34.39%
Latest Educational Background		
SMP	1	0.20%
SMA/SMK	93	16.30%
D1	6	1.10%
D2	1	0.20%
D3	13	2.30%
D4	8	1.40%
S1	392	68.80%
S2	51	8.90%
S3	5	0.90%
Occupation		
Student	317	55.61%
Civil Servant	32	5.61%
Private Employee	122	21.40%
Entrepreneur	22	3.86%
Unemployed	6	1.05%
Others	71	12.46%
Monthly Shopping per Month		
1 – 2 times	205	35.96%
3 – 5 times	219	38.42%
> 5 times	146	25.61%
Basic Necessities Expenses per Month (in thousands Rupiah)		

Demography Factor	Frequency	Percentage (%)
< Rp 500	88	15.40%
Rp 500 – 1,000	153	26.80%
Rp 1,000 – 3,000	201	35.30%
Rp 3,000 – 5,000	71	12.50%
Rp 5,000 – 10,000	43	7.50%
Rp 10,000 – 20,000	9	1.60%
> Rp 20,000	5	0.90%
Expenses Including Family Members		
Yes	209	36.70%
No	361	63.30%

From the demographic result presented in Table 5.3 that shows the 'Know' group profile, the percentages are relatively the same as the entire respondents profile in Table 5.1. There's only a slight difference in the percentages for each section, however, it still have the same proportion.

The majority of the 'Know' group happens to be in the age of 21-25, followed by the age group of 17-20. This is fitting because the age group that uses Instagram based on NapoleonCat (2020) shows the highest number for age group of 18-24 and 25-34. However, when seeing the place of residence, with Jakarta having the most number of Zero-Waste Stores, it is expected that there will be a higher proportion of people that knows about this store in Jakarta. Yet, in this demographic profile, Surabaya has the highest percentage. This demographic profile however cannot be used for a conclusive research because the proportion number of respondents in each cities hasn't been comprehensive.

5.1.1.2 The 'Don't Know' Group

The survey conducted yields 172 respondents for this group, therefore, it is already meets the requirement based on the minimum requirement sample size of 150. These respondents have a demographic profile as presented in Table 5.4 below.

Table 5.4 Demography of the 'Don't Know' group respondents.

Demography Factor	Frequency	Percentage (%)
Gender		
Male	95	55.20%
Female	77	44.80%
Age Range		
< 17 years old	6	3.50%
17 – 20 years old	37	21.50%
21 – 25 years old	78	45.30%
26 – 30 years old	9	5.20%
31 – 40 years old	14	8.10%
> 40 years old	28	16.30%
Place of Residence (displayed cities are cities with selected Zero-Waste Stores)		
Jakarta	39	22.67%
Surabaya	46	26.74%
Bali	11	6.40%
Yogyakarta	0	0.00%
Others	76	34.39%
Latest Educational Background		
SMP	2	1.20%
SMA/SMK	37	21.50%
D1	2	1.20%
D2	0	0%
D3	7	4.10%
D4	4	1.40%
S1	108	62.80%
S2	9	5.20%
S3	3	1.70%
Occupation		
Student	92	53.49%
Civil Servant	16	9.30%
Private Employee	38	22.09%
Entrepreneur	6	3.49%
Unemployed	2	1.16%

Demography Factor	Frequency	Percentage (%)
Others	18	10.47%
Monthly Shopping per Month		
1 – 2 times	65	37.80%
3 – 5 times	68	39.50%
> 5 times	39	22.70%
Basic Necessities Expenses per Month (in thousands Rupiah)		
< Rp 500	32	18.60%
Rp 500 – 1,000	49	28.50%
Rp 1,000 – 3,000	45	26.2%
Rp 3,000 – 5,000	22	12.50%
Rp 5,000 – 10,000	18	7.50%
Rp 10,000 – 20,000	4	1.60%
> Rp 20,000	2	0.90%
Expenses Including Family Members		
Yes	70	40.70%
No	102	59.30%

It can be seen that the demographic for the 'Don't Know' group also doesn't differ much than the entire population average demographic. However, this group shows a higher proportion for men, with 55.20% from the total respondent for this group. Adding on to that, the age group of with more than 40 years of age is higher in percentage in this 'Don't Know' group. This is fitting because it is according to NapoleonCat (2020), there are only 7% of Instagram users whose age are above 40 years old.

5.1.3 Customers' Characteristics

The survey questions aims to know customers perspective in two main areas: Zero-Waste Stores concept and Packaging. The questions regarding Zero-Waste Stores helps to gain information about the willingness of the customer to shop in those stores, and questions about packaging helps to see customer's willingness is sacrifice the roles of packaging, since shopping in a Zero-Waste Store meaning that they have to sacrifice them.

5.1.3.1 Survey Result and Comparison

The following section shows the result from the survey, from both the 'Know' and 'Don't Know' group, answering the questions or statements from the survey. Each question or statement is placed inside a table, with answers summarized and visualized in a pie chart. Table 5.5 to Table 5.14 shows the answer for the first part of the question about Zero-Waste Stores, and Table 5.15 to Table 5.20 shows the answer for the second part of the question about Packaging.

Table 5.5 Environmental awareness statement

Statement or Question	
I consider myself as a person who has an awareness of the environment.	
Know	**Don't Know**

Table 5.6 Zero-Waste Stores concept statement

Statement or Question	
I feel that Zero-Waste Stores concept is good for the environment.	
Know	**Don't Know**

Table 5.7 Hassle of bringing container to shop

Statement or Question	
I don't mind the hassle of bringing my own container to shop because Zero-Waste Stores are good for the environment.	
Know	**Don't Know**

Table 5.8 Willingness to shop if not bringing container.

Statement or Question	
If you are shopping in a Zero-Waste Store but you don't bring a container, you are ____% willing to keep on shopping and to buy the containers sold in the stores.	
Know	**Don't Know**

Table 5.9 Paying more expensive in a Zero-Waste Store

Statement or Question	
I don't mind paying for a more expensive product because Zero-Waste Stores are good for the environment.	
Know	**Don't Know**

Table 5.10 Percentage of paying more expensive

Statement or Question	
Until how many percent (%) more expensive that you are still willing to shop in a Zero-Waste Store?	
Know	**Don't Know**

Table 5.11 Willing to make it a routine if nearby

Statement or Question	
I am willing to make shopping in Zero-Waste Stores as a routine if it is nearby my house.	
Know	**Don't Know**

Table 5.12 Maximum distance of Zero-Waste Stores

Statement or Question	
Until how far away is the Zero-Waste Store from your house that you are still willing to shop there as a habit?	
Know	**Don't Know**

Table 5.13 Willing to make it a routine if needs are fulfilled

Statement or Question	
I am willing to make shopping in Zero-Waste Stores as a routine if the majority of my daily needs can be fulfilled.	
Know	**Don't Know**

Table 5.14 Minimum percentage of needs fulfilled

Statement or Question	
With a minimum of ___% of your daily needs fulfilled, you will shop in a Zero-Waste Stores as a routine.	
Know	**Don't Know**

Table 5.15 Packaging as a way of communication

Statement or Question	
Packaging is a form of communication from the producers to the consumers.	
Know	**Don't Know**

Table 5.16 Willingness to sacrifice communication role

Statement or Question	
How willing are you to sacrifice the role of COMMUNICATION from packaging due to shopping in Zero-Waste Stores?	
Know	**Don't Know**

Table 5.17 Packaging as a way of protection

Statement or Question	
Packaging is a form of protection to preserve the quality of the product.	
Know	**Don't Know**

Table 5.18 Willingness to sacrifice protection role

Statement or Question	
How willing are you to sacrifice the role of PROTECTION from packaging due to shopping in Zero-Waste Stores?	
Know	**Don't Know**

Table 5.19 Packaging as a way of convenience

Statement or Question	
Packaging is a form of convenience to make it easy for customers to buy.	
Know	**Don't Know**

Table 5.20 Willingness to sacrifice convenience role

Statement or Question	
How willing are you to sacrifice the role of CONVENIENCE from packaging due to shopping in Zero-Waste Stores?	
Know	**Don't Know**

5.1.3.2 Analysis of Customer's Perspective

Based on what is presented in Table 5.5 to Table 5.20, there are interesting results that can be noted about the customer's perspective on Zero-Waste Stores. Each of the statement are answered by two groups: one from a group that already

knows about the concept, and another group that doesn't know about the concept. Both of the group have relatively similar proportion for environmental awareness in Table 5.5. Shown in Table 5.6, both of the group mostly agrees that this store is good for the environment, with 73.30% of the 'Know' group strongly agrees on this statement.

There are several differences in Zero-Waste Store shopping compared to the traditional retails or supermarket. This includes shifting to a new habit of bringing own container to shop, the differences in product sold causes the difference in price, very few stores resulting very far distances from customers' houses, and also the variety of goods sold in the store. Each of those aspects can vary between individuals, more willing to sacrifice one aspects rather than the other.

Table 5.13 shows how customers are willing to make it as a routine if almost all of their needs can be fulfilled by the Zero-Waste Stores. The 'Know' group has 53.20% of the respondents who are strongly agree with the statement, and 36.80% who agrees. Only 8.40% who are neutral and very few who disagrees. On the other hand, the 'Don't Know' group has more percentage on who agree, and has a bigger percentage for the neutral group at 18.60% compared to 8.40% from the 'Know' group. However, in Table 5.14, the proportion of minimum percentage of needs fulfilled are similar for both group. They both mostly shows requires a minimum of 70-80% minimum needs fulfilled before making it as a routine.

This shows that there's a good response and willingness from Indonesians to shop in a Zero-Waste Store if it can meet the following criteria: being closer to their houses with the radius of below 5 km, the products cannot be more than 25% more expensive compared to the traditional retails, and have at least 70% of their daily needs sold in the Zero-Waste Stores.

5.1.4 Shopping Experience in Zero-Waste Stores

To fully evaluate the suitability of these Zero-Waste Stores in Indonesian context, the current operations of Zero-Waste Stores must first be understood. The survey also had a section where it asked whether the respondents has visited a Zero-Waste Store before. From the 570 respondents who knew about the concept of this store, 199 respondents have visited a Zero-Waste Store and have answered questions regarding their experience and gave some suggestions.

5.1.4.1 General Experience

This section will show a summary of their general experience of shopping in a Zero-Waste Store. Each question or statement is placed inside a table, with answers summarized and visualized in a pie chart. Table 5.21 to Table 5.31 shows the answer for the first part of the question about their Zero-Waste Store shopping habit, and Table 5.32 to 5.39 shows the answer for the second part of the question about their in-store activity.

Table 5.21 Visited Zero-Waste Stores

Statement or Question	Result
Which of the following stores that you have visited?	

Table 5.22 Getting information about Zero-Waste Stores

Statement or Question	Result
Where or how did you find out about Zero-Waste Stores?	

Table 5.23 Reason on visiting Zero-Waste Stores

Statement or Question	Result
What makes you interested to visit a Zero-Waste Store?	

Table 5.24 Visitation to Zero-Waste Stores

Statement or Question	Result
Did you visit the Zero-Waste Store only once?	

Table 5.25 Visiting Zero-Waste Store more than once

Statement or Question	Result
If no, how many times have you been to a Zero-Waste Store?	

Table 5.26 Making Zero-Waste Store shopping a routine

Statement or Question	Result
Do you make shopping to Zero-Waste Stores as a routine?	

Table 5.27 House distance from Zero-Waste Stores

Statement or Question	Result
How far away is your house to the Zero-Waste Store?	

Table 5.28 Bringing own container to shop in Zero-Waste Stores

Statement or Question	Result
Do you bring your own container to shop?	

Table 5.29 Planning what to buy in the Zero-Waste Store

Statement or Question	Result

Do you plan the items that you are going to buy?	

Table 5.30 Items bought in Zero-Waste Stores

Statement or Question	Result
What are the types of items that you buy from the store?	

Table 5.31 Challenges in Zero-Waste Store shopping

Statement or Question	Result
What do you feel are the challenges in shopping in a Zero-Waste Store?	

Table 5.32 The visited Zero-Waste Store has strategic location

Statement or Question	Result
The visited Zero-Waste Store has strategic location.	

Table 5.33 The visited Zero-Waste Store has an attractive layout

Statement or Question	Result
The visited Zero-Waste Store has an attractive layout.	

Table 5.34 Diverse options of items in Zero-Waste Store

Statement or Question	Result
There are diverse options of items sold in the Zero-Waste Store.	

Table 5.35 Each type of item has many variations

Statement or Question	Result
There are a lot of variations for each item sold in the Zero-Waste Store.	

Table 5.36 Shopping process in a Zero-Waste Store

Statement or Question	Result
The shopping process in a Zero-Waste Store is easy.	

Table 5.37 The containers in the Zero-Waste Stores easy to operate

Statement or Question	Result
The containers in the Zero-Waste Store are easy to operate.	

Table 5.38 Filling in process to own container

Statement or Question	Result
The process of filling-in product to our own container is easy.	

Table 5.39 Shopping process duration in Zero-Waste Store

Statement or Question	Result
The shopping process in a Zero-Waste Store only takes a little time.	

52.80% of the customers' shown in Table 5.22 knew about the Zero-Waste Stores from social media, which is where these stores are mainly promoted and introduced. Almost one third (30.00%) of the customers' got informed from their

families and friends, who might've visited one or also gained the information on the Internet. There are many reasons why they wanted to visit a Zero-Waste Store. As shown in Table 5.23, the highest percentage is from the group who wants to reduce packaging waste. There are also people who were just curious about the store's concept in the first place.

With this new concept, customers' face some challenges while shopping in a Zero-Waste Store. Moreover, they have a lot of variety because they can sell those products in their many chains. These newly-introduced Zero-Waste Stores must be able to come up with competitive advantage that can cause customers to sacrifice these barriers to choose their stores instead of traditional retails.

5.1.4.2 Suggestions for Better Experience

Even though Table 5.31 through Table 5.38 shows mostly positive output, there are also quite a lot that chose "neutral" option, and that are still some of the proportion that choses "disagree" and "strongly disagree". This indicates that there are still many rooms for improvement. Other than collecting opinions with direct statements or questions, the author also gives an opportunity for the customers to express their needs and comments for the improvements of the Zero-Waste Stores.

Below are the selected excerpt from some of the respondents curated by the author to give suggestions for the Zero-Waste Stores owner, giving suggestion from many aspect of the shopping activity. Not only about the shopping action that is happening in the store, but also aspects on how to build customer trust. This will help Zero-Waste Stores have more loyal customers to their store.

"Providing a comfortable seating area (like a café) while demonstrating how to create foods with the ingredients sold in the Zero-Waste Stores. This will also make us more interested to buy the other products offered there and get an hands-on experience." – *Woman, 31-40 years old, Surabaya.*

"Some of the containers' shape are not suitable for the content, as I frequently having some trouble to get out liquid products since it got stuck inside

the tap or is settling at the bottom of the containers and cannot be sucked by the tap." – *Woman, 26-30 years old, Surabaya.*

"I think the transparency of the product status should also be provided. From my experience, the store doesn't give information on how long does that product has been seating on display, the expiry date. I just assume that they regularly check the quality of the product." – *Woman, 26-30 years old, Jakarta.*

5.1.5 Conclusion on Customer's Perspective

This table concludes the findings using the Beitzen-Heineke framework, adding on points that are answerable from customers' perspective.

Table 5.40 Beitzen-Heineke framework – Customer's Perspective

Technology Development		
Technology plays a very big role from customer's perspective because the most of the customer knows about Zero-Waste Store from social media. It helps to give customer information about the store itself too, such as a glimpse of their products, other services and events.		
Procurement		
There are an array of item choices that the customers can buy from Zero-Waste Stores, such as dry goods and liquid goods, but customers thinks that there are still a lack in variation from the products. This makes it one of their challenges in shopping in a Zero-Waste Store.		
Operations	**Logistics**	**Marketing and Sales**
From the survey result, some behavior that supports the operations in Zero-Waste Stores. Almost all customers bring their own containers to shop.	Distance-wise, the stores are located quite far from the customer's houses, as more than half of the customers are located more than 5 km away from the store.	The customer knows about the Zero-Waste Store mostly from social media, and some of them also heard about it from their friends.

5.2 SUPPLIERS' PERSPECTIVE

This section gives an additional insight about the operations of Zero-Waste Stores in Indonesia from the perspective from the suppliers. The suppliers who are participating in this research are suppliers that are found by direct observation by the author to the existing Zero-Waste Stores in Indonesia. There are three suppliers included in this research: Jiva Soap, Hepi Circle, and Wheat & Water.

5.2.1 Background and Values

For **Jiva Soap,** a supplier that sells personal hygiene soaps, supplies to Zero-Waste Stores because they initially wanted to expand the coverage of their brand. Jiva Soap was initiated because they wanted to create a small business, previously called Green Orient, that focuses on minimizing the amount of trash. The owners believed that by buying soap, people are also buying the packaging that eventually leads to landfill. Moreover, it brings more benefit since the content of homemade products are made from safe and non-chemicals. Located in Surabaya, they already have this business through online and offline platform since early February 2019. Figure 5.1 shows the profile of Jiva Soap on Instagram social media platform.

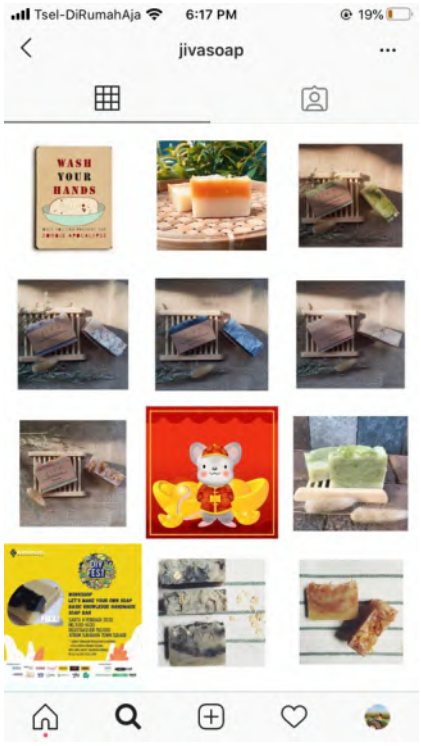

Figure 5.1 Jiva Soap's Instagram profile

Another supplier that supplies soap to Zero-Waste Stores in Surabaya area is a business called **Hepi Circle**. They started their business a few years ago, but firmly going since January 2019. In addition to personal hygiene soaps, they also sell household products such as liquid detergents, floor cleaners, fabric softener, and hand sanitizers. With the intention to reduce the amount of plastic trashes on Earth, they are also aiming to ameliorate the community's shopping behavior. This is shown by their continuous effort to campaign about reducing plastic wastes and encouraging their customer to reuse and recycle through their platform. Supplying their products to Zero-Waste Stores was also one of their efforts. By making their products available there, people will come to shop and buy for their product using their own packaging, therefore it aligns with their goals. Figure 5.2 shows the Instagram profile of Hepi Circle.

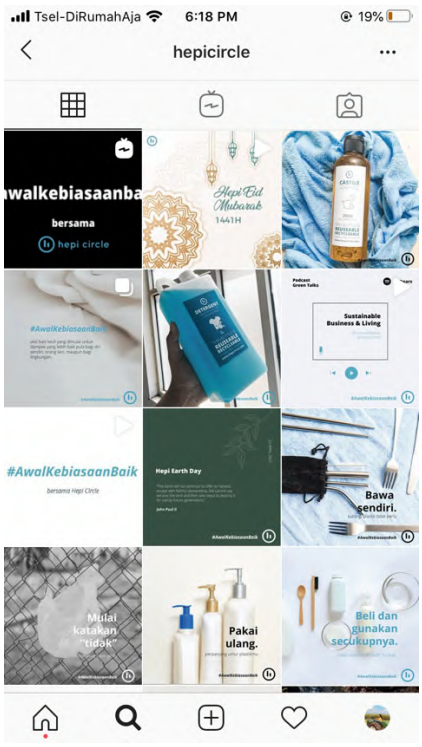

Figure 5.2 Hepi Circle's Instagram profile

Zero-Waste Stores supplies a plethora of daily necessities other than the soaps and household products, such as what is provided by Jiva Soap and Hepi Circle. There are also many raw foods and cooking ingredients. One of them is

Pasta. Supplying many Zero-Waste Stores across the Java island, **Wheat and Water** starts their pasta-making business due to the personal hobby of the owner. Since 2017, they sell their product by themselves, and only later in mid-2019 that they started to supply to the emerging Zero-Waste Stores. They weren't the one who approached the stores, however, it was the stores that come to them. Upon hearing and believing in Zero-Waste Stores' philosophy, they give their full support to those stores and supply the Wheat and Water products to those Zero-Waste Stores. Figure 5.3 shows the Instagram profile of Wheat and Water.

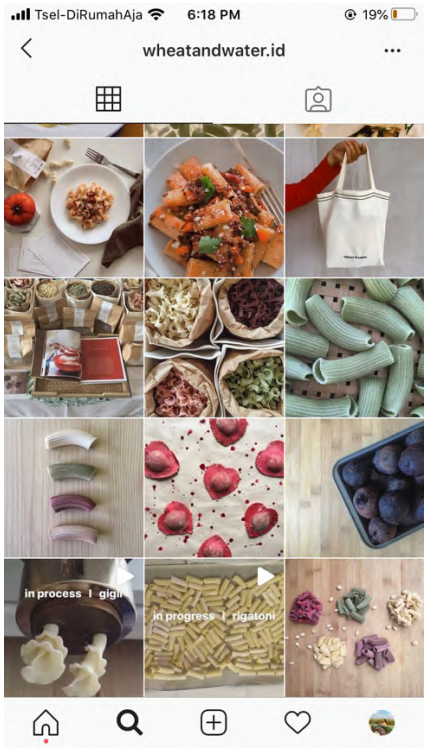

Figure 5.3 Wheat and Water's Instagram profile.

All of the aforementioned suppliers was involved in the Zero-Waste Stores chain since they support the goals and dreams of these stores to do good for the environment.

5.2.2 Products in Zero-Waste Stores & Pricing

The products in Zero-Waste Stores are sold by the suppliers are with a special price for bulk purchases from the suppliers. It varies according to the variety

of the products' type. Each suppliers have at least more than one product that are being sold in the stores.

For example, **Jiva Soap** sells liquid soaps and bar soaps. There are many scents for each liquid soap, as well as different scents and colors for the bar soaps. It is sold relatively cheaper in Zero-Waste Stores, since they are not selling the packaging. They sells their bar soaps enclosed with a cardboard paper to hold the soaps, and uses a special pumping container for the liquid goods. This is shown in Figure 5.4 below.

Figure 5.4 Jiva Soap products in Zero-Waste Stores.
Liquid soap (left) and bar soap (right)

Hepi Circle with their variety of products sold, mostly sells their castile soaps (personal hygienic soaps) to these stores. From observing its price with the same product and volume in one of the Zero-Waste Stores in Surabaya, it is cheaper to buy from the Zero-Waste Store itself. Not only that, by bringing containers from home, the amount bought can be specifically tailored so that it can be more affordable. Figure 5.5 shows the Hepi Circle container located in Zero-Waste Stores.

Figure 5.5 Hepi Circle product in Zero-Waste Stores.

There are two types of Castile soaps sold in the Zero-Waste Store by Hepi Circle, as seen in Figure 5.5, the unscented and scented soap. The scented soap uses Bergamot scent and is more expensive compared to the unscented one.

Wheat and Water products are sold in units of grams in Zero-Waste Stores. They sell different kinds of pastas which are incorporated with five vegetables: pumpkin, tomato, beet, spinach, and butterfly pea flower, all of which makes the pasta mix colorful. The pasta also comes in six different shapes: *gigili, gemeili, gnocchetti, conchiglie, creste di gallo,* and *zucca.* All of them have the same price and is sold to customers in packs of 450 grams. In the Zero-Waste Stores, customers can buy less than 450 grams and even get all shapes in the 450 grams mixture. However, to buy the same amount of 450 grams is more expensive in the Zero-Waste Store compared to the one sold immediately by Wheat and Water. Figure 5.6 below shows an example of their pastas in one of the Zero-Waste Stores.

Figure 5.6 Wheat and Water's pasta in Zero-Waste Stores.

The pricing is all up to the owners of the Zero-Waste Stores. These suppliers gave them a special price on bulk purchases and the selling price determination is up to the owner.

5.2.3 Delivery to Zero-Waste Stores

These stores aim to reduce packaging wastes of their customers, but are also trying to reduce packaging wastes from the delivery process. Some suppliers are able to do refill system since they are close in proximity, but others are just trying to come up with different ideas on how to eliminate wastes as much as possible. The Zero-Waste Stores has requested to use minimal plastic or using carton-based materials if packaging are indispensable.

Jiva Soap delivers their product directly by their own using a regular cardboard box which are filled in with bar soaps according to the request of the owners. Delivery for liquid soaps are using larger containers that will be transferred to the shop's container. **Hepi Circle** also does the same thing. All of their soaps are delivered directly by them and the soaps will be transferred to the containers in the stores. They also have a mini-warehouse located in two different areas of Surabaya, the east and west part, to make sure the delivery are closer to each stores.

Located in a city where most of the Zero-Waste Stores they supply are located outside of their areas, the strategy of shipment by **Wheat and Water** are slightly different. They opt to use corrugated cardboard box to place all of the pastas inside and ship them to the stores. This is a different approach than what they do

personally. They use plastic zip-lock bags and bubble wrap packaging for customers who buys directly from them. However, since they support the movements of these Zero-Waste Stores, they tried to send their products using those corrugated cardboard box. When they are opening a stand in bazaars, they also encourage their customers to bring their own containers too.

5.2.4 Conclusion on Supplier's Perspective

After understanding the activities of the suppliers and seeing the perspective of the Zero-Waste Store business from the suppliers, the information can be summarized using the framework shown in Table 5.67.

Table 5.41 Beitzen-Heineke's framework – Supplier's Perspective

<table>
<tr><th colspan="3">Technology Development</th></tr>
<tr><td colspan="3">Technology also plays a key role on the supplier's side, because it is what connects this initiatives (suppliers) to the Zero-Waste Stores.</td></tr>
<tr><th colspan="3">Procurement</th></tr>
<tr><td colspan="3">The volume of products procured from the suppliers depend on the store's request and using the capacity that the suppliers have. Minimizing purchase frequency and packaging is also done to align with the goal of the Zero-Waste Stores.</td></tr>
<tr><th>Operations</th><th>Logistics</th><th>Marketing and Sales</th></tr>
<tr><td>Whenever the supplies ran out from the store, the owners will contact the suppliers to repurchase the product. The suppliers will try to make sure to accommodate the request from the stores.</td><td>Products are delivered to the stores by local suppliers directly, using refillable containers. For the suppliers who are located outside of the area, the products are shipped using as minimal packaging as possible, and reducing plastic by opting for corrugated cardboard box.</td><td>The partnership between the stores and the suppliers are mutual, where the suppliers wants to also increase their brand coverage by selling their products through Zero-Waste Stores.</td></tr>
</table>

CHAPTER VI
LIFE CYCLE ASSESSMENT OF CUSTOMERS' SHOPPING ACTIVITY

This chapter is focuses on customers' life cycle assessment (LCA) since customers are the key player in making sure the Zero-Waste Store achieve their goal. The reduction of plastic waste packaging are also calculated in this chapter.

6.1 LCA SYSTEM BOUNDARY

Goal and scope definition helps to ensure that the LCA is performed consistently to avoid simplifications and distortions influence the results too much (Sustainability, n.d.). The activities needs to be analyzed to see to its impact and to what extend is Zero-Waste Store shopping is beneficial for the environment. These activities can be depicted in the diagram as shown in Figure 6.1.

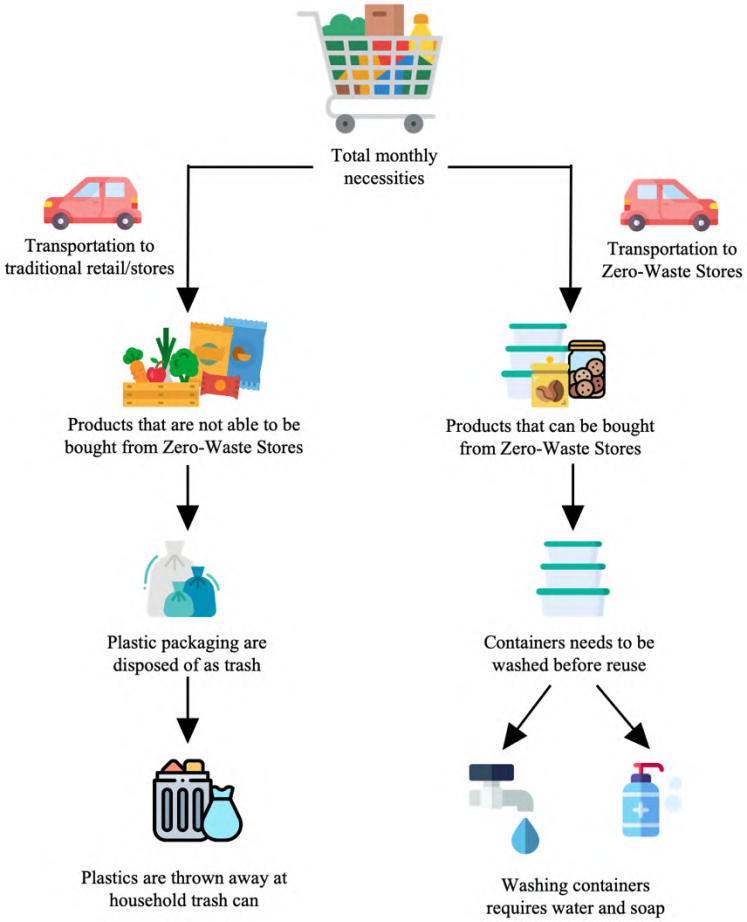

Figure 6.1 Life Cycle Assessment system boundary

The items sold in Zero-Waste Stores are mostly dry goods, things that are storable on shelves inside of containers. There are some items that are not able to be stored such as the products in Zero-Waste Stores, but are still needed to fulfill the needs of customers. Figure 6.1 shows that to fulfill those necessities, customers will have to travel two times, to Zero-Waste Stores and buy the other things from traditional retails or supermarkets. The distance to the stores also will be different, since supermarkets are in abundance and are located nearer to customers' house. While on the other hand, Zero-Waste Stores are still very few, resulting in further distance for customer to get to them.

Then, from the products that they bought, two treatment process are needed to take care of the "packaging". Things that are bought from traditional retail stores are disposed of after usage. The containers that are used to bring purchased goods from Zero-Waste Stores needs to be washed before reuse. To analyze those aspects, this entire LCA system boundary are partitioned into parts. Figure 6.2 shows the partitioned parts then referred to as sub-systems.

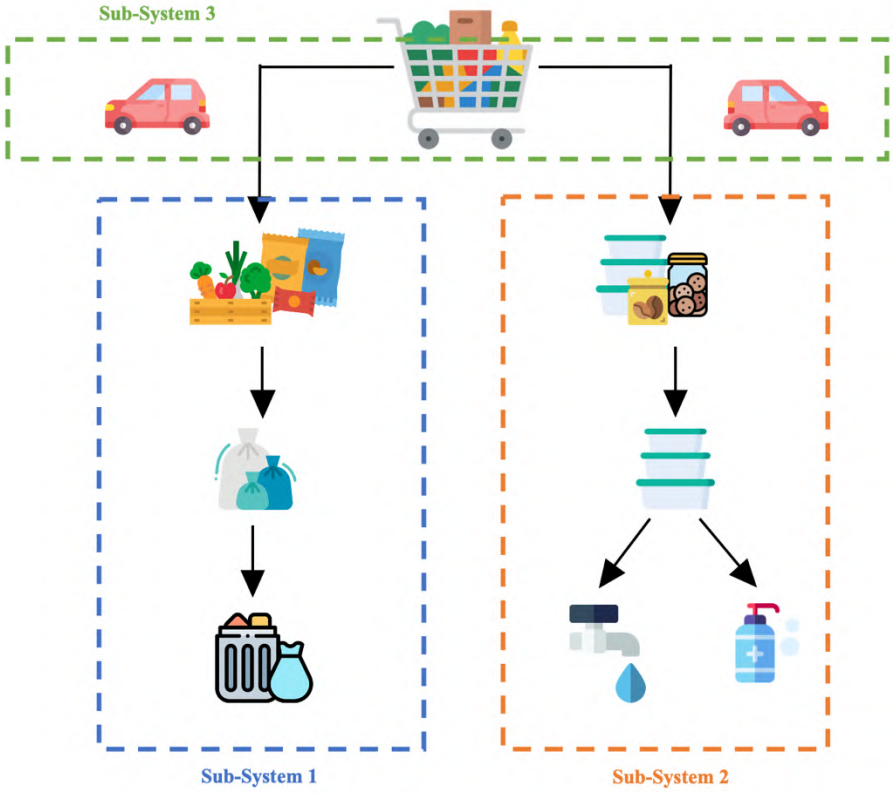

Figure 6.2 Sub-System for LCA Assessment

Figure 6.2 partitioned the system into three sub-systems. The first sub-system is the products that are bought from traditional retail stores, where the products are packed using plastic. The second sub-system is the condition where the items are bought using reusable containers, therefore are not generating plastic packaging waste. It is however, uses water and soap to clean the container for reuse. The third sub-system is where transport is done, to purchase goods from traditional retail stores and Zero-Waste Stores. The assessment in this chapter is the Life Cycle Assessment (LCA), presented in sub-chapter 6.3. The data for the LCA in sub-chapter 6.3 will take the data from sub-chapter 6.2 below.

6.2 PACKAGING WASTE REDUCTION

The aim of shopping in Zero-Waste Store is mostly to reduce solid plastic packaging waste to end up in landfill. By shopping items that are available in Zero-Waste Stores, customers are able to reduce their plastic packaging waste since it is sold unpacked. This section will see the amount of plastic waste reduced, measured by its weight (kg).

6.2.1 Substitutable Items in Zero-Waste Stores

The plastic waste reduction from Zero-Waste Store shopping can be calculated by firstly identifying the items that can be substituted. According to the data from Chapter 4, a variety of items can be bought from Zero-Waste Stores. Those items are listed down in Table 6.1 below.

Table 6.1 Items that can be bought from Zero-Waste Stores

No.	Type of item	Items
1.	Dry cooking/baking goods	Flour
2.		Rice
3.		Pasta
4.		Baking powder
5.		Baking soda
6.		Chia seeds
7.		Salt
8.	Other dry goods	Cookies

No.	Type of item	Items
9.		Oatmeal
10.		Noodles
11.	Hygienic products	Soap
12.		Shampoo
13.		Clothes detergent
14.		Floor-cleaning soap
15.		Dish-leaning soap
16.	Liquid consumable goods	Honey
17.		Soy sauce
18.		Cooking oil

With all kinds of items presented in Table 6.1 can be replaced, there will be a reduction of plastic waste resulting from these items. The items used in this research are packaging with the most common item seen in the traditional supermarket or retails and the refill version. Only one item are not the refill version, which is shampoo. Each of the items' packaging are weight can be seen in Table 6.2 below.

Table 6.2 Plastic packaging waste weight and plastic type

No.	Items	Retail size (kg/gr/l/ml)	Packaging weight (gr)
1.	Flour	1 kg	9 gr
2.	Rice	5 kg	27 gr
3.	Pasta	450 gr	6 gr
4.	Baking powder	45 gr	18 gr
5.	Baking soda	45 gr	18 gr
6.	Chia seeds	45 gr	18 gr
7.	Salt	250 gr	2 gr
8.	Cookies	72 gr	8 gr
9.	Oatmeal	150 gr	4 gr
10.	Noodles	1 packet	1.3 gr

6.2.2 Plastic Waste per Capita

Based on the report by Badan Pusat Statistik Indonesia (2019), the total number of Indonesia's population is equal to 265,015,300 in the year 2018. This number of people are generating trash every day, with an approximation of total waste generated is equal to 400,186,104 kg/day in the same year (BPS, 2019). From the findings of Hotspot Sampah Laut Indonesia (2018), amongst all of the waste generated, 13.16% are categorized as plastic waste. Following the unit from Kaza, et al. (2018) on the World Bank's report that states number waste per capita in kg/capita/day, the total plastic waste per capita can be calculated as follows:

$$Plastic\ waste = \ 13.16\%\ x\ 400{,}186{,}104\ kg/day$$
$$= \ 52{,}664{,}492\ kg\ per\ day$$

$$Plastic\ waste\ per\ capita = \frac{52{,}664{,}492\ (kg/day)}{265{,}015{,}300}$$
$$= \ 0.2\ kg\ per\ day\ per\ capita$$

This will be used as the number of plastic waste generated by Indonesian per day. Assuming that one month is equal to 30 days, the total plastic waste per capita in a month is equals to:

$$Plastic\ waste\ per\ capita\ per\ month = \ 0.2\ kg\ per\ capita\ x\ 30$$
$$= 6\ kg\ per\ capita\ per\ month$$

This number of 6 kg per capita per month will be used as the assumption of plastic waste per capita per month in this research.

6.2.3 Reduction from Zero-Waste Shopping

Shopping from a Zero-Waste Store helps to reduce the amount of plastic waste, by immediately transferring the goods to self-brought container. The items sold in the store are able to replace some of the daily needs. These are the product

that are substitutable, and are assumed from observation to be the consumption for each person per month (shown in grams/capita/month).

Table 6.3 Packaging waste generated per capita per month

No.	Items	Packaging weight	Usage	Packaging weight per capita
1.	Flour (1 kg)	9 gr	1/4	2.25 gr
2.	Rice (5 kg)	27 gr	1/4	6.75 gr
3.	Pasta (450 gr)	6 gr	1/2	3 gr
4.	Baking powder (45 gr)	18 gr	1/6	3 gr
5.	Baking soda (45 gr)	18 gr	1/6	3 gr
6.	Chia seeds (45 gr)	18 gr	1/6	3 gr
7.	Salt (250 gr)	2 gr	1/4	0.5 gr
8.	Cookies (72 gr)	8 gr	2	16 gr
9.	Oatmeal (150 gr)	4 gr	1	4 gr
10.	Noodles (1 packet)	1.3 gr	4	5.2 gr
TOTAL				139.6 gr
Rounding off				140 gr

From Table 6.3, the packaging waste weight per capita can be seen to be equals to 139.6 grams, rounding it off to 140 grams. This can be inferred that if each person can buy their daily needs of these items through Zero-Waste Store shopping, there will be an approximate of 140 grams (0.14 kg) of plastic packaging waste reduction per capita per month.

$$Plastic\ waste\ reduction = \frac{0.14}{6} x100\% = 2.34\%$$

Based on the assumption above, it shows that there is a 2.34% reduction of plastic waste per capita per month. The percentage of 2.34% is quite small, as 0.14 kg out of the 6 kg reduction is small. This shows that the amount of plastic generated per capita are mostly not from purchasing daily necessities, as these basic items can actually be covered from Zero-Waste Store shopping. The plastic waste that makes

up 6 kg per capita per month can be from other plastics such as disposable plastic cups, disposable takeaway food packaging, condiments and snacks, frozen food packaging, and even plastic bags that are used to shop in supermarkets.

However, based on the survey result, with 199 people have shopped in a Zero-Waste Store. This means that out of all the respondents, there are 26.8% who have shopped in Zero-Waste Stores. If those people are committed in shopping in a Zero-Waste Store to buy their daily necessities unpackaged, it can bring big impact to plastic reduction. According to the data of BPS, there are 56.46% of the population lives in Java and Bali island. Therefore, the population that can shop in a Zero-Waste Store can be taken from the total population of Java and Bali island.

$$Java - Bali\ island\ population = 265{,}015{,}300\ x\ 56.46\%$$
$$= 149{,}627{,}638\ people$$

$$People\ shopping\ in\ Zero - Waste\ Stores = 149{,}627{,}638\ x\ 26.8\%$$
$$= 40{,}100{,}208\ people$$

From the calculation above, it can be seen that there will be 40,100,208 people who shops in a Zero-Waste Store. With 0.14 kg per month plastic reduction, these people can help to reduce packaging waste of per capita as shown in the calculation below.

$$Packaging\ waste\ reduction = \frac{0.14\ kg}{30\ days}\ x\ 40{,}100{,}208$$
$$= 187{,}134.3\ kg/day$$

Therefore, there will be a reduction of 187,134.3 kg per day of plastic waste if there are 26.8% of the population in Java and Bali island shops in Zero-Waste Store for their daily necessities.

6.3 LIFE CYCLE ASSESSMENT (LCA)

As presented in Figure 6.2, the LCA for this sub-chapter will be partitioned into three sub-systems. The goal of conducting this LCA is to see how is the

environmental impact of shopping in Zero-Waste Stores differs to shopping in a traditional retail store. These sub-systems will be analyzed with the functional unit of shopping per month, as the data gathered are all with unit of month.

6.3.1 LCA for Sub-System 1

Sub-system 1 is the LCA to see the environmental impact of the plastic packaging waste to the environment. The inventory, impact assessment and the interpretation are shown below.

6.3.1.1 Life Cycle Inventory

In this sub-system, the inventory is the plastic packaging waste that are resulted from purchasing the household items from traditional retail stores. Each of the item listed in Table 6.3 are classified based on the plastic types which will become the inventory for the packaging waste. Presented in Table 6.4 is the Inventory taken from *Ecoinvent 3* from SimaPRO for sub-system 1 LCA process.

Table 6.4 Life Cycle Inventory for Sub-System 1

Production				
Type of Plastic	**Weight (gr)**	**Inventory in LCA**	**Processes**	
PET	9	Polyethylene terephthalate, granulate, bottle grade (GLO) market for | Cut-off, U	Extrusion, co-extrusion (GLO) market for | Cut-off, U	Blow molding (GLO) market for | Cut-off, U
HDPE	53	Polyethylene, high density, granulate (GLO) market for | Cut-off U	Extrusion, co-extrusion (GLO) market for | Cut-off, U	Blow molding (GLO) market for | Cut-off, U
PP	26.95	Polypropylene, granulate (GLO) market for | Cut-off, U	Extrusion, co-extrusion (GLO) market for | Cut-off, U	Calendering, rigid sheets (GLO) market for | Cut-off U
Other (Nylon)	50.7	Nylon 6-6 (GLO) market for | Cut-off, U	Extrusion, co-extrusion (GLO)	Calendering, rigid sheets

Production				
Type of Plastic	**Weight (gr)**	**Inventory in LCA**	**Processes**	
			market for | Cut-off, U	(GLO) market for | Cut-off U
Disposal				

The inventory used in LCA for the Other plastic packaging are assumed to be Nylon since the majority of plastic packaging that are identified with the resin code 7 are made up of Nylon. Each of the plastics follows a certain process in their production, and are incinerated at its disposal.

6.3.1.2 Life Cycle Impact Assessment

The impact assessment is conducted to see the product's impact to the environment. The Sub-System 1 impact assessment will be done for two main activity: production and disposal. These flowcharts show the environmental contribution of each processes and materials that are involved in the end product. The flowchart are connected by red lines, thick and thin. The thicker the line means that the process yields bigger impact in creating the selected product. Each of the boxes (nodes) are the material or activity related to the creation of the selected product.

For Sub-System 1 in production activity, there are four flowcharts, one for each type of the plastic materials used in the packaging. Figure 6.4 to Figure 6.7 will show the flowchart result for the production process.

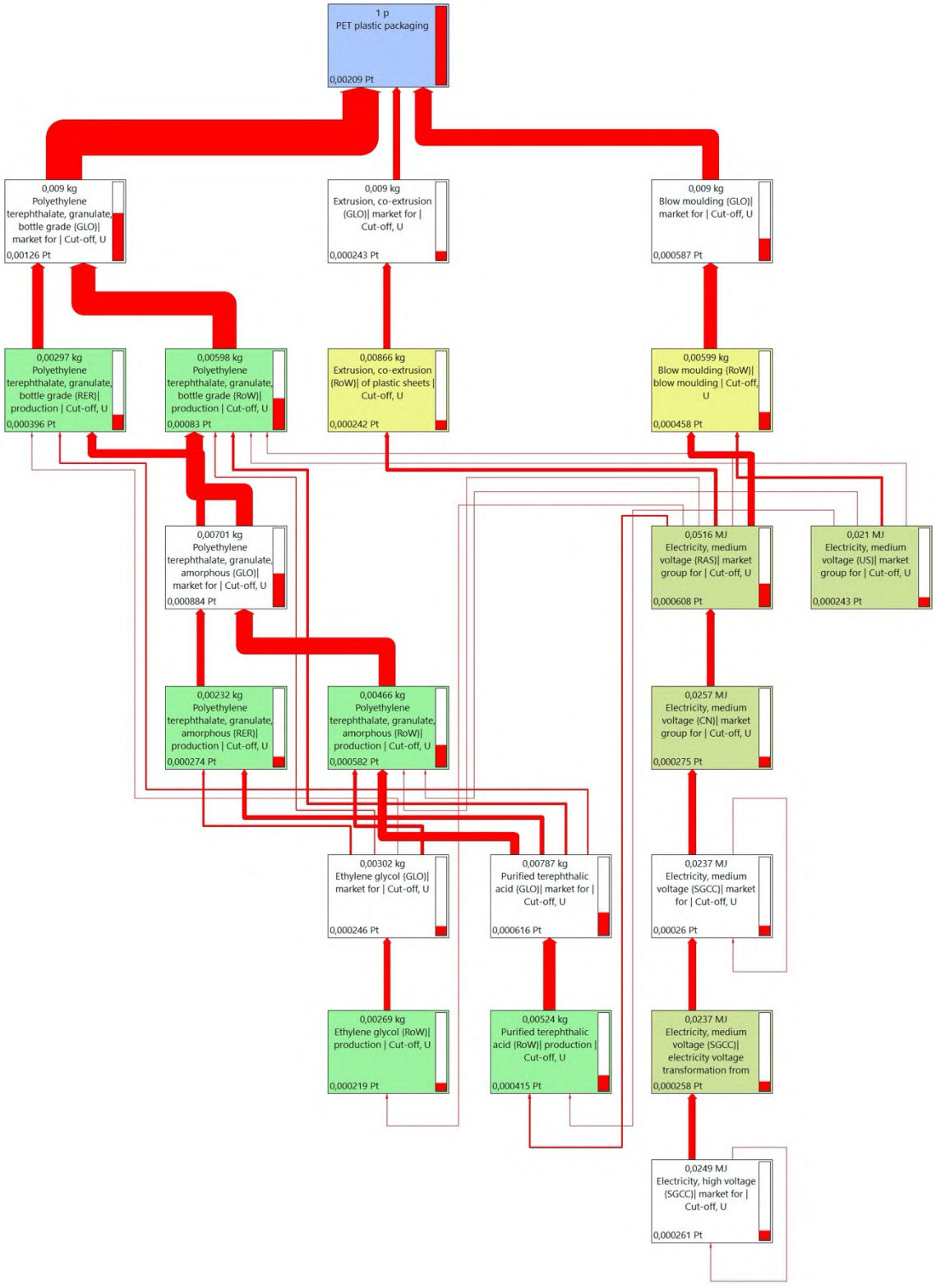

Figure 6.3 PET plastic packaging production flowchart

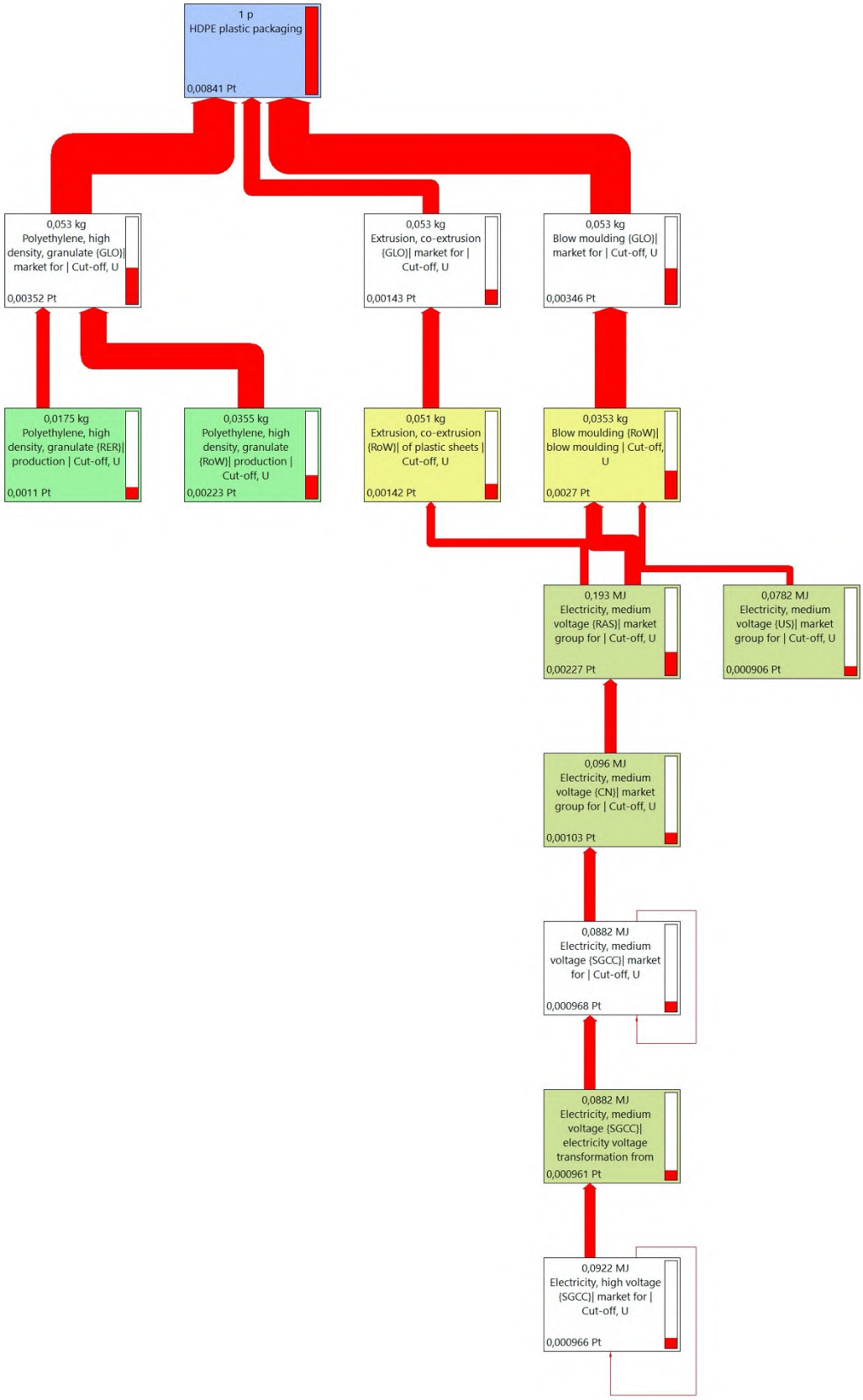

Figure 6.4 HDPE plastic packaging production flowchart

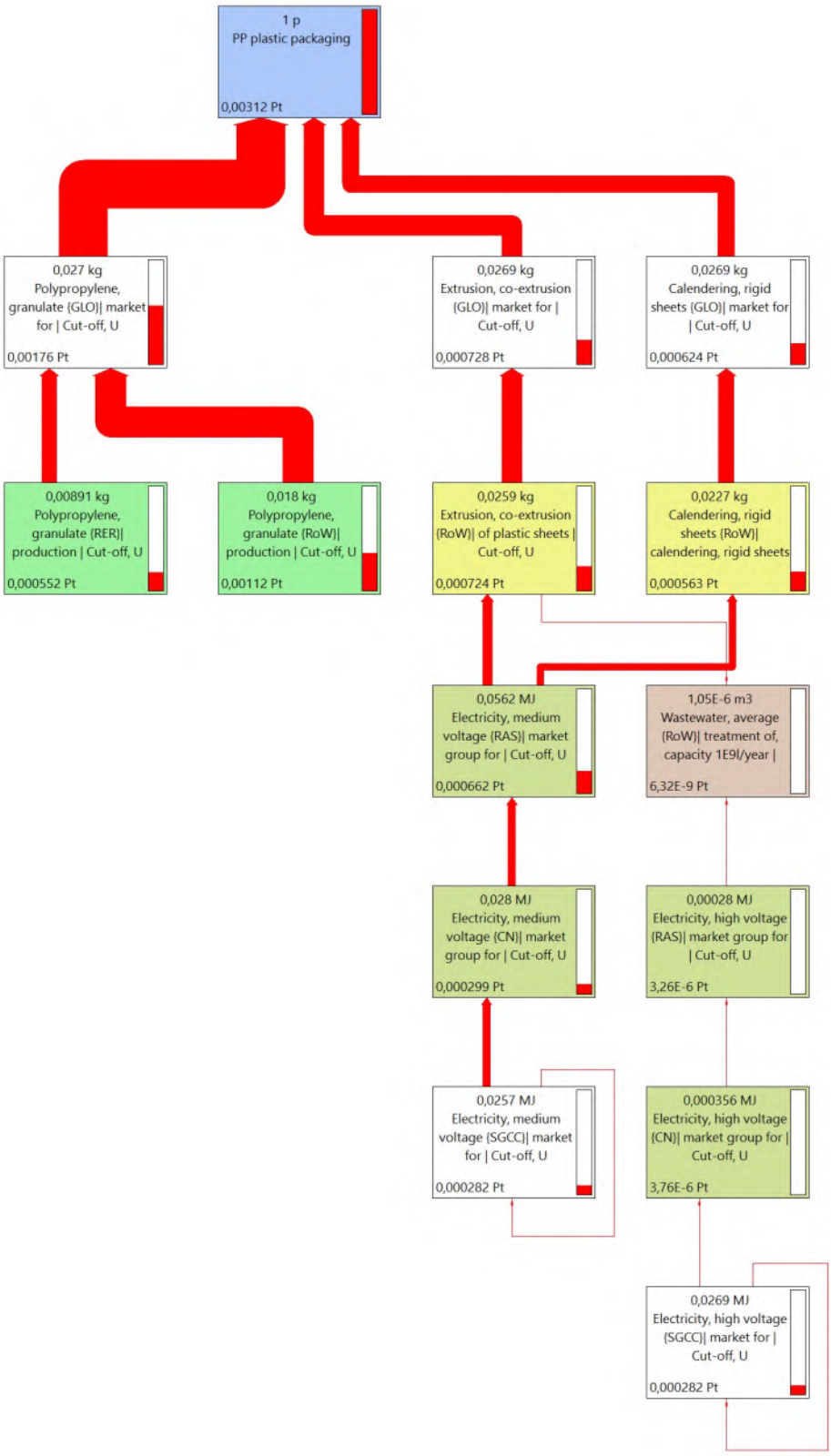

Figure 6.5 PP plastic packaging production flowchart

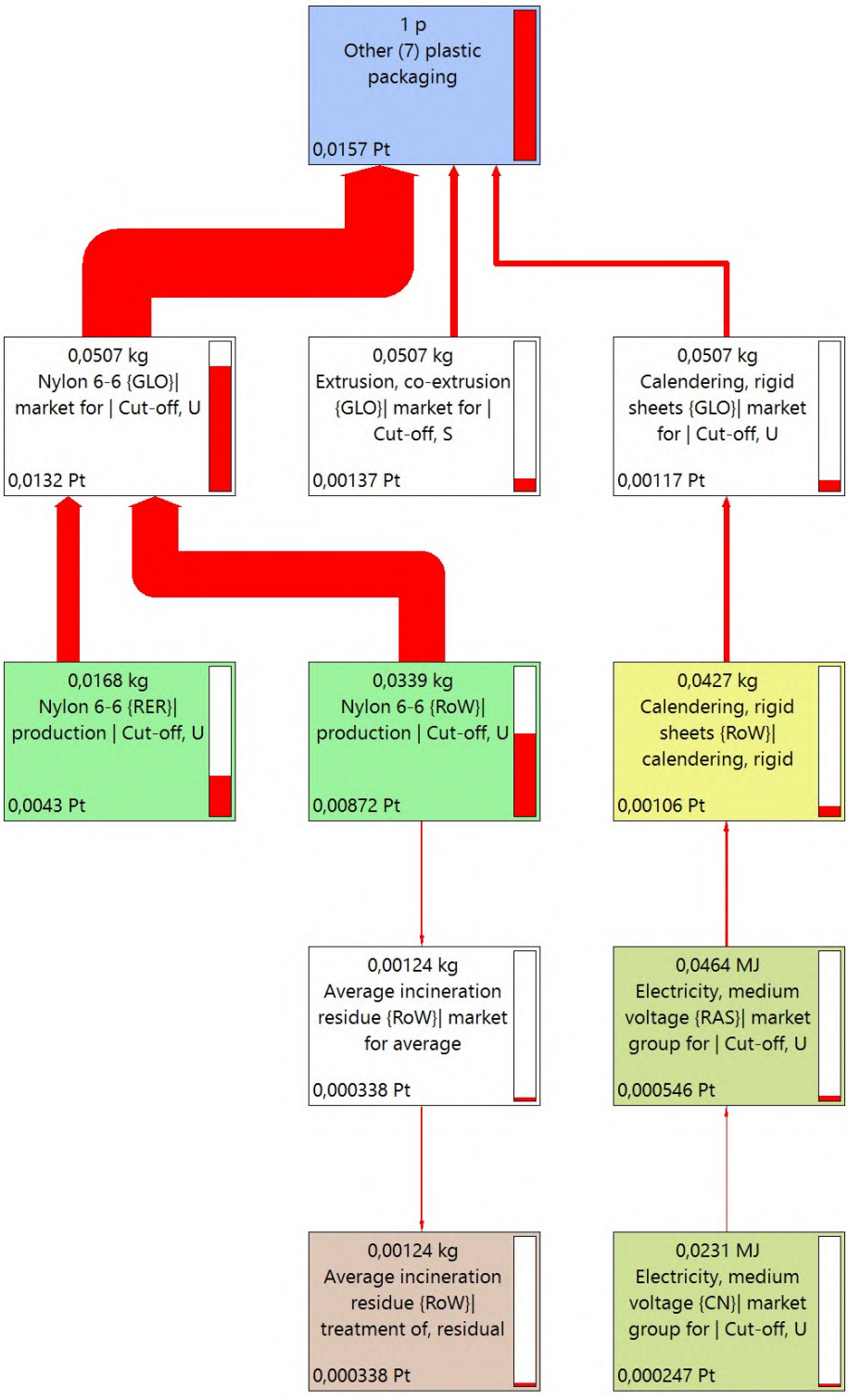

Figure 6.6 Other plastic packaging production flowchart

For Sub-System 1 in disposal activity, there are also four flowcharts; one for each type of the plastic materials used in the packaging. Figure 6.8 to Figure 6.11 will show the flowchart result for the disposal process.

Figure 6.7 PET plastic packaging disposal flowchart

Figure 6.8 HDPE plastic packaging disposal flowchart

Figure 6.9 PP plastic packaging disposal flowchart

Figure 6.10 Other plastic packaging production flowchart

There are four stages in which the environmental impact of these products can be calculated by using the SimaPRO 9.0.0 software. These are *characterization, damage assessment, normalization,* and *weighting.*

Characterization shows the result of the inventory impact according to the impact category listed. It shows the impact to different categories, specifically 22 categories as listed in Table 6.5 for production, and Table 6.9 for the disposal process. The impact categories have different units: *DALY*, *species.yr*, and *USD2013*. DALY is an abbreviation of *disability adjusted life year,* stating the amount of year that are lost due to health issues. One DALY equals to one year of a healthy living year. Species.yr shows impact that are caused to the ecosystem for a year. USD2013 is the unit that expresses the surplus cost potential of that resources extracted per unit, measured in USD value in the year of 2013.

Damage Assessment groups the impact category into three main groups: *human health, ecosystem,* and *resources.* Each of the categories from the previous step are classified in the main groups with the same unit. This is shown in Table 6.6 for production and Table 6.10 for disposal. Human health are measured with DALY unit, Ecosystem are measured with species.yr unit, and Resources are measured with USD2013 unit.

In order to make these units comparable, Normalization step is done. This process helps to yield same unit for the three main damage category. It divides the impact in each category by the estimated impacts from a reference system. Shown in Table 6.7 is the Normalization table for production process and 6.11 for disposal process. Comparison can now be made by having the same unit of analysis.

Weighting process is the last step in the Life Cycle Impact Assessment. This process multiplies the normalized result from the previous step with a factor that expresses the relative importance of the impact category. This process uses the points (Pt) and millipoints (mPt) unit. This represents the annual environmental load of process divided to the share of one person. Millipoints are used since most products have a lower impact than one Pt. These scores serves as an easy baseline to see the environmental impact it creates and enables us to compare. This allows the LCA result to be presented in a single score. This facilitates decision making, to make it clear whether a product's impact is either higher or lower with the other

product. A higher mPt or Pt score correlates to contributing more. The weighting result is presented in Table 6.8 for the production process and Table 6.12 for the disposal process.

The weighted value from production and disposal are then added to create one impact value for each type of plastic packaging, shown in Table 6.13. It is then totalled to yield the value of environmental impact from Sub-system 1.

Table 6.5 LCA Characterization – Sub System 1 Production

Impact Category	Unit	Type of Plastic Packaging			
		PET	HDPE	PP	Other
Global warming, human health	DALY	4.54E-8	2.02E-7	8.12E-8	4.56E-7
Global warming, terrestrial ecosystems	species.yr	1.37E-10	6.11E-10	2.45E-10	1.38E-9
Freshwater eutrophication	species.yr	1.26E-11	3.85E-11	1.06E-11	3.29E-11
Marine eutrophication	species.yr	2.39E-15	8.49E-15	2.94E-15	2.16E-13
Terrestrial ecotoxicity	species.yr	1.47E-12	1.86E-12	6.75E-13	1.54E-12
Freshwater ecotoxicity	species.yr	8.77E-13	2.07E-12	6.19E-13	1.62E-12
Marine ecotoxicity	species.yr	1.88E-13	4.3E-13	1.3E-13	3.37E-13
Human carcinogenic toxicity	DALY	6.67E-9	2.23E-8	7.28E-9	3.4E-8
Human non-carcinogenic toxicity	DALY	8.17E-9	1.64E-8	4.95E-9	1.23E-8
Land use	species.yr	2.12E-11	9.77E-11	1.01E-11	1.92E-11
Mineral resource scarcity	USD2013	2.29E-5	3.11E-5	1.16E-5	3.46E-5
Fossil resource scarcity	USD2013	0.00643	0.04	0.019	0.0525

Water consumption, human health	DALY	9.21E-10	2.76E-9	1.6E-9	2.67E-8
Water consumption, terrestrial ecosystem	species.yr	5.62E-12	1.68E-11	9.78E-12	1.63E-10
Water consumption, aquatic ecosystems	species.yr	3.05E-16	9.38E-16	4.93E-16	7.38E-15

Table 6.6 LCA Damage Assessment – Sub System 1 Production

Damage Category	**Unit**	**Type of Plastic Packaging**			
		PET	**HDPE**	**PP**	**Other**
Human Health	DALY	1.14E-7	4.5E-7	1.65E-7	8.46E-7
Ecosystems	species.yr	2.29E-10	9.77E-10	3.53E-10	2.01E-9
Resources	USD2013	0.00645	0.0401	0.019	0.0525

Table 6.7 LCA Normalization – Sub System 1 Production

Damage Category	**Unit**	**Type of Plastic Packaging**			
		PET	**HDPE**	**PP**	**Other**
Human Health		4.8E-6	1.9E-5	6.96E-6	3.56E-5
Ecosystems		3.2E-7	1.36E-6	4.93E-7	2.81E-6
Resources		2.3E-7	1.43E-6	6.8E-7	1.87E-6

Table 6.8 LCA Characterization – Sub System 1 Disposal

Impact Category	Unit	Type of Plastic Packaging			
		PET	HDPE	PP	Other
Global warming, human health	DALY	1.69E-8	1.47E-7	6.33E-8	1.1E-7
Global warming, terrestrial ecosystems	species.yr	5.11E-11	4.44E-10	1.91E-10	3.33E-10
Terrestrial acidification	species.yr	4.57E-13	2.E-12	9.81E-13	3.68E-12
Freshwater eutrophication	species.yr	1.66E-14	1.26E-13	5.71E-14	5.82E-13
Marine eutrophication	species.yr	3.25E-16	4.02E-16	1.73E-16	1.85E-15
Terrestrial exotoxicity	species.yr	5.24E-15	4.31E-12	1.94E-14	6.56E-14
Freshwater ecotoxicity	species.yr	2.63E-13	2.78E-12	1.19E-12	1.83E-12
Marine ecotoxicity	species.yr	5.58E-14	5.87E-13	2.52E-13	3.45E-13
Human carcinogenic toxicity	DALY	2.25E-10	2.61E-9	1.14E-9	7.22E-9
Human non-carcinogenic toxicity	DALY	3.27E-10	3.91E-9	1.69E-9	2.02E-9
Land use	species.yr	1.39E-14	1.08E-13	5.02E-14	3.37E-13

Mineral resource scarcity	USD2013	2.53E-7	1.5E-6	7.17E-7	2.28E-6
Fossil resource scarcity	USD2013	8.42E-6	4.82E-5	2.31E-5	0.000125
Water consumption, human health	DALY	2.17E-11	1.29E-10	6.52E-11	1.84E-10
Water consumption, terrestrial ecosystem	species.yr	1.28E-13	7.62E-13	3.84E-13	1.1E-12
Water consumption, aquatic ecosystems	species.yr	5.95E-18	3.56E-17	1.79E-17	5.28E-17

Table 6.9 LCA Damage Assessment – Sub System 1 Disposal

Damage Category	**Unit**	**Type of Plastic Packaging**			
		PET	**HDPE**	**PP**	**Other**
Human Health	DALY	1.14E-7	4.5E-7	1.65E-7	1.24E-7
Ecosystems	species.yr	2.29E-10	9.77E-10	3.53E-10	3.45E-10
Resources	USD2013	0.00645	0.0401	0.019	0.000128

Table 6.10 LCA Normalization – Sub System 1 Disposal

Damage Category	Unit	Type of Plastic Packaging			
		PET	HDPE	PP	Other
Human Health		7.57E-7	6.57E-6	2.83E-6	5.23E-6
Ecosystems		7.36E-8	6.33E-7	2.73E-7	4.82E-7
Resources		3.09E-10	1.78E-9	8.53-10	4.55E-9

Table 6.11 Total LCA Weighting of Sub System 1

Environmental Impact (Weighting)	Unit	Type of Plastic Packaging			
		PET	HDPE	PP	Other
TOTAL SUB-SYSTEM 1		0.000 mPt			

6.3.1.3 Interpretation

The interpretation stage of the LCA process is done to understand the results generated from the calculation. Sub-system 1 focuses on seeing the environmental impact yielded from the plastic packaging wastes of the items sold in traditional retail stores. Since Sub-system 1 covers the environmental impact caused from the production of those packaging and its disposal, those two numbers are added to generate a total number of environmental impact from this sub-system. This totals to **36.062 mPt** of environmental impact from plastic packaging waste of shopping the listed items (Table 6.3) in traditional retail, or is noted here as Sub-system 1.

6.3.2 LCA for Sub-System 2

Sub-system 2 is the LCA to see the environmental impact of reusable containers and its maintenance for using it in Zero-Waste Store shopping. The reusable plastic containers used are all with plastic resin code material of PP and with the same type. Since different items are consumed with variety of amount, the containers sizes used also varies. Table 6.14 below shows the assumption for the containers sizes that are used to buy the items from Zero-Waste Store. The inventory, impact assessment and the interpretation are shown below.

Table 6.12 Containers used to buy items

Items	Product consumed	Container capacity used	Container code
Flour	250 gr	250 gr	1
Pasta	225 gr		
Oatmeal	150 gr		
Honey	125 gr		
Baking powder	7.5 gr	30 gr	2
Baking soda	7.5 gr		
Chia seeds	7.5 gr		
Rice	1250 gr	1500 gr	3
Cookies	500 gr	600 gr	4
Clothes detergent	600 gr		

6.3.2.1 Life Cycle Inventory

In this sub-system, the inventory for the reusable packaging is created by adding the data from direct observation of the author. Since reusable packaging needs to be washed before reuse, the inventory will also include water and soap waste. Presented in Table 6.15 is the Inventory taken from *Ecoinvent 3* from SimaPRO for the sub-system 2 LCA process.

Table 6.13 Life Cycle Inventory for Sub-System 2

<table>
<tr><td colspan="5">Production</td></tr>
<tr><td colspan="2">Type of Plastic</td><td colspan="3">Polypropylene, granulate (GLO) market for | Cut-off, U</td></tr>
<tr><td>Container code</td><td>Qty</td><td>Weight (gr)</td><td colspan="2">Processes</td></tr>
<tr><td>1</td><td>4</td><td>13</td><td rowspan="7">Extrusion, co-extrusion (GLO) market for | Cut-off, U</td><td rowspan="7">Blow molding (GLO) market for | Cut-off, U</td></tr>
<tr><td>2</td><td>3</td><td>16</td></tr>
<tr><td>3</td><td>1</td><td>25</td></tr>
<tr><td>4</td><td>3</td><td>16</td></tr>
<tr><td>5</td><td>1</td><td>64</td></tr>
<tr><td>6</td><td>1</td><td>41</td></tr>
<tr><td>7</td><td>5</td><td>14</td></tr>
<tr><td colspan="5">Maintenance (Washing)</td></tr>
<tr><td colspan="2">Water</td><td colspan="3">Tap water (GLO) market for | Cut-off, U</td></tr>
<tr><td colspan="2">Soap</td><td colspan="3">Soap (GLO) market for | Cut-off, U</td></tr>
<tr><td>Container code</td><td>Qty</td><td colspan="2">Water needed to clean (gr)</td><td>Soap needed to clean (gr)</td></tr>
<tr><td>1</td><td>4</td><td colspan="2">77</td><td rowspan="7">0.5</td></tr>
<tr><td>2</td><td>3</td><td colspan="2">40</td></tr>
<tr><td>3</td><td>1</td><td colspan="2">110</td></tr>
<tr><td>4</td><td>3</td><td colspan="2">64</td></tr>
<tr><td>5</td><td>1</td><td colspan="2">378</td></tr>
<tr><td>6</td><td>1</td><td colspan="2">42</td></tr>
<tr><td>7</td><td>5</td><td colspan="2">70</td></tr>
</table>

6.3.2.2 Life Cycle Impact Assessment

The impact assessment is conducted to see the product's impact to the environment. The Sub-System 2 impact assessment will be done for two main activity: production and maintenance (washing). These flowcharts show the environmental contribution of each processes and materials that are involved in the end product. The flowchart are connected by red lines, thick and thin. The thicker the line means that the process yields bigger impact in creating the selected product. Each of the boxes (nodes) are the material or activity related to the creation of the selected product.

For Sub-System 2 in production activity, there are seven flowcharts, one for each type of the containers. Figure 6.12 to Figure 6.18 will show the flowchart result for the production process.

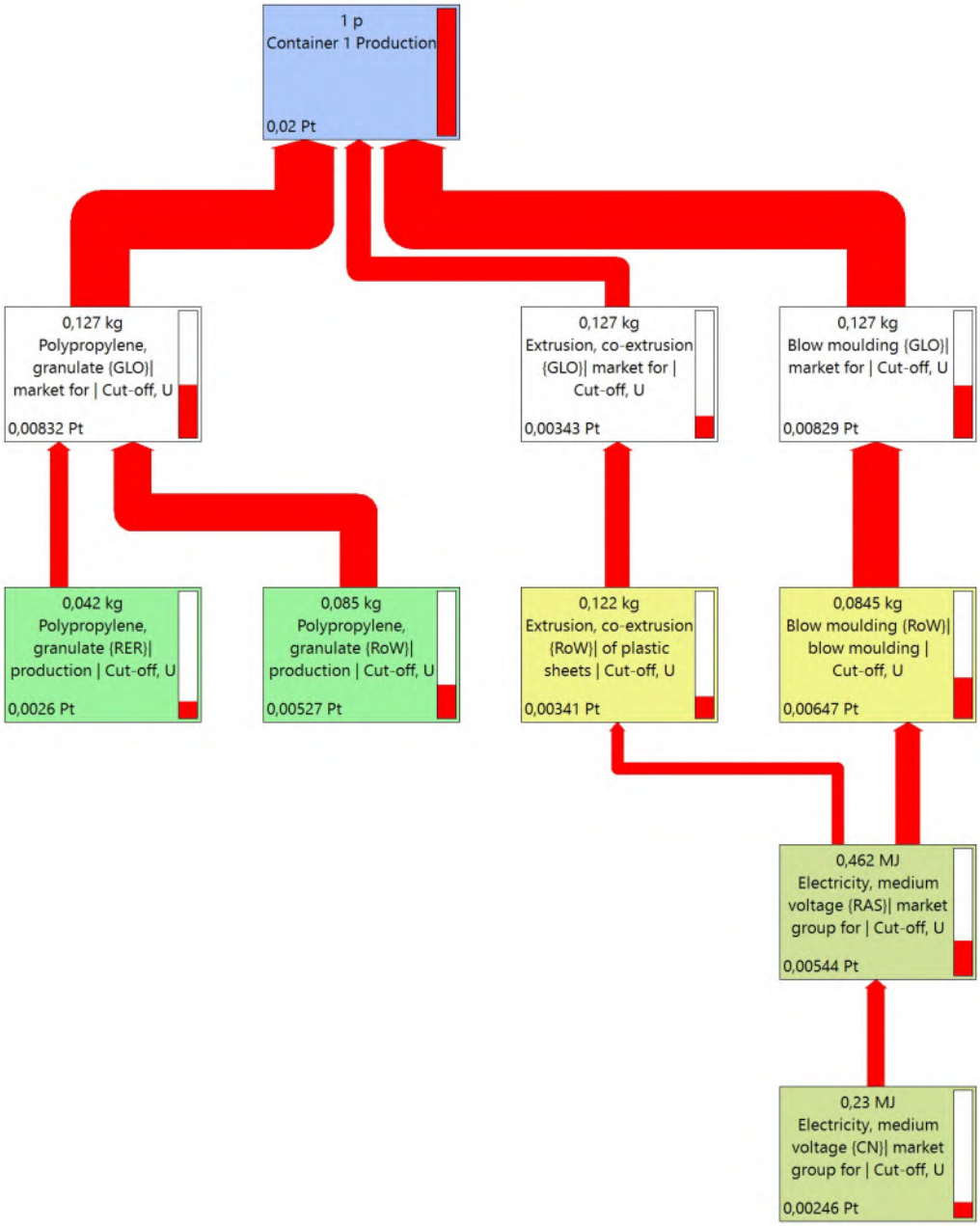

Figure 6.11 Container type 1 production process

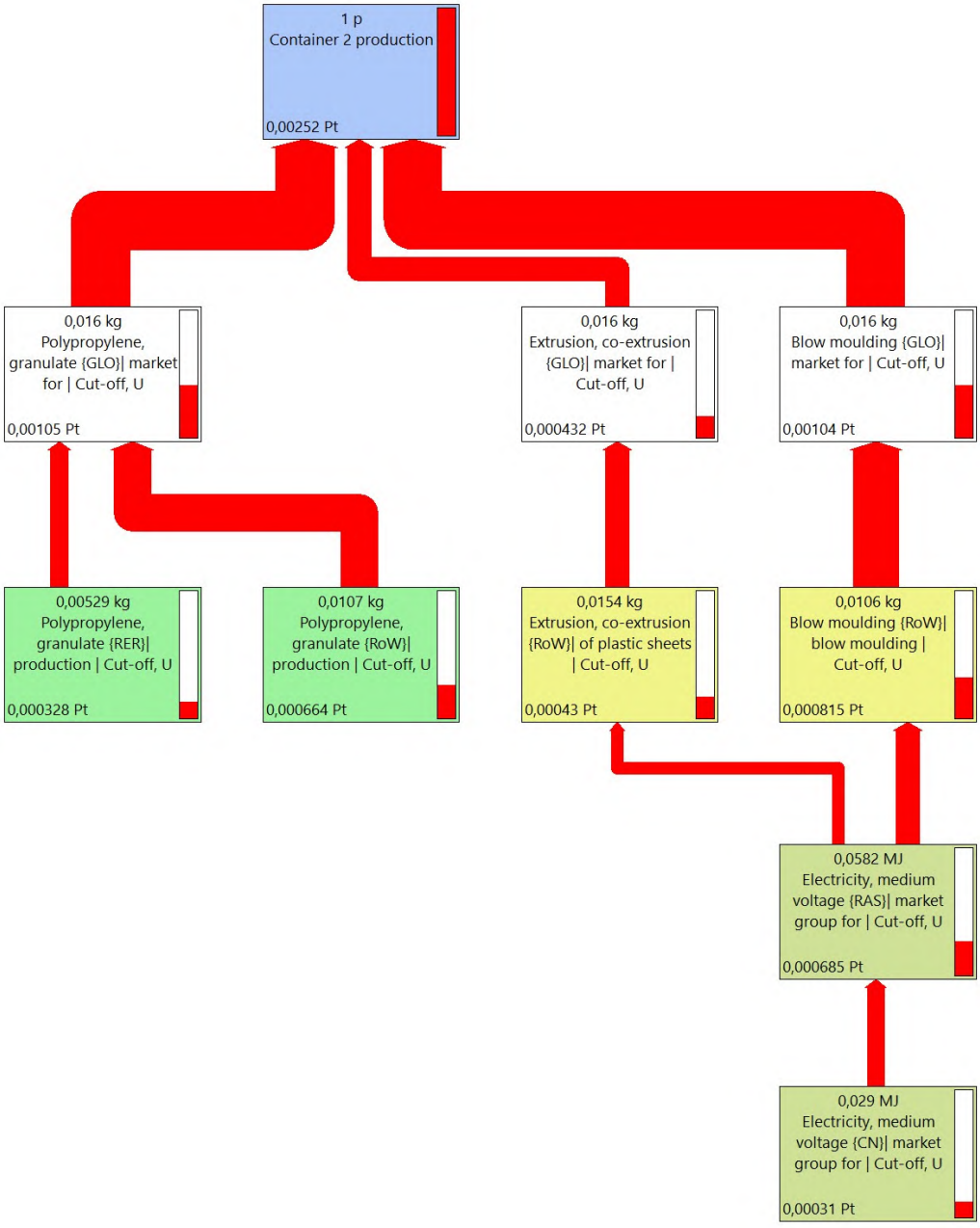

Figure 6.12 Container type 2 production process

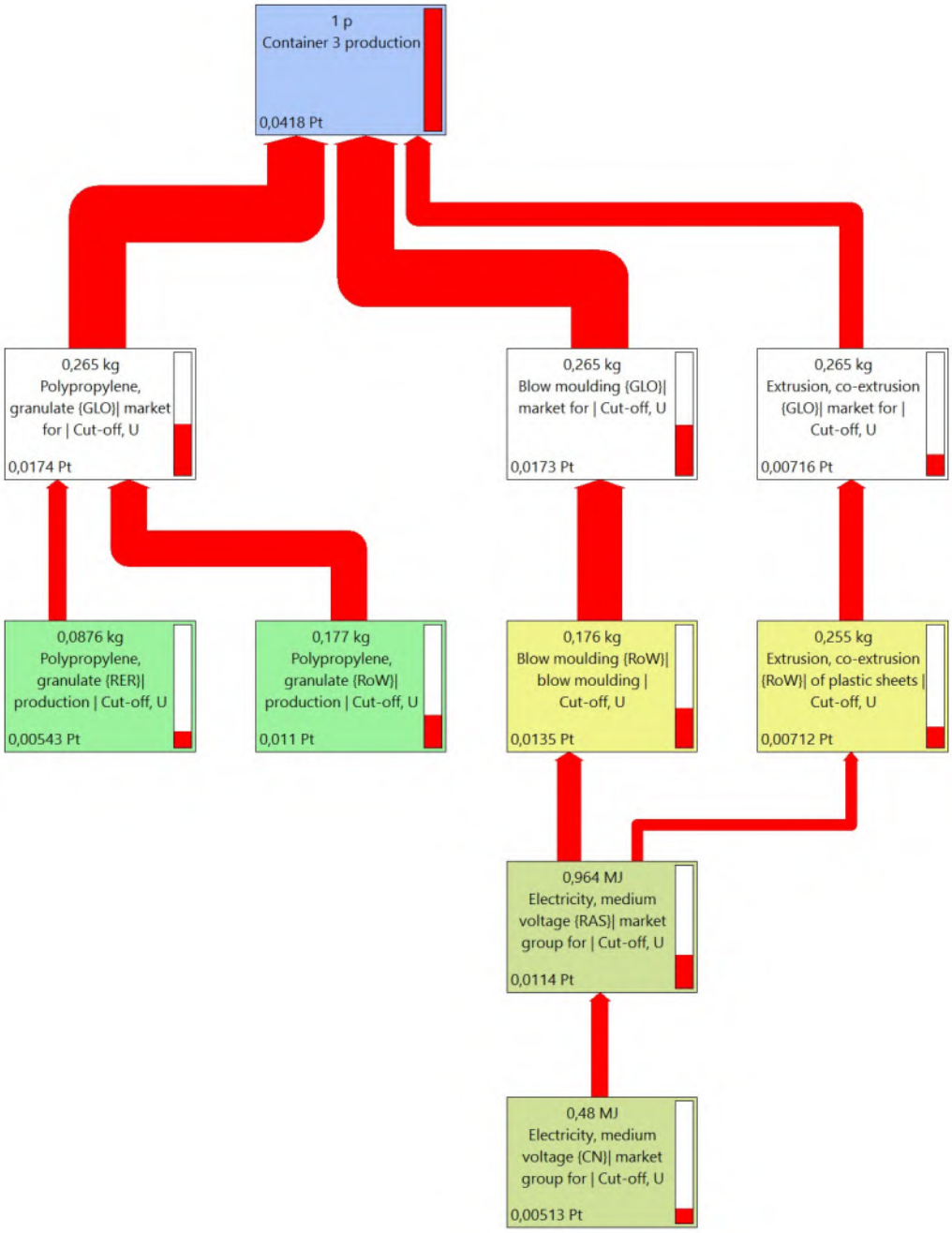

Figure 6.13 Container type 3 production process

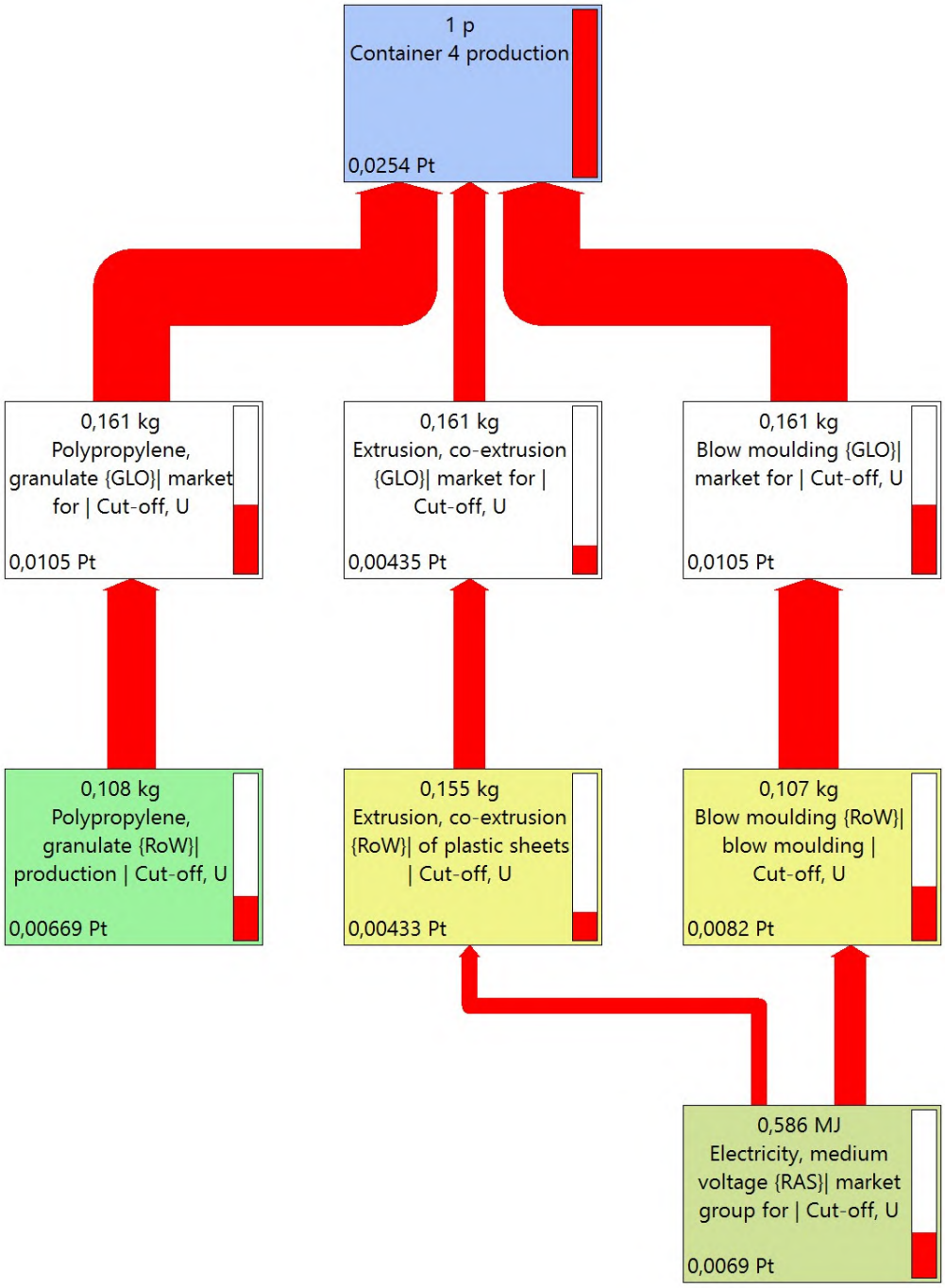

Figure 6.14 Container type 4 production process

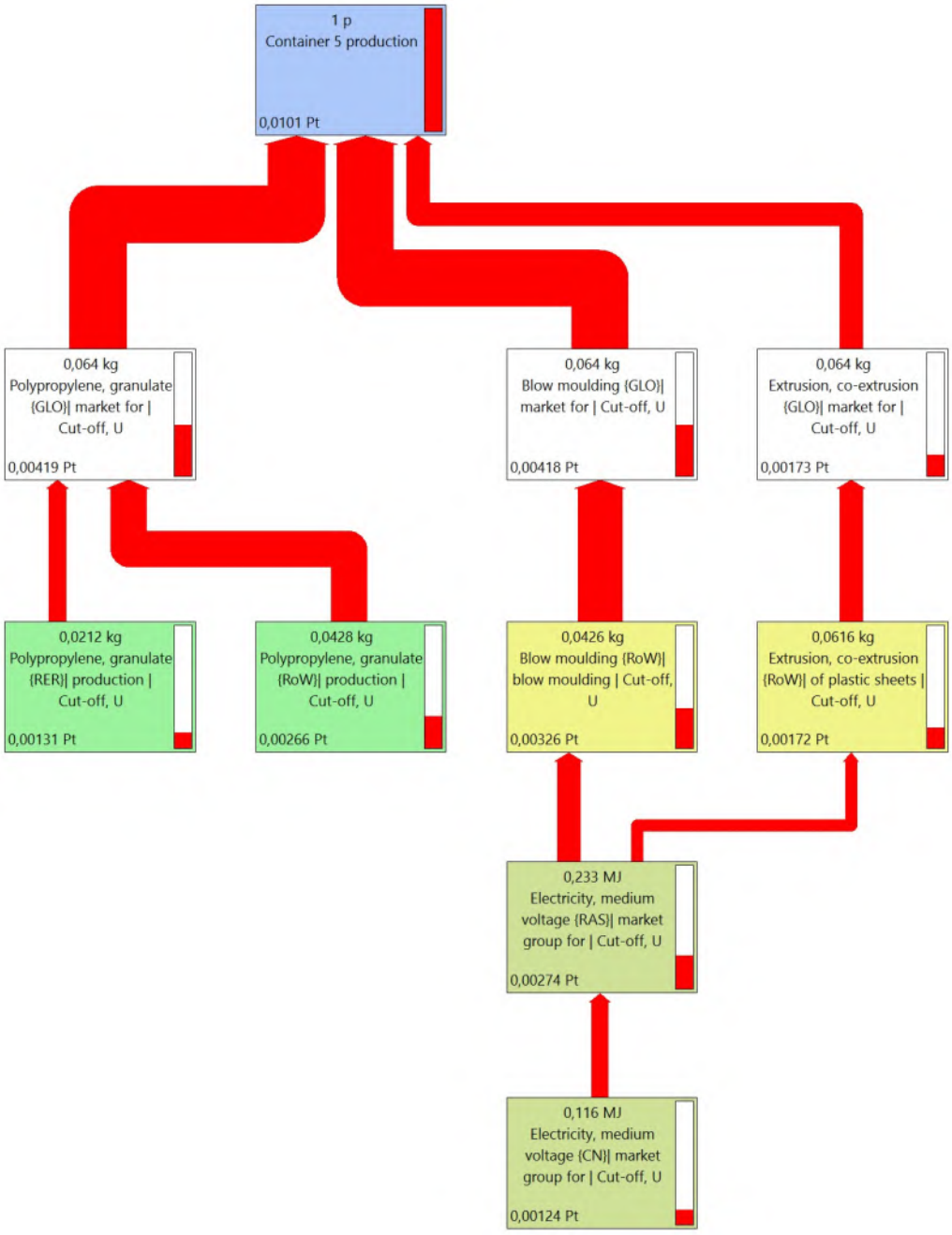

Figure 6.15 Container type 5 production process

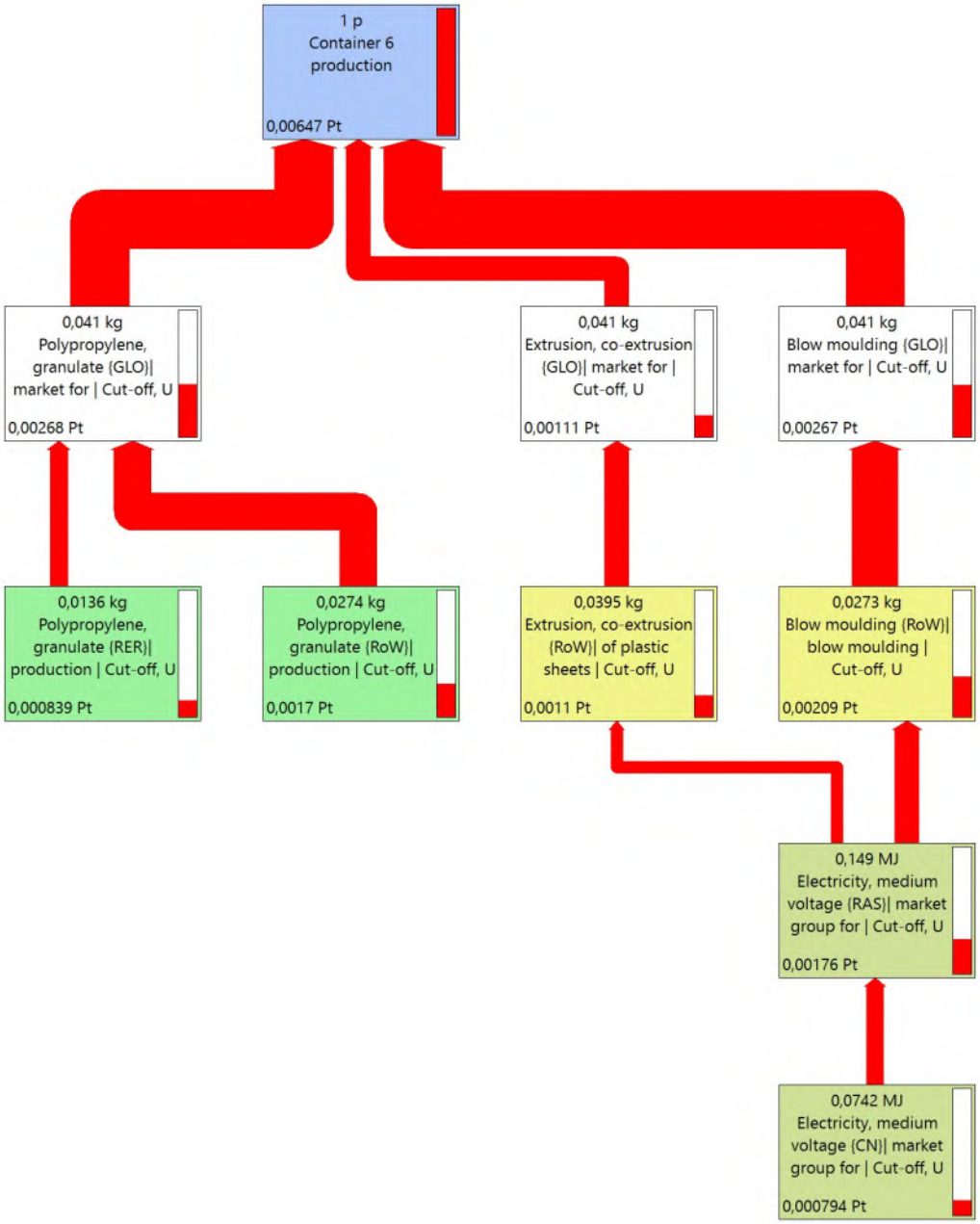

Figure 6.16 Container type 6 production process

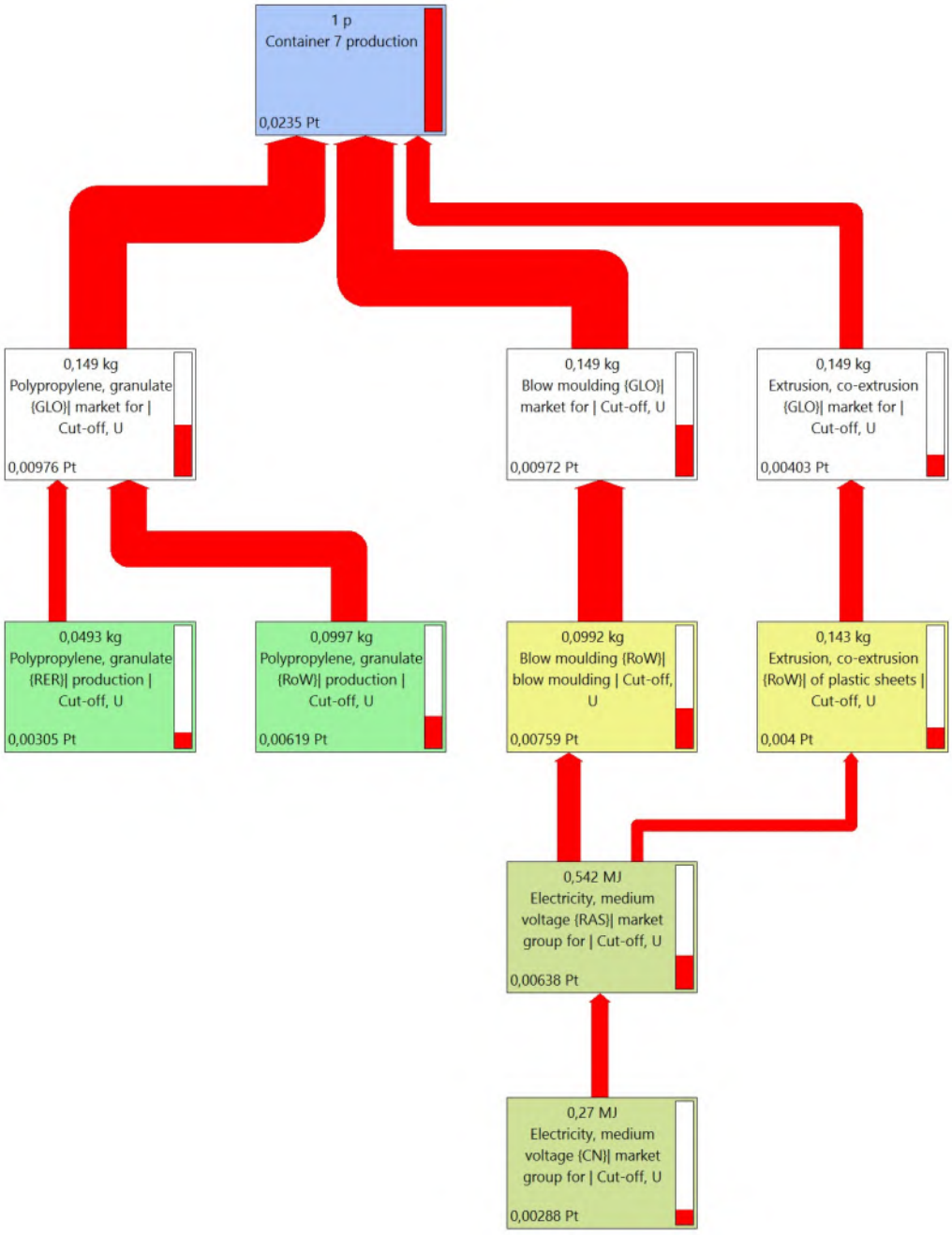

Figure 6.17 Container type 7 production process

For Sub-System 2 in maintenance (washing) activity, there are eight flowcharts, one for each water amount to wash the different containers type, and one for the soap used to wash the containers. Figure 6.19 to Figure 6.26 will show the flowchart result for the maintenance process.

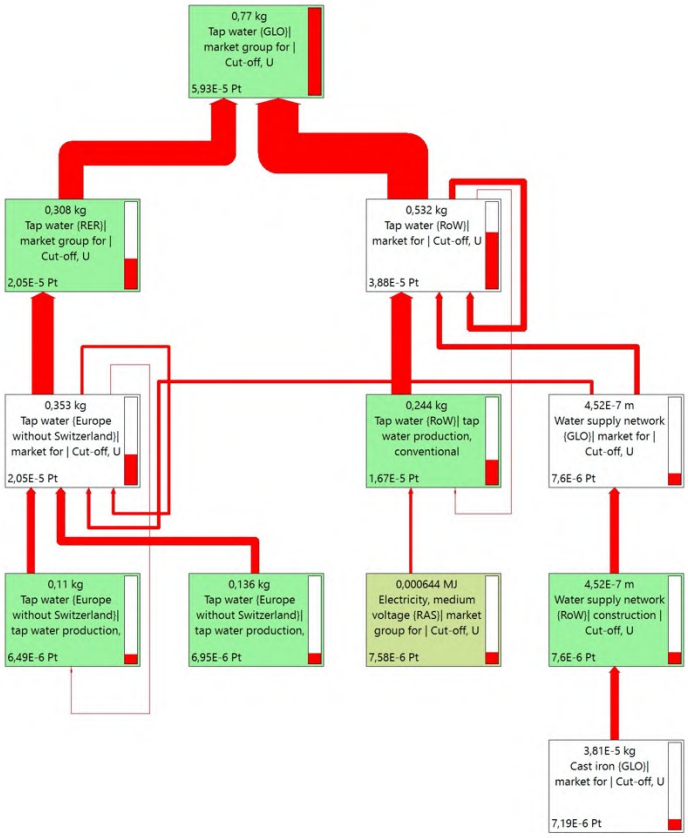

Figure 6.18 Water consumption to wash Container type 1

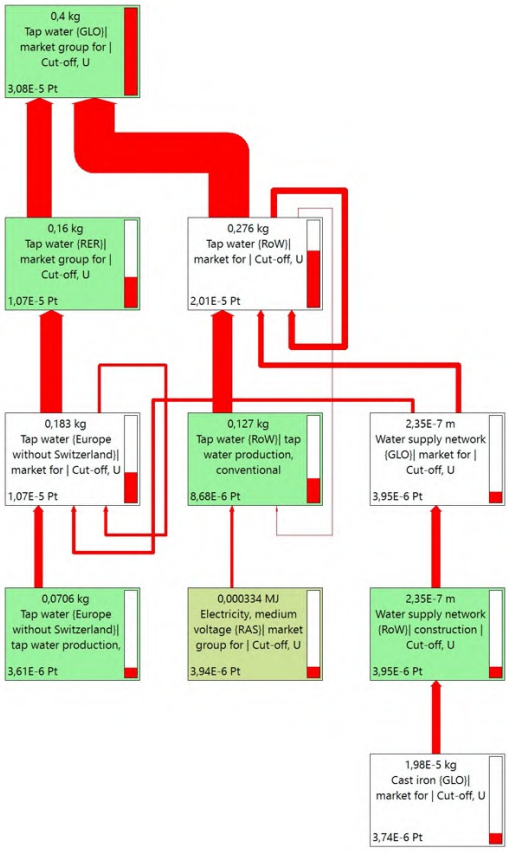

Figure 6.19 Water consumption to wash Container type 2

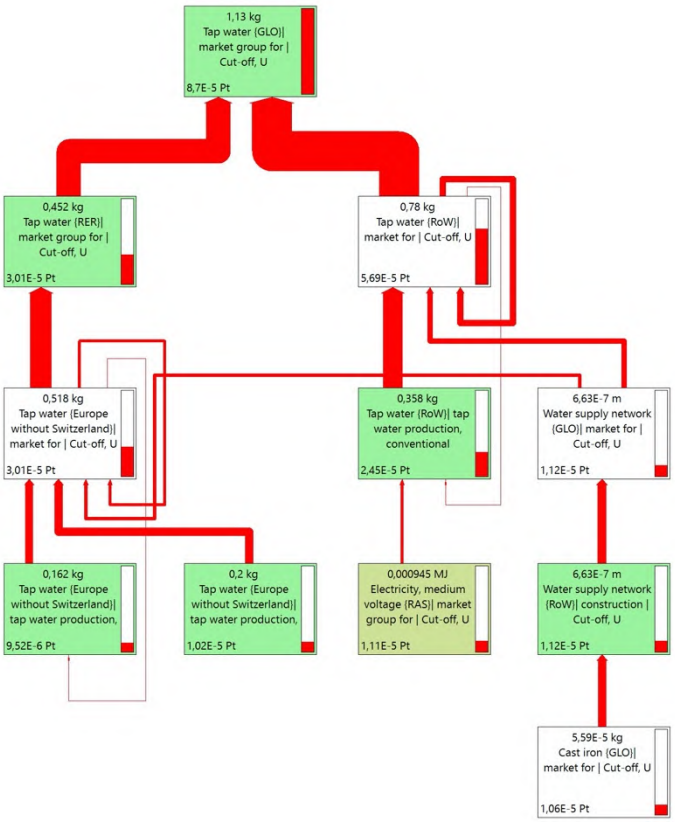

Figure 6.20 Water consumption to wash Container type 3

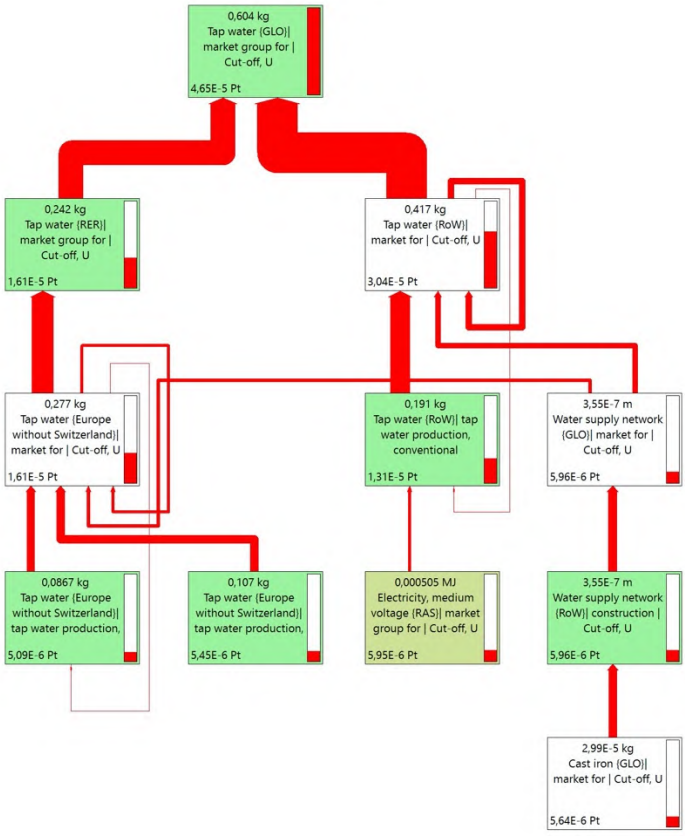

Figure 6.21 Water consumption to wash Container type 4

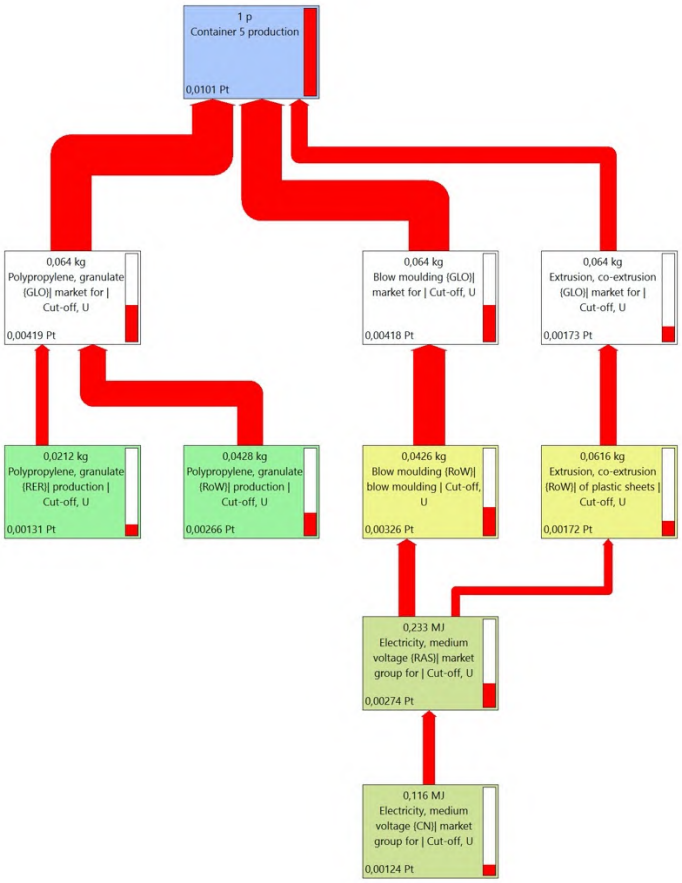

Figure 6.22 Water consumption to wash Container type 5

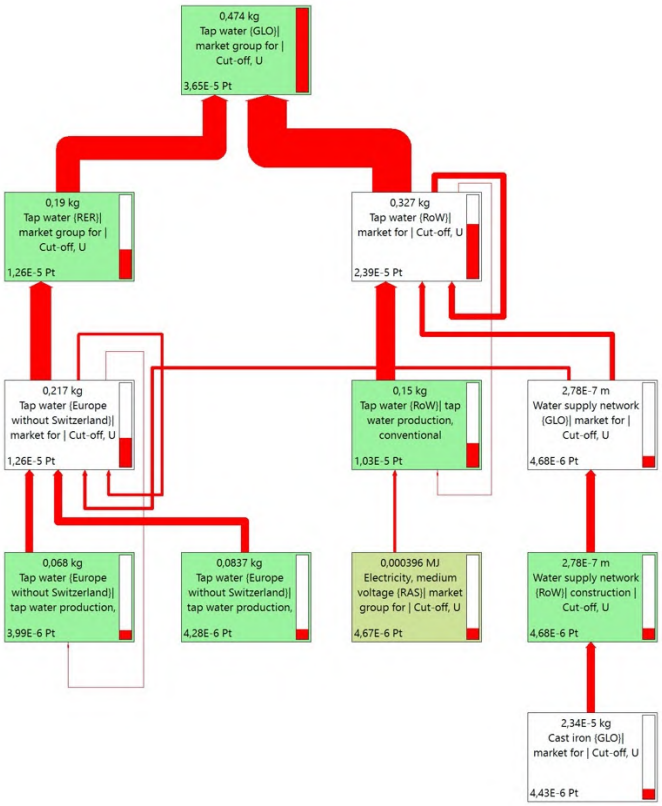

Figure 6.23 Water consumption to wash Container type 6

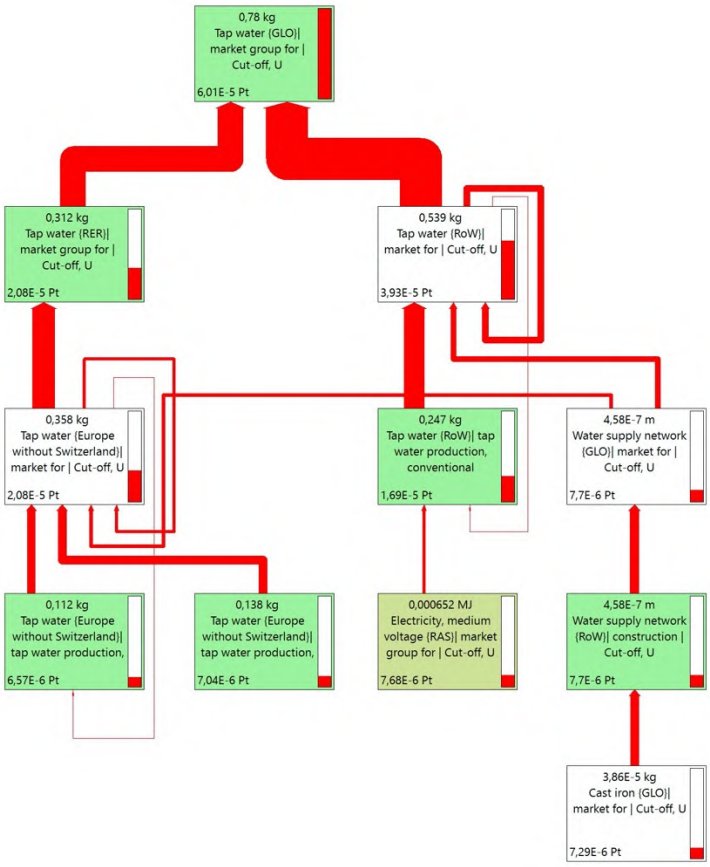

Figure 6.24 Water consumption to wash Container type 7

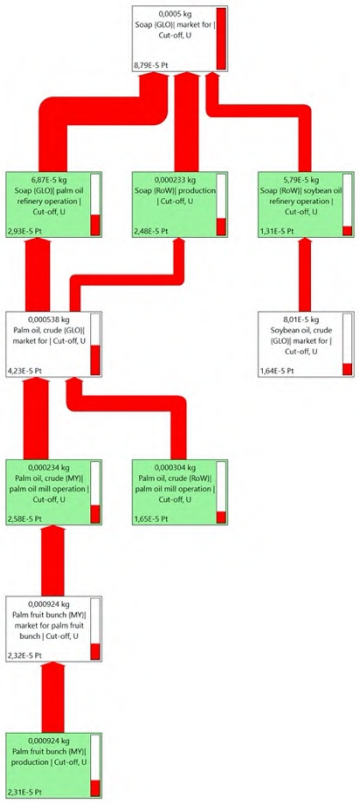

Figure 6.25 Soap consumption to wash all containers

Similar to what is conducted in the first Sub-system, there are four stages in which the environmental impact of these products can be calculated by using the SimaPRO 9.0.0 software. These are *characterization, damage assessment, normalization,* and *weighting.*

Characterization shows the result of the inventory impact according to the impact category listed. For Sub-system 2, Table 6.16 shows impact categories result for production, Table 6.22 shows the maintenance of using soap and Table 6.26 for water impact categories. The impact categories have different units: *DALY*, *species.yr*, and *USD2013*.

Damage Assessment groups the impact category into three main groups: *human health, ecosystem,* and *resources.* Each of the categories from the previous step are classified in the main groups with the same unit. This is shown in Table 6.17 for production, Table 6.23 for maintenance of using soap, and Table 6.27 for water damage category. Human health are measured with DALY unit, Ecosystem are measured with species.yr unit, and Resources are measured with USD2013 unit.

In order to make these units comparable, Normalization step is done. This process helps to yield same unit for the three main damage category. Shown in Table 6.18 is the Normalization table for production process, Table 6.24 for using soap, and Table 6.28 for water usage.

Weighting process is the last step in the Life Cycle Impact Assessment. This process multiplies the normalized result from the previous step with a factor that expresses the relative importance of the impact category. This allows the LCA result to be presented in a single score. Similar to Sub-system 1, this section uses mPt unit. A higher mPt or Pt score correlates to contributing more. For sub-system 2, the weighting result is presented in Table 6.19 for the production process, Table 6.25 for soap and Table 6.29 for the water usage.

Since the containers produced are assumed be used up to 240 times, the environmental impact resulted from the production are suited to that so that the impact can be comparable. This value can be seen in Table 6.20 for per usage, and Table 6.21 for per month, following the monthly unit of analysis.

Table 6.14 LCA Characterization – Sub-system 2 Production

Impact Category	Unit	Container Types						
		1	2	3	4	5	6	7
Global warming, human health	DALY	4.87E-7	6.14E-8	1.02E-6	6.18E-7	2.46E-7	1.57E-7	5.72E-7
Global warming, terrestrial ecosystems	species.yr	1.47E-9	1.85E-10	3.07E-9	1.86E-9	7.41E-10	4.75E-10	1.73E-9
Global warming, freshwater ecosystems	species.yr	4.02E-14	5.06E-15	8.38E-14	5.09E-14	2.02E-14	1.3E-14	4.71E-14
Marine eutrophication	species.yr	2,2E-14	2.77E-15	4.59E-14	2.79E-14	1.11E-14	7.11E-15	2.58E-14
Terrestrial ecotoxicity	species.yr	4.45E-12	5.61E-13	9.29E012	5.64E-12	2.24E-12	1.44E-12	5.22E-12
Freshwater ecotoxicity	species.yr	4.9E-12	6.17E-13	1.02E-11	6.21E-12	2.47E-12	1.58E-12	5.75E-12
Marine ecotoxicity	species.yr	1.02E-12	1.29E-13	2.13E-12	1.29E-12	5.14E-13	3.29E-13	1.2E-12
Human carcinogenic toxicity	DALY	5.04E-8	6.34E-9	1.05E-7	6.38E-8	2.54E-8	1.63E-8	5.91E-8
Human non-carcinogenic toxicity	DALY	3.9E-8	4.91E-9	8.14E-8	4.95E-8	1.97E-8	1.26E-8	4.58E-8
Land use	species.yr	2.34E-10	2.95E-11	4.88E-10	2.97E-10	1.18E-10	7.56E-11	2.75E-10
Mineral resource scarcity	USD2013	7.37E-5	9.29E-6	0.000154	9.35E-5	3.72E-5	2.38E-5	8.65E-5
Fossil resource scarcity	USD2013	0.0965	0.0122	0.201	0.122	0.0486	0.0312	0.113

Water consumption, human health	DALY	7.5E-9	9.45E-10	1.56E-8	9.5E-9	3.78E-9	2.42E-9	8.8E-9
Water consumption, terrestrial ecosystem	species.yr	4.57E-11	5.76E-12	9.55E-11	5.8E-11	2.31E-11	1.48E-11	5.37E-11
Water consumption, aquatic ecosystems	species.yr	2.49E-15	3.14E-16	5.19E-15	3.16E-15	1.25E-15	8.04E-16	2.92E-15

Table 6.15 LCA Damage Assessment – Sub-system 2 Production

Damage Category	Unit	Container types						
		1	2	3	4	5	6	7
Human Health	DALY	4.24E-7	1.35E-7	2.23E-6	1.36E-6	5.4E-7	3.46E-7	1.26E-6
Ecosystems	species.yr	1.04E-9	2.96E-10	4.9E-9	2.98E-9	1.18E-9	7.58E-10	2.75E-9
Resources	USD2013	0.0966	0.0122	0.202	0.122	0.0487	0.0312	0.113

Table 6.16 LCA Normalization – Sub-system 2 Production

Damage Category	Unit	Container types						
		1	2	3	4	5	6	7
Human Health		4.51E-5	5.68E-6	9.41E-5	4.15E-6	2.27E-5	1.46E-5	5.29E-5
Ecosystems		3.28E-6	4.13E-7	6.84E-6	4.37E-6	1.65E-6	1.06E-6	3.84E-6
Resources		3.45E-6	4.34E-7	7.2E-6	5.71E-5	1.74E-6	1.11E-6	4.05E-6

Table 6.17 LCA Weighting – Sub-system 2 Production

Damage Category	Unit	Container types						
		1	2	3	4	5	6	7
Human Health	mPt	18	2.27	37.6	22.9	9.09	0.0000	21.2
Ecosystems	mPt	1.31	0.165	2.73	1.66	0.66	0.000	1.54
Resources	mPt	0.69	0.0869	1.44	0.874	0.348	0.00000	0.809

The result above is for the production for each container types. Assuming that a container can be used for 10 years and will be used twice per month, the environmental impact resulted by the production per unit will be divided by the frequency of usage of its entire lifetime.

$$Total\ frequency\ usage\ of\ container = 10\ years\ x\ 12\ months\ x\ 2\ time\ per\ month = 240\ times$$

This means that the environmental impact of the container production per usage will be as shown in Table 6.20 below.

Table 6.18 Environmental Impact of Container production per usage

Environmental Impact	Unit	Container types						
		1	2	3	4	5	6	7
For 240 usage	mPt	20	2.52	41.8	25.4	10.1	6.47	23.5
Per usage	mPt	0.000	0.0105	0.000	0.106	0.0000	0.0270	0.000

However, since the unit of analysis for this study is set for a month, therefore, the environmental impact of the container production will be multiplied by the usage per month frequency. The frequency is 2 times a month. The environmental impact of the container production per month will be shown in Table 6.21.

Table 6.19 Environmental Impact of Container production per month

Environmental Impact	Unit	Container types						
		1	2	3	4	5	6	7
Per usage	mPt	0.0834	0.0105	0.174	0.106	0.0421	0.0270	0.098
Per month	mPt	0.000	0.021	0.000	0.212	0.000	0.0000	0.196

Table 6.20 LCA Characterization – Sub-system 2 Maintenance (Soap)

Impact Category	Unit	Soap
Global warming, human health	DALY	2.16E-9
Global warming, terrestrial ecosystems	species.yr	6.51E-12
Global warming, freshwater ecosystems	species.yr	1.78E-16
Stratospheric ozone depletion	DALY	3.88E-12
Ionizing radiation	DALY	2.78E-13
Ozone formation, human health	DALY	3.01E-12
Fine particulate matter formation	DALY	1.77E-9
Ozone formation, terrestrial ecosystems	species.yr	4.64E-13

Terrestrial acidification	species.yr	1.37E-12
Human non-carcinogenic toxicity	DALY	1.38E-10
Land use	species.yr	1.69E-11
Mineral resource scarcity	USD2013	8.53E-7
Fossil resource scarcity	USD2013	4.83E-5
Water consumption, human health	DALY	1.19E-10
Water consumption, terrestrial ecosystem	species.yr	8.2E-13
Water consumption, aquatic ecosystems	species.yr	1.46E-16

Table 6. 21 LCA Damage Assessment – Sub-system 2 Maintenance (Soap)

Damage Category	Unit	Soap
Human health	DALY	4.33E-9
Ecosystems	species.yr	2.64E-11
Resources	species.yr	4.91E-5

Table 6.22 LCA Normalization– Sub-system 2 Maintenance (Soap)

Damage Category	Unit	Soap
Human health		1.82E-7
Ecosystems		3.68E-8
Resources		1.75E-9

Table 6.23 LCA Weighting – Sub-system 2 Maintenance (Soap)

Damage Category	Unit	Soap
Human health	µPt	0.000
Ecosystems	µPt	14.7
Resources	µPt	0.351
TOTAL	µPt	0.000
	mPt	0.0000

Table 6.24 LCA Characterization – Sub-system 2 Maintenance (Water)

Impact Category	Unit	Container Types						
		1	2	3	4	5	6	7
Global warming, human health	DALY	4.02E-10	2.09E-10	5.9E-10	3.15E-10	1.97E-10	2.47E-10	4.07E-10
Global warming, terrestrial ecosystems	species.yr	1.21E-12	6.3E-13	1.78E-12	9.52E-13	5.96E-13	7.47E-13	1.23E-12
Global warming, freshwater ecosystems	species.yr	3.31E-17	1.72E-17	4.86-17	2.6E-17	1.63E-17	2.04E-17	3.36E-17
Stratospheric ozone depletion	DALY	1.51E-13	7.84E-14	2.22E-13	1.18E-13	7.41E-14	9.29E-14	1.53E-13
Ionizing radiation	DALY	5.02E-13	2.61E-13	7.36E-13	3.9E-13	2.46E-13	3.09E-13	5.08E-13

Ozone formation, human health	DALY	9.69E-13	5.03E-13	1.42E-12	7.6E-13	4.76E-13	5.96E-13	9.82E-13
Fine particulate matter formation	DALY	6E-10	3.12E-10	8.81E-10	4.71E-10	2.95E-10	3.7E-10	6.08E-10
Human carcinogenic toxicity	DALY	3.22E-10	1.67E-10	4.72E-10	2.52E-10	1.58E-10	1.98E-10	3.26E-10
Human non-carcinogenic toxicity	DALY	6.74E-11	3.5E-11	9.89E-11	5.29E-11	3.31E-11	4.15E-11	6.83E-11
Land use	species.yr	6.95E-14	3.61E-14	1.02E-13	5.46E-14	3.41E-14	4.28E-14	7.04E-14
Mineral resource scarcity	USD2013	7.53E-7	3.91E-7	1.11E-6	5.91E-7	3.7E-7	4.64E-7	7.63E-7
Fossil resource scarcity	USD2013	2.21E-5	1.15E-5	3.24E-5	1.73E-5	1.08E-5	1.36E-5	2.24E-5
Water consumption, human health	DALY	1.71E-9	8.8E-10	2.51E-9	1.34E-9	8.39E-10	1.05E-9	1.73E-9
Water consumption, terrestrial ecosystem	species.yr	1.04E-11	5.4E-12	1.53E-11	8.15E-12	5.1E-12	6.4E-12	1.05E-11
Water consumption, aquatic ecosystems	species.yr	4.66E-16	2.42E-16	6.84E-16	3.65E-16	2.29E-16	2.87E-16	4.72E-16

Table 6.25 LCA Damage Assessment – Sub-system 2 Maintenance (Water)

Damage Category	Unit	Container types						
		1	2	3	4	5	6	7
Human Health	DALY	3.1E-9	1.61E-9	4.55E-9	2.43E-9	1.52E-9	1.91E-9	3.14E-9
Ecosystems	species.yr	1.24E-11	6.42E-12	1.81E-11	9.69E-12	6.07E-12	7.61E-12	1.25E-11
Resources	USD2013	2.28E-5	1.19E-5	3.35E-5	1.79E-5	1.12E-5	1.41E-5	2.31E-5

Table 6.26 LCA Normalization – Sub-system 2 Maintenance (Water)

Damage Category	Unit	Container types						
		1	2	3	4	5	6	7
Human Health		1.31E-7	6.78E-8	1.92E-7	1.02E-7	6.41E-8	8.04E-8	1.32E-7
Ecosystems		1.73E-8	8.96E-9	2.53E-8	1.35E-8	8.47E-9	1.06E-8	1.75E-8
Resources		8.15E-10	4.23E-10	1.2E-9	6.39E-10	4E-10	5.02E-10	8.26E-10

Table 6.27 LCA Weighting – Sub-system 2 Maintenance (Water)

Damage Category	Unit	Container types						
		1	2	3	4	5	6	7
Human Health	µPt	52.2	27.1	0.000	41	25.6	32.2	0.000
Ecosystems	µPt	0.000	0.000	10.1	0.000	3.00	0.000	6.99
Resources	µPt	0.163	0.0847	0.239	0.128	0.00	0.1	0.165
TOTAL	µPt	0.000	0.000	80.000	46.5	0.000	36.5	0.000

Damage Category	Unit	Container types						
		1	2	3	4	5	6	7
	mPt	0.000	0.000	0.000	0.000	0.00	0.00	0.000

The water and soap environmental impact are for each washing period. However, the unit of analysis in this study is per month. Since the shopping frequency equals to 2 times per month, the environmental impact for water and soap are multiplied by 2. The result are presented in Table 6.30.

Table 6.28 Environmental Impact of Soap and Water per month

Aspect	Unit	Container types						
		1	2	3	4	5	6	7
Soap (per wash)	mPt	0.0879						
Soap (per month)	mPt	0.00						
Water (per wash)	mPt	0.0593	0.0308	0.087	0.0465	0.0291	0.0365	0.0601
Water (per month)	mPt	0.000	0.0616	0.000	0.000	0.0582	0.000	0.000

Table 6.29 Total LCA Weighting of Sub System 2

Aspect	Unit	Container types						
		1	2	3	4	5	6	7
Production	mPt	0.1688	0.021	0.000	0.212	0.0842	0.000	0.196

Aspect	Unit	Container types						
		1	2	3	4	5	6	7
Maintenance - Soap	mPt	0.000						
Maintenance - Water	mPt	0.1186	0.0616	0.000	0.093	0.0582	0.000	0.1202
TOTAL per container	mPt	0.000	0.2584	0.6978	0.000	0.3182	0.3028	0.492
QTY container		4	3	1	1	1	1	5
TOTAL	mPt	1.8448	0.7752	0.6978	1.4424	0.3182	0.3028	2.46
TOTAL SUB-SYSTEM 2		7.8412 mPt						

6.3.2.3 Interpretation

The interpretation stage of the LCA process is done to understand the results generated from the calculation. Sub-system 2 focuses on seeing the environmental impact yielded from using reusable containers to shop in a Zero-Waste Store. There are different container sizes that are used to purchase different types of goods with different amounts. The impact that are assessed for this sub-system are the production of the reusable containers and the maintenance of reusing the containers.

The unit of analysis for this research is comparing the impact for monthly activity. Table 6.21 shows the values of environmental impact for each containers if it is used monthly, which means two times usage per month.

Reusing containers requires additional activity to ensure the hygiene of the containers to be reused, which is washing the containers after usage. This activity involves water and soap which also has its own environmental impact. Soap used for all containers are the same amount, yet, the water used to wash different containers will differ, as shown in Table 6.29. The numbers generated from this step is only for one time washing activity. Therefore, the numbers are multiplied by two due to the two times usage of containers per month.

Each of the impact value of the containers are multiplied by the quantity, resulting the final total of impact from each containers to be equal. Therefore, the total environmental impact from sub-system 2 alone is equals to 7.8412 mPt.

6.3.3 LCA for Sub-System 3

Sub-system 3 is the LCA to see the environmental impact of the transportation needed to buy products from traditional retails and Zero-Waste Stores. Shopping in a traditional retail allows customers to get everything they need in one go. However, in shopping from Zero-Waste Stores, they will need to also go to traditional retail stores to buy the items that are not substitutable in the Zero-Waste Stores. Noting also that since Zero-Waste Stores are still very few, therefore the distance will be assumed to be further compared to visitation to traditional store. The inventory, impact assessment and the interpretation are shown below.

6.3.3.1 Life Cycle Inventory

In this sub-system, the inventory for the distance will be assumed based on observation. The distance for retail stores will be nearer compared to shopping in a Zero-Waste Store Presented in Table 6.32 is the Inventory taken from SimaPRO for the sub-system 3 LCA process.

Table 6.30 Life Cycle Inventory for Sub-System 1

Transportation	
Transport, passenger car, medium size, petrol EURO 5 (GLO) market for | Cut-off, U	
Activity	**Distance (km)**
Shopping to traditional retail store	3
Shopping to Zero-Waste Stores	100

Distance to shopping in traditional retail stores are assumed to be 3 km due to the many outlets available for people to shop and fulfill their daily necessity. The 100 km distance assumption for Zero-Waste Stores are set because of the very few stores available in the big cities of Indonesia.

6.3.4.2 Life Cycle Impact Assessment

The impact assessment is conducted to see the product's impact to the environment. The Sub-System 3 impact assessment will be done for two different distances, 3 km and 100 km. These flowcharts show the environmental contribution of each processes and materials that are involved in the end product. The flowchart are connected by red lines, thick and thin. The thicker the line means that the process yields bigger impact in creating the selected product. Each of the boxes (nodes) are the material or activity related to the creation of the selected product.

For Sub-System 3 in production activity, there are two flowcharts, one for each transport with different distance. Figure 6.27 to Figure 6.28 will show the flowchart result for the transportation needed.

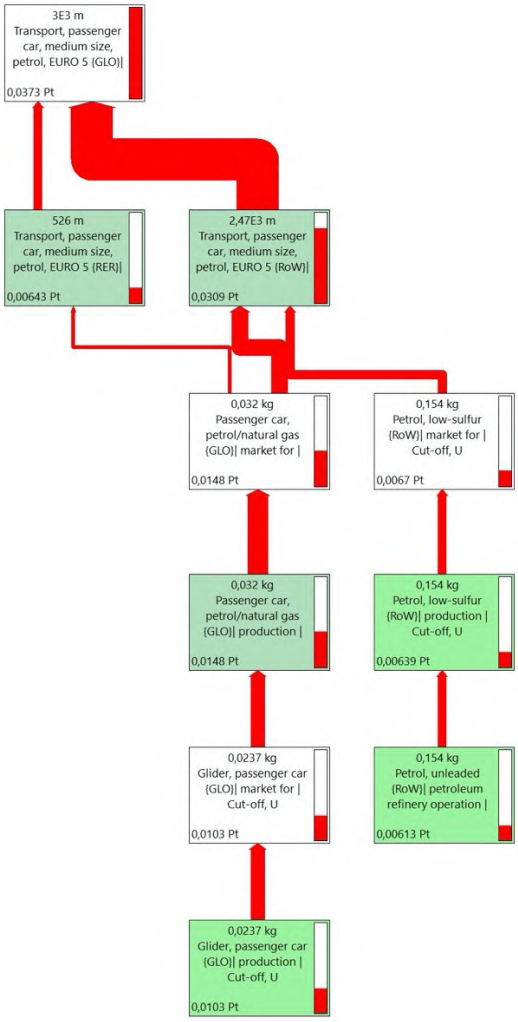

Figure 6.26 Distance travel to traditional retails flowchart

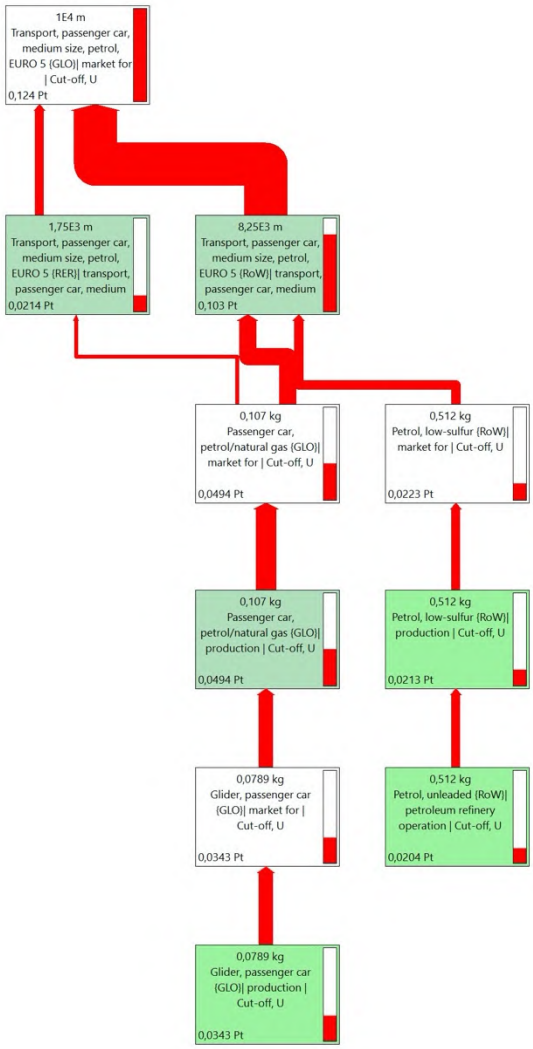

Figure 6.27 Distance travel to Zero-Waste Stores flowchart

Similar to what is conducted in the previous sub-systems, there are four stages in which the environmental impact of these products can be calculated by using the SimaPRO 9.0.0 software. These are *characterization, damage assessment, normalization,* and *weighting.*

Characterization shows the result of the inventory impact according to the impact category listed. For Sub-system 3, Table 6.33 shows impact categories resulting from the 3 km and 100 km distance. The impact categories have different units: *DALY*, *species.yr*, and *USD2013*.

Damage Assessment groups the impact category into three main groups: *human health, ecosystem,* and *resources.* Each of the categories from the previous

step are classified in the main groups with the same unit. This is shown in Table 6.34. Human health are measured with DALY unit, Ecosystem are measured with species.yr unit, and Resources are measured with USD2013 unit.

In order to make these units comparable, Normalization step is done. This process helps to yield same unit for the three main damage category. Shown in Table 6.35 is the Normalization table both of the distances.

Weighting process is the last step in the Life Cycle Impact Assessment. This process multiplies the normalized result from the previous step with a factor that expresses the relative importance of the impact category. This allows the LCA result to be presented in a single score. Similar to Sub-system 2, this section uses mPt unit. A higher mPt or Pt score correlates to contributing more. The result is presented in Table 6.36.

Since people who are shopping to Zero-Waste Stores they cannot fulfil all of their needs in one go, they need to buy those items in the traditional retail store. This will increase the frequency of shopping in Zero-Waste Stores. This makes shopping in a Zero-Waste Store's impact are from the 100 km distance travelled to that store, plus the impact of 3 km distance to get to the retail store. This calculation is presented in Table 6.37 as the final impact from sub-system 3.

Table 6.31 LCA Characterization – Sub-systems 3

Impact Categories	Unit	Distance	
		Shopping to Retail (3 km)	Shopping to Zero-Waste Stores (100 km)
Global warming, human health	DALY	9.64E-7	3.21E-6
Global warming, terrestrial ecosystems	species.yr	2.91E-9	9.7E-9
Global warming, freshwater ecosystems	species.yr	7.95E-14	2.65E-13
Terrestrial ecotoxicity	species.yr	4.83E-11	1.61E-10
Freshwater ecotoxicity	species.yr	5.07E-11	1.69E-10
Marine ecotoxicity	species.yr	9.97E-12	3.32E-11
Human carcinogenic toxicity	DALY	1.61E-7	5.38E-7
Human non-carcinogenic toxicity	DALY	2.13E-7	7.09E-7
Land use	species.yr	2.04E-10	6.79E-10
Mineral resource scarcity	USD2013	0.00129	0.00429
Fossil resource scarcity	USD2013	0.134	0.446
Water consumption, human health	DALY	7.23E-9	2.41E-8
Water consumption, terrestrial ecosystem	species.yr	4.42E-11	1.47E-10

Impact Categories	Unit	Distance	
		Shopping to Retail (3 km)	Shopping to Zero-Waste Stores (100 km)
Water consumption, aquatic ecosystems	species.yr	2.38E-15	7.93E-15

Table 6.32 LCA Damage Assessment – Sub-systems 3

Impact Categories	Unit	Distance	
		Shopping to Retail (3 km)	Shopping to Zero-Waste Stores (100 km)
Human Health	DALY	2.02E-6	6.73E-6
Ecosystems	species.yr	4.12E-9	1.37E-8
Resources	USD2013	0.135	0.45

Table 6.33 LCA Normalization– Sub-systems 3

Impact Categories	Unit	Distance	
		Shopping to Retail (3 km)	Shopping to Zero-Waste Stores (100 km)
Human Health		8.51E-5	0.000284
Ecosystems		5.75E-6	1.92E-5
Resources		4.82E-6	1.61E-5

Table 6.34 LCA Weighting– Sub-systems 3

Impact Categories	Unit	Distance	
		Shopping to Retail (3 km)	Shopping to Zero-Waste Stores (100 km)
Human Health	mPt	34	113
TOTAL	mPt	37.3	124

Following the condition where people goes shopping 2 times in a month, where people who shops in Zero-Waste Store also needs to shop two times to fulfil their needs, the environmental impact are suited as shown in Table 6.37.

Table 6.35 Total LCA Weighting for Sub-system 3

Scenario	Unit	Distance	Environmental Impact (per shopping)	Environmental Impact (per month)
Shopping only at Retail Store	mPt	3 km	37.3	89.0 mPt
Shopping to Retail	mPt	3 km	37.3	
Shopping at Zero-Waste Stores	mPt	113 km	161.3	111 mPt
Shopping to Zero-Waste Stores	mPt	100 km	124	
Shopping to Retail	mPt	3 km	3.73	

6.3.4.3 Interpretation

The interpretation stage of the LCA process is done to understand the results generated from the calculation. Sub-system 3 focuses on seeing the environmental impact yielded from transportation activity to shop. By using the same mode of transportation, traveling to different distance however, will yield different environmental impact.

Shown in Table 6.36 is the weighted impact for shopping to retail store of 3 km distance and to Zero-Waste Store with 100 km distance. Since shopping in a Zero-Waste Store requires also shopping in a retail store, the total distance are accumulated in Table 6.37. This shows the impact of shopping only at retail store is equal to 74.6 mPt, and the impact of shopping at Zero-Waste Stores is equal to 322.6 mPt for two times shopping in a month. This shows that shopping at Zero-Waste Store actually contributes a very large amount of environmental impact from the travelling aspect, making up to 4 times of the impact generated from shopping in traditional retail stores. These values then will be added to the sub-systems 1 and 2 to see the impact of Zero-Waste Store shopping and traditional shopping entirely.

6.3.4 Sub-System Comparison

After all of the calculation for each sub-system have been done, the activity for shopping in a Zero-Waste Store and traditional retail can be compared using the values obtained from the calculation. Table 6.38 below shows the summary for the environmental impact of each sub-systems.

Table 6.36 Sub-systems environmental impact

Sub-System		Impact
1	Plastic packaging waste	36.062 mPt
2	Reusable containers	0.000 mPt
3	Shopping only at retail stores	74.6 mPt
	Shopping at Zero-Waste Store and retail	322.6 mPt

6.3.4.1 Normal Shopping Activity

Normal shopping activity means that the person are only shopping in a retail store, buying their products all with plastic packaging. This shopping activity then yields the environmental impact from plastic packaging and the transport to the

retail store. It is analyzed in sub-system 1 and sub system 3. From Table 6.38, the impact values of this activity can be obtained. The total impact from the normal shopping activity then is calculated as shown below.

$$Normal\ shopping\ activity = 36.062\ mPt + 74.6\ mPt$$
$$= 110.662\ mPt$$

With sub-system 1 impact of 36.062 mPt and sub-system 3 impact of 74.6 mPt, the normal shopping activity has a total of 110.662 mPt.

6.3.4.2 Zero-Waste Store Shopping Activity

Zero-Waste Store shopping activity means that the person are shopping using reusable containers in a Zero-Waste Store to buy their daily needs available there unpackaged. The person however still also need to visit the traditional retail store since they have to buy the stuff that are not available in Zero-Waste Store. This makes the impact for this shopping activity calculated as follows.

$$Zero - Waste\ Store\ shopping\ activity$$
$$= (Sub - system\ 2\ + Transport\ to\ retail$$
$$+ Transport\ to\ ZWS) - (Sub - system\ 1)$$

$$Zero - Waste\ Store\ shopping\ activity = (7.8412\ + 322.6) - (36.062)$$
$$= 294.3792\ mPt$$

With the values taken from Table 6.38, it can be seen that the total impact for this activity is from sub-system 2 impact of 7.8412 mPt and sub-system 3 total impact of 322.6 mPt. It is subtracted by sub-system 1 since when the person is shopping to the traditional retail to buy the remaining products, they will not buy these products and these values can be subtracted. Therefore, for the Zero-Waste Store shopping activity, the environmental impact value is equals to 294.3792 mPt.

6.3.4.3 Analysis

The environmental impact of a normal shopping activity shows a value of 110.662 mPt and the Zero-Waste Store shopping activity shows a value of 294.3792 mPt. This shows that the environmental impact of shopping in a Zero-Waste Store is turns out to be significantly higher compared to that of shopping in a traditional retail store. The practice of reusing containers compared to disposing plastic packaging is actually better for the environment since it has lower environmental impact, 7.8412 mPt compared to 36.062 mPt.

However, the number of Zero-Waste Stores available are still very minimal, as it makes the travelling distance to the stores very far. From the calculation presented in Table 6.37, it shows that the distance for Zero-Waste Store shopping is very high. Therefore, this shows that the biggest contributor for the Zero-Waste Store shopping is from transportation. Even though the impact from reusing containers are very low, it should also be balanced with low environmental impact from other activity that supports Zero-Waste Store shopping.

CHAPTER VII
CONCLUSION AND SUGGESTION

This chapter will show the conclusion and the suggestion for this research. The conclusion will answer the main objectives of the research, with suggestions focusing on further research and also the Zero-Waste Store owners.

7.1 CONCLUSION

Based on the research that has been conducted thoroughly, there are conclusions that can be made according to the initial objectives of the research:

1. The number of packaging waste that can be reduced through Zero-Waste Stores are 2.34% from all the plastic waste generated per capita per month, that are able to fulfill a month daily necessity. This can also show that plastic wastes are generated mostly from other packaging other than what is sold from the Zero-Waste Stores. The stores must be able to somewhat substitute more items from traditional store such as condiments to result in a higher percentage of plastic waste reduction. Moreover, this shows that Zero-Waste Store alone then cannot significantly reduce plastic waste. Additional effort must be made to help reduce plastic waste. Yet, Zero-Waste Store still bring reduction to packaging waste, and if done collectively by many people, it will reduce more plastic waste than the amount it is today.
2. The life cycle assessment shows the result that shopping in a Zero-Waste Store currently have higher environmental impact. This significant difference of impact are mostly the contribution of the impact of transportation. Since Zero-Waste Stores are still very few which result in very far distance from customers, they need to travel further to reach the stores. However, the practice of reusing containers compared to disposing plastic packaging is actually better for the environment since it has lower environmental impact.
3. Through extensive interview with the Zero-Waste Store owners and suppliers and asking voice of the customers through survey, the operations of a Zero-Waste Store can be understood.

a. *Zero-Waste Store*: All of the Zero-Waste Stores are initiated by the owner because of a personal goal to make a better environment, not focusing on the business perspective. The stores absorb nature-friendly theme for the store design, and mostly assort product which are also aligning with eco-friendly product that are not using chemicals in their sold products.
b. *Supplier*: The suppliers are mostly home-based businesses, who are also having the goal of making better environment. The items that they sold are a more eco-friendly product, using less chemicals unlike mass produced products. Some of them who are located locally are able to transport the goods using reusable containers. For the supplier that are located outside of the city are making their effort to reduce plastic packaging by using a more eco-friendly approach such as cardboard boxes.
c. *Customer*: Customers that haven't known about Zero-Waste Stores before are asked about their willingness and opinion about Zero-Waste Stores. The majority of them shows a positive perception and willingness to shop in Zero-Waste Stores. Since this concept is relatively new, as the stores are only starting to emerge in late 2018 to early 2019, not that many customers are making this a routine. From the statement testing aspect, it also can be concluded that from the group who have only visited the Zero-Waste Store once, it shows higher percentage of willingness to make it a routine if the majority of their needs is fulfilled, compared to the distance factor. This means that if the store are able to increase their product variety, more customers are willing to make it a routine.

4. Recommendations for this research on Zero-Waste Store shopping activity will be presented in the suggestion section for each stakeholders.

7.2 SUGGESTION

This section will outline the suggestions that is able to be obtained from the experiences of this research, that will help ameliorate this research and to give recommendation for Zero-Waste Store stakeholders.

7.2.1 Suggestion for Further Researchers

1. The survey participant's demography needs to be more comprehensive and have uniform participant for some groups so that the result can be more representative.
2. A more specific questionnaire designed to see the correlation of factors that affects intention on shopping in a Zero-Waste Store can help to explore a more detailed profile of the Zero-Waste Store customers. More respondents are needed for specific characteristics in the survey to confirm those correlations.
3. Further researchers can opt to analyze the other scope of the LCA from other aspects, such as the store owners and supplier's point of view.
4. Further researchers can also analyze more on the technical shopping experiences inside of the store, such as the effectiveness and the efficiency of the shopping sequence.
5. Further researchers can also assess the impact and operation if these stores are created in an online format. During an unprecedented situation such as the COVID-19 pandemic, these stores must be able to think how to survive in the market by considering ways on delivering their products online. This is of course done by carefully managing their product and shipping their product with as less packaging as possible.

7.2.2 Suggestion for Zero-Waste Store Stakeholders

1. Zero-Waste Stores: As there are still very few of these store available, these stores must provide more to compensate for the environmental impact. These stores must be able to either increase the variety of products sold in the stores or open up more branches to make it closer to customers. Having more variety of product will enable customers to

shop only in Zero-Waste Stores so that they don't need the extra distance to retail stores. On the other hand, having more branches means that the distance will be closer and even if it is not as complete, the result from LCA shows significant difference in distance. So if it is located closer, it will help to reduce the environmental impact. Moreover, the stores can opt to provide an online catalogue with online store service so customer's doesn't have to travel the distance to the store. This can be facilitated with eco-courier delivery as what has been done by some stores, to lessen the environmental impact from transportation.

2. Suppliers: As there are still many products expressed by customers that are lacking in Zero-Waste Stores, this becomes a business opportunity for suppliers to diversify their options to supply products to Zero-Waste Stores. Traditional retail suppliers can also opt to supply in bulk for these stores to give an option for the supplier's customers to buy their product without packaging.
3. Customers: Even though shopping in a Zero-Waste Store gives out less impact for the environment from the reusable container practice, the impact from transportation due to the far distance is very big. It is suggested to customers who are located very far from Zero-Waste Stores should reduce the travel frequency to the store by opting for monthly trip or even bi-monthly trip in order to reduce impact from the travel. Customers can buy more things in advanced (stock for two months need instead of one) with more containers to hold them since the impact is very low compared to travelling again. Another alternative that can be done by customer is to choose a more eco-friendly means of transportation, such as using public transport or even bicycle.

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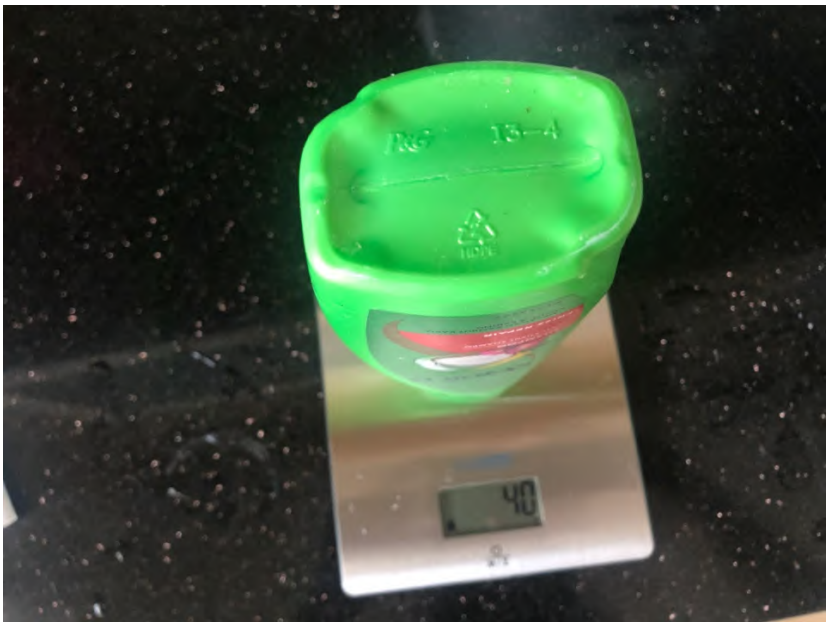
APPENDIX



Appendix 1 Weighing process for plastic packaging waste

Appendix 2 Weighing process for plastic packaging waste

Appendix 3 Weighing reusable containers (empty)

Appendix 4 Collecting water usage for washing container

Appendix 5 Weighing the water usage to wash containers

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AUTHOR'S PROFILE

Putu Ayu Indira Ardiyatna is an undergraduate student in the Industrial and Systems Engineering Department of Institut Teknologi Sepuluh Nopember (ITS) Surabaya. Before pursuing an education in Surabaya, she spent her previous years studying in various places. Her elementary school education was obtained from SD YPS Singkole in Sorowako, South Sulawesi in 2010. Following the elementary education, her middle school and high school education is completed in Global Prestasi School in Bekasi, West Java. She also undergoes the Cambridge International program during the first four years of middle school, and completing the study with an IGCSE certification. This experience allows her to get many insights from different places and has shaped the person she is today. She is currently spearheading an organization called "Bumi Buddies". It is an organization that aims to raise awareness of Indonesian youth and children to gain knowledge about the environment, touching areas such as Climate Change, Waste Management, and Responsible Consumption. Contact her via email at dirardiyatna8@gmail.com or LinkedIn profile in linkedin.com/in/dirardiyatna.