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Systems Thinking for a
Sustainable Food System Booklet Series

Reducing Food Loss and Waste

4

Foreword

The food crisis has become a hot topic across various mass media platforms. The looming threat of a climate crisis has only heightened the potential for future food crises. Unfortunately, many of us continue to engage in behaviors that contribute to food waste, which is a striking irony. On one hand, we face the threat of a food crisis, while on the other hand, food loss and waste persist.

Our behaviors that lead to food waste also have a detrimental impact on the environment. Food loss and waste (FLW) contributes to the emission of greenhouse gases (GHG), which are the primary drivers of the climate crisis. In turn, climate crisis leads to food crisis. This is a never-ending cycle within the food system.

By recognizing the interconnected nature of the food system, we can begin to take action and make individual changes by avoid wasting food. By doing so collectively, we can improve the overall situation.

Koalisi Sistem Pangan Lestari (KSPL), part of Food and Land Use Coalition (FOLU), has produced this booklet to invite readers to apply systems thinking not only in looking at food issues, but also in finding solutions. This booklet is a part of the Systems Thinking for a Sustainable Food System Booklet Series, which consists of five volumes:

Volume 1: Understanding the Food System and the Systems Thinking Framework

Volume 2: Healthy Diet

Volume 3: Agroecology

Volume 4: Reducing Food Loss and Waste
Volume 5: Environmental Sustainability within the Food System Framework

This booklet, Volume 4, is divided into four sections. The first section begins with an introduction to food loss and waste (FLW). Readers will learn about FLW and its negative impacts.

The second section of this booklet addresses food loss and waste within the framework of the food system. Readers can explore the interrelationships among different components of the food system that are affected by and also impact FLW.

The third section of this booklet discusses the causes of FLW. Readers can not only understand the causes of food waste but also begin to identify causes that can be prevented by individual actions.

The fourth and final section of this booklet discusses important steps that can be taken to reduce FLW. This section will give readers insight into strategic actions that they can take to address the problem of food waste.

This booklet draws on training materials on systems thinking for a sustainable food system and other relevant literature. KSPL would like to express our gratitude to all those who have assisted in the publication of this booklet.

We understand that this booklet may not be perfect and there is always room for improvement. We welcome any feedback or constructive criticism that can help us enhance the quality of this booklet in the future.

Ultimately, we hope for this booklet to be a valuable resource for readers who are interested in learning about the application of systems thinking in building a sustainable food system.

Jakarta, January 2023

I. Understanding Food Loss and Waste

Did you leave any of your breakfast uneaten this morning? Have you heard of people throwing away food ingredients because they have gone bad? Have you seen piles of leftover food in the trash? The answer is most likely yes.

In the food system, we use the term Food Loss and Waste (FLW). Before delving deeper, it's essential to understand the difference between food loss and food waste.

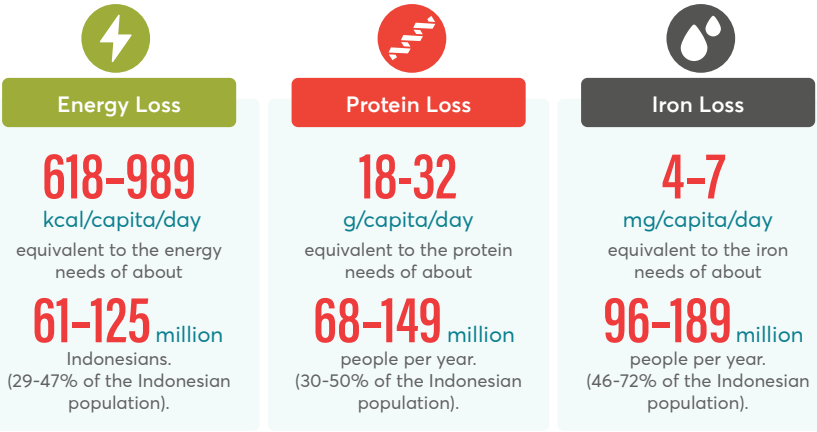
According to the FAO in The State of Food Agriculture 2019, food loss refers to a decrease in the quantity or quality of food resulting from decisions and behaviors of food suppliers outside of retail, food service providers and consumers[1]. Meanwhile, food waste refers to a decrease in the quantity or quality of food resulting from decisions and behaviors of retail, food service providers and consumers. To better understand the difference, the following figure compares food loss and food waste in the food supply chain[2].

Indonesia is claimed to be the second largest FLW producer globally, just after Saudi Arabia. According to data from the Ministry of Environment and Forestry in 2018, 44 percent of the waste generated in Indonesia in 2018 was food waste.[3] The FLW rate in Indonesia is significantly high, ranging from 115-184 kilograms/capita/year in 2000-2019[4].

Such high FLW rate has a detrimental impact on Indonesia, **ranging from the loss of nutrient content in food to environmental and economic impact.**

A. Impact of Loss of Nutrient Content

Here is the potential loss of nutrient content due to FLW[5]:



For more details, the losses suffered from the loss of nutrient content due to FLW can be seen in the table below[6].

Table A. Loss of Nutrient Content per Person per Day due to FLW Generation.

Nutrient Content	Range of Nutrient Loss from FLW per person per day	Nutrient Needs per person per day	% of Indonesian Population that can be Fed from FLW	Number of Malnourished People in Indonesia
Energy	618-989 kcal	2100 kcal	29-47%	45.7%*
Protein	18-32 g	57 g	30-50%	36,1%
Vitamin A	360-953 Ug RE	575 Ug RE	63-166%	N/A
Iron (Fe)	4-7 mg	10.1 mg	46-72%	40.9%**

Notes:
* Health Research and Development Agency (2014) in Buku Studi Diet Total: Survei Konsumsi Makanan Individu Indonesia.

** Basic Health Research (Riskesdas), Ministry of Health (2018).

Source: Summary for Policy Makers, Food Loss & Waste in Indonesia

B. Environmental Impact: Greenhouse Gas Emissions

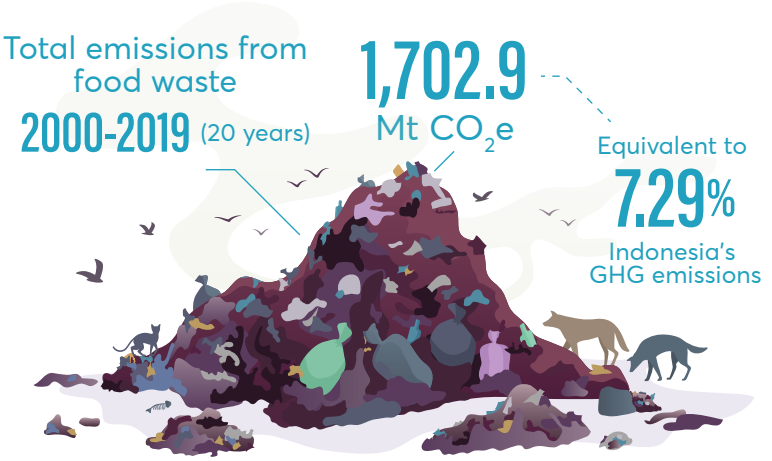
In Indonesia, FLW contribute significantly to the increase of GHG emissions, which are the main cause of the climate crisis. The total emissions from food waste generated between 2000-2019 (20 years) are estimated to be 1,702.9 Mt CO2 eq, with an average annual contribution equivalent to 7.29 percent of Indonesia's GHG emissions[7].

The climate crisis has already caused ecological disasters around the world, with floods and droughts leading to various food security issues in many countries, including Indonesia.

One example is crops failure due to drought in Kampar Regency, Riau Province in 2015. Tens of hectares of rice fields in Bangkinang Sub-district, Kampar Regency, experienced crops failure due to drought, resulting in losses of tens of millions of rupiah.

The effects of drought are not limited to Bangkinang Sub-district, as crop failures are predicted to affect hundreds of hectares of rice fields throughout Kampar Regency[8].

Beyond Riau, the impact of the climate crisis is also felt by vegetable farmers on the eastern slopes of Mount Slamet, Central Java. Vegetable farmers in the area are facing an increase in plant diseases caused by pests attacking their crops. The Head of the Agricultural Environment Research Center at the Ministry of Agriculture, Prihasto Setyanto, explained that global warming triggers climate change that leads to pest attacks and plant diseases, as there is no disruption to the pest development cycle[9].



Source: Summary for Policy Makers, Food Loss & Waste in Indonesia.

C. Economic Impact

Whenever food is wasted, all the resources used in each step of the process are wasted too. These include the plastic used for packaging frozen vegetables that is discarded during food processing or the smoke and fuel emitted during fruit distribution. The use of non-productive natural resources, like land and water, causes economic losses[10].

Additionally, every instance of food loss and waste comes with an environmental cost that needs to be paid and is economically damaging. The environmental costs include water that is continually used at every stage of food production for irrigating crops, producing food, packaging and transporting. When food is wasted, all of that water goes to waste as well[11].

FLW also causes considerable economic losses in Indonesia. Such loss in 2000-2019 is estimated to amount to IDR213-551 trillion per year, which is equivalent to 4-5 percent of Indonesia's GDP. Such economic losses may be even greater, as the data used to calculate economic loss is based on available food price data, which includes only 64-88 commodities out of a total of 146 commodities in the Food Balance Sheet[12].

Source: Summary for Policy Makers, Food Loss & Waste in Indonesia.

II. Food Loss and Waste within the System Framework

As we have learned in Volume I, the elements within a system are interrelated. Disruption to one element in the system will affect the overall functioning of the system. In the food system, FLW also affects the entire food system.

For instance, if food crops are not handled properly during pre-harvest processes or if they are stored in a manner that results in a decrease in quality, food loss can occur. This reduction in food quality during pre-harvest processes can lead to a decrease in nutrient intake for consumers, just as a decrease in quantity can have the same effect.

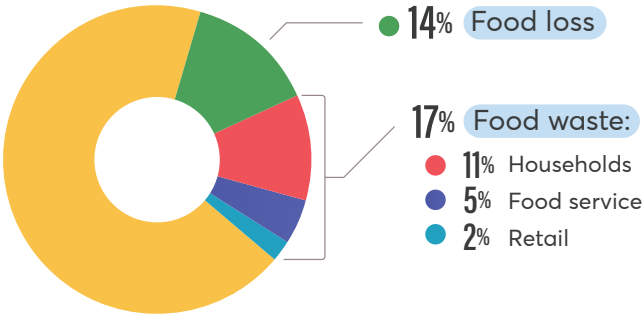
An example of food loss in the production phase is when pests attack crops or when bad weather damages the harvest. Food can also spoil during transportation and storage, making it unfit for consumption[13]. Therefore, the longer the food supply chain, the greater the likelihood of food loss..

Meanwhile, our behavior as consumers often contributes to FLW. For example, when we consume food excessively beyond our needs, it not only endangers our health, but also creates a pileup of food waste.

Some consumer behaviors are often caused by food industry promotions. Some food company promotions encourage consumers to buy more food than they need. When a company promotes a buy-one-get-one or buy-two-get-three offer to manipulate demand, the second or third product may not be consumed or may expire and end up being wasted[14]. These piles of food waste ultimately end up in landfills and emit greenhouse gases, contributing to the climate crisis. The climate crisis then creates various disasters that will, in turn, affect food production.

III. Drivers of Food Loss and Waste

The losses caused by FLW are indeed very significant. Globally, around 14 percent of produced food is lost at the agricultural and sales stages and about 17 percent ends up as food waste (11 percent in households, 5 percent in food service and 2 percent in retail) due to consumption behavior[15].



In 2018, around 20 percent of global corn production or about 400 million metric tons were lost at the post-harvest stage before consumption. Malawi lost 550,000 tons of corn worth USD150 million. Arab countries lost 30 percent of their cereal production between production and consumption, equivalent to USD100 million per year. Brazil lost 3-30 percent of corn kernels post-harvest, causing a maximum loss of USD60 billion. Peru lost 15-27 percent of corn kernels post-harvest, while Thailand lost 19 percent of its cereal production[16].

In Indonesia, the total FLW is generated throughout the five stages of the food supply chain:

1. **Production stage**
2. **Post-harvest and storage stage**
3. **Processing and packaging stage**
4. **Distribution and marketing stage**
5. **Consumption stage**

The critical point of loss that shows the highest FLW generation is the consumption stage, which generates 5-19 million tons of food waste per year. Based on food types, the food crop sector, particularly grains, is the largest contributor to FLW generation at 12.21 million tons per year. Meanwhile, the most inefficient is the horticultural sector, especially vegetables, which generates 62.8 percent of the loss in domestic vegetable supply. **This means that more vegetables are wasted than consumed[17].**

Here are the causes and drivers of FLW in Indonesia, based on Bappenas research (2021):[18].

Causes and Drivers of FLW in Indonesia

VERY IMPORTANT

Direct causes

Lack of Good Handling Practice (GHP)

Suboptimal storage space

Excessive portion & consumer behavior

Technological limitations

Poor packaging /containers

Poor harvesting techniques

Indirect causes

Market quality standards & consumer preferences

Lack of information/educati on for food workers and consumers

Market competition & consumer purchasing power limitations

Infrastructure limitations

SUFFICIENTLY IMPORTANT

Direct causes

Misinterpretation of expiration dates & "best before" dates

Suboptimal preparation of food ingredients

Indirect causes

Market prices

Inefficient supply chain

Lack of regulations on food waste

Limited access to funding

Source: Summary for Policy Makers, Food Loss & Waste in Indonesia

IV. Steps towards Food Loss and Waste Reduction

Reducing FLW will prevent significant losses. So, what can we do to reduce FLW? Here are some actions that can be taken by each actor[19]:

Producer/Supplier

- Aligning production planning to the market.
- Making more effort to develop better food harvesting, storage, processing and distribution processes to allow for redistribution of food to those in need when an oversupply occurs.
- Collecting accurate data to identify critical points where food loss and waste usually occur.
- Implementing innovative solutions such as creating e-commerce platforms for distributing or processing recoverable food.
- Improving food packaging and loosening regulations and standards on aesthetic requirements for fruits and vegetables.
- The use of crates during transportation has reduced food loss for vegetables and fruits by 87 percent. Replacing single-use plastic bags with crates also brings environmental benefits.

Supermarket/Wholesale

- Lowering the prices of food that may be considered "imperfect" or "ugly" so consumable foods will not be wasted.
- Paying attention to the "best before" dates on the food they sell to prevent the sale of expired food that may end up being discarded by consumers.
- Donating unsold food.
- Identifying where food waste occurs.
- Donating food that has to be discarded to the local community for livestock feed.

Government

- Providing incentives to support actions to reduce food loss and waste and collaboration across the supply chain.
- Providing training as well as technology and innovation support, including for small-scale producers, to develop the capacity to prevent food loss and waste in processing, storage and distribution.
- Facilitating food banks.
- Facilitating access to consumers for farmers by creating shorter value chains through farmer markets.

Private Sector

- Fostering an environment that supports policy and institutional development.
- Increase awareness and advocacy.
- Developing partnerships and alliances with various stakeholders to build capacity in preventing food waste.
- Supporting innovative products and processes.
- Developing capacity at the supply chain and institutional level.

Consumers

- Reusing leftover food for the next day instead of discarding it.
- Properly storing food to prevent easy spoilage.
- Planning menus with appropriate portions to avoid wasting food later and save money. When dining out, we can request smaller portions.
- Consuming a variety of foods.
- Checking the refrigerator or storage area before going shopping and making a list of what needs to be purchased.
- Understanding the difference between expiration dates and best before dates. The best before date is only a guide to when the product will be at its best quality, so it is acceptable to consume it after the date, as long as it is not spoiled, moldy, smelly, has an altered taste or has passed the expiration date (if specified).
- Imperfect or "ugly" fruits and vegetables are not always bad and can still be purchased and used in dishes.
- Freezing food if it is not used immediately, even for milk. In some places, especially developing countries, refrigeration may not be practical. One alternative is to dry the food or store it in a moisture-resistant container.
- Finally, instead of throwing away all the food that is no longer fit for consumption, some of it can be used as animal feed. We can also enrich the soil by creating compost from leftover food rather than discarding it.

The ball is in our court. Will we take action to reduce FLW or allow it to continue to increase?

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