

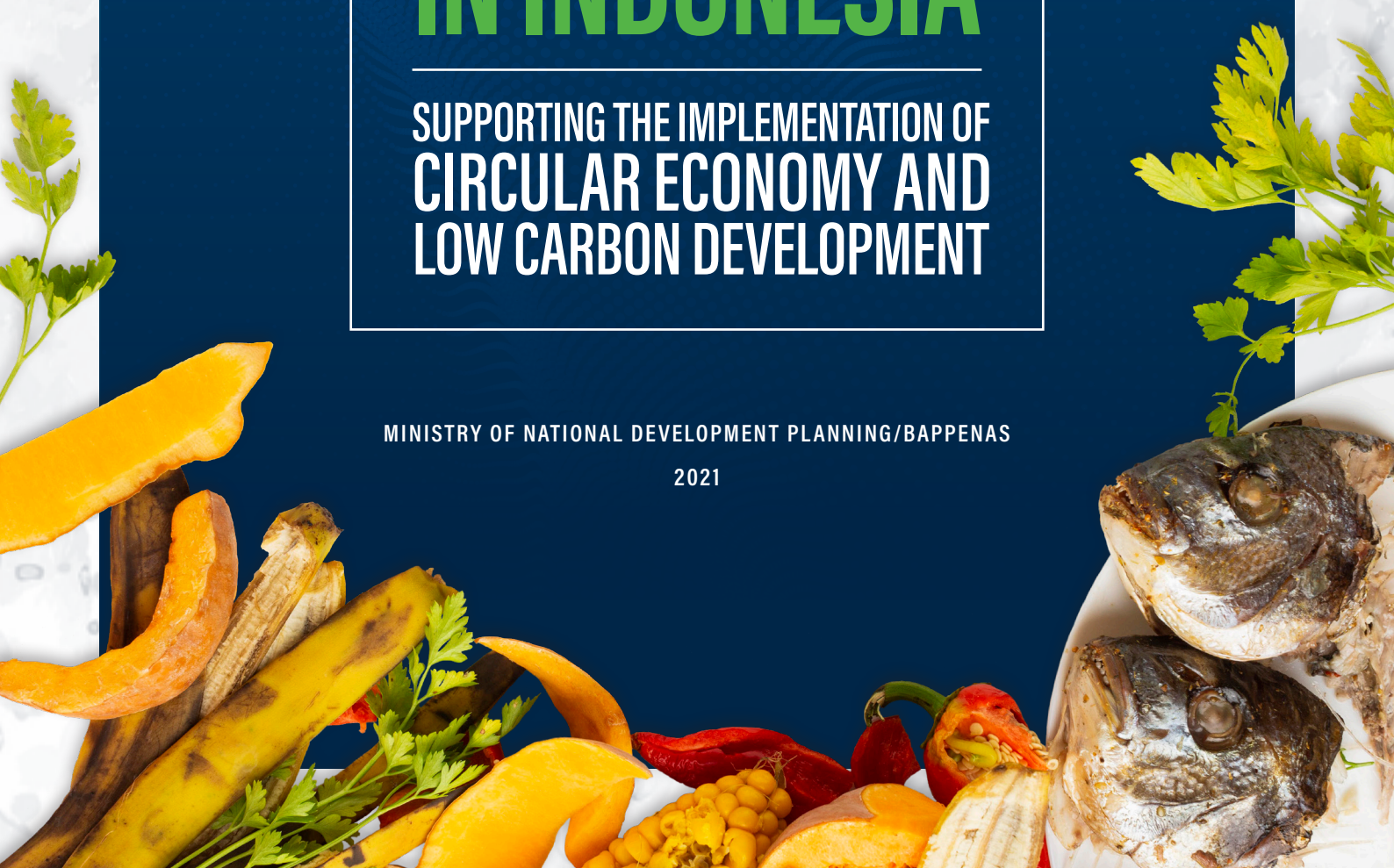
**EXECUTIVE SUMMARY FOR POLICY MAKERS**

# **FOOD LOSS AND WASTE IN INDONESIA**

**SUPPORTING THE IMPLEMENTATION OF  
CIRCULAR ECONOMY AND  
LOW CARBON DEVELOPMENT**

**MINISTRY OF NATIONAL DEVELOPMENT PLANNING/BAPPENAS**

**2021**





# FOOD LOSS AND WASTE IN INDONESIA

SUPPORTING THE IMPLEMENTATION OF  
CIRCULAR ECONOMY AND  
LOW CARBON DEVELOPMENT



## ABOUT THIS RESEARCH

This research was initiated by the Ministry of National Development Planning/ Bappenas of the Republic of Indonesia in collaboration with Waste4Change and the World Resource Institute.

This report is written within the framework of the Government of Indonesia LCDI program supported by UK-FCDO through British Embassy Jakarta. The content of this report is based on consultation with various institutions, including both government and non-government organizations. Any views and opinions represented in this report belong solely to the Editorial team and does not necessarily reflect the view of UK FCDO and British Embassy Jakarta.

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## FOREWORD

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As a country that was agreeing on the global development agenda, Indonesia has committed to supporting the Sustainable Development Goals (SDGs) and greenhouse gas (GHG) emission reduction targets following the Paris Agreement in 2030. This commitment is demonstrated by mainstreaming the SDGs' goals, targets, and indicators in the National Medium Term Development Plan (RPJMN) 2020 - 2024 and prioritize Low Carbon Development programs in National Priority (PN) 6: Build the Environment, Improving Disaster Resilience, and Climate Change. In addition, under the Low Carbon Development program, the Government of Indonesia is also developing the Circular Economy policy as an approach to encourage green and sustainable economic growth.

These steps are the systemic and integrated efforts by the Government of Indonesia in dealing with various development problems, one of which is food loss and waste. With a more than 200 million population, Indonesia can generate a large amount of food loss and waste (FLW) that continues to grow every year. Food loss that occurs in the food preparation supply chain and food waste generated in the process of distribution, service, and food consumption is causing economic and social impact and contributes to the increased greenhouse gas emissions. Therefore, a responsible, integrated, and holistic reduction and handling of FLW can be part of efforts to accelerate the implementation of low carbon development and green economic development to address the challenges of food security and nutrition deficit in Indonesia.

As an initial step in the transformation of FLW management in Indonesia, the Government of Indonesia, supported by the Foreign, Commonwealth, and Development Office, United Kingdom, conducted a Study of Food Loss and Waste in Indonesia. This study has identified baseline data on FLW for the last 20 years and its environment, economy, and social impact and provided recommendations of sustainable FLW management strategies in Indonesia.

By presenting several evidence-based results, we hope that this study can serve as a reference and guide for stakeholders and policymakers and provide an overview of the Government of Indonesia's efforts in managing FLW in the context of implementing a Circular Economy and Low Carbon Development.



Jakarta, June 2021

**Dr. (H.C.) Ir. H. Suharso Monoarfa**

Minister of National Development  
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EXECUTIVE SUMMARY FOR POLICY MAKERS

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## TABLE OF CONTENTS

Foreword Minister of National Development Planning/ Bappenas	1
Main Findings of Food Loss and Waste in Indonesia	4
Background	5
FLW Generation in Indonesia	6
Environmental Impact of FLW: Greenhouse Gas Emissions	8
Economic Impact of FLW: Potential Economic Loss	10
Social Impact of FLW: Nutrition Loss	11
Causes and Drivers of FLW in Indonesia	12
Management Strategy and Projection of FLW Generation in Indonesia	13


## LIST OF TABLES

Table A. Nutrition Loss per Individual per Day Due to FLW Generation	11
Table B. Causes and Drivers of FLW in Indonesia	12
Table C. Projection Results of % FLW generation in 2020 - 2045	14

## LIST OF FIGURES


Figure A. Food Loss and Waste Generation in Indonesia from 2000 - 2019 per Food Supply Chain Stage (in thousand tons)	6
Figure B. Percentage of Food Loss (FL) and Food Waste (FW) Generation to Total FLW in 2000 - 2019	6
Figure C. Proportion of FLW Generation to Total Domestic Supply 2000 - 2019 in 5 Sectors & in 11 Food Categories	7
Figure D. Contribution of 5 Stages of Food Supply Chain to Total FLW-Associated GHG Emissions per Year	8
Figure E. Percentage of GHG from Food Loss (FL) and Food Waste (FW) in 2000 - 2019	9
Figure F. Comparison of % FLW to Economic Loss in 5 Food Sectors	10
Figure G. Comparison of % FLW to Economic Loss in 11 Food Categories	10
Figure H. Five Major Directions of Strategy of FLW Management in Indonesia	13
Figure I. Total FLW Generation of BAU Projection to Strategy Projection	14

# MAIN FINDINGS OF FOOD LOSS & WASTE IN INDONESIA


**115-184**  
KG/CAPITA/YEAR

FLW generation in Indonesia in 2000 - 2019 has reached 115-184 kg/capita/year. Based on the food supply chain, the biggest generation occurs in **consumption stage**. Based on the food sector and types, the biggest generation is found in **crops, particularly cereals**. Meanwhile, the most inefficient food sector and category is horticulture plants, especially **vegetables**.




**1.702,9**  
Mt CO<sub>2</sub> EQ

The total FLW-associated emission in 2000 - 2019 (20 years) is estimated at 1,702.9 Mt CO<sub>2</sub> eq, with the average contribution per year equals 7.29% of GHG emission in Indonesia.



**213-551**  
TRILLION RUPIAH/YEAR

The economic loss due to the FLW generation in Indonesia in 2000 - 2019 is approximately IDR 213-551 trillion/year or equals 4-5% of Indonesia's GDP.




**61-125**  
MILLION PEOPLE

The number of people that can be fed from the loss of nutrition (energy) from FLW in 2000 - 2019 is 61-125 million people, or 29-47% of Indonesia's population.

- ## 5 MAIN CAUSES & DRIVERS OF FLW IN INDONESIA
- 1 The lack of implementation of Good Handling Practice (GHP)
  - 2 Insufficient quality of storage
  - 3 Market quality standards & consumer preference
  - 4 Lack of Information/education for food workers & consumers
  - 5 Excess portion & consumers behavior

- 
- At the national level, 45 strategies are designed and categorized in
- ## 5 POLICIES DIRECTION OF FLW MANAGEMENT IN INDONESIA
- 1 Behavioral Change
  - 2 Improving Food Support System
  - 3 Strengthening Regulations & Optimizing Funding
  - 4 Utilizing FLW
  - 5 Development of FLW Study & Data Collection



In the Business-as-Usual scenario, it is estimated that FLW generation in Indonesia may reach 344 kg/capita/year in 2045. Meanwhile, with the strategy scenario, it is estimated that the FLW generation can be reduced and reach only 166 kg/capita/year in 2045.

EXECUTIVE SUMMARY



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## BACKGROUND

One-third of the food produced for human consumption is lost or wasted in between the harvesting process and consumption process<sup>1</sup>, which is known as food loss and waste (FLW). Each year, FLW on a global scale contributes to approximately 4.4 gigatons of greenhouse gas emissions<sup>2</sup>. In 2015, FLW issue became part of the Sustainable Development Goals (SDGs) contained in target 12.3, stating, "By 2030, halve per capita global food waste at the retail and consumer levels and reduce food losses along production and supply chains, including post-harvest losses"<sup>3</sup>. As a country that agree upon the global development agenda, Indonesia has committed to mainstreaming SDGs' goals, targets and indicators in the Medium Term National Development Plan (RPJMN) 2020-2024.

According to the data of the Ministry of Environment and Forestry (MoEF) of the Republic of Indonesia, in 2018, as much as 44% of waste generation in Indonesia was food waste<sup>4</sup>. Indonesia is also claimed to be the second largest FLW producing country in the world, reaching 300 kg per capita per year<sup>5</sup>. However, to this day, Indonesia has not arranged comprehensive information and strategies regarding FLW, especially at the national level. The FLW study in Indonesia aims to discover the FLW database and identify policies and strategies to be implemented in an effort to support low carbon development and circular economy.

### The output of this study comprises:

- 1 Estimation of FLW generation in 2000 - 2019 as well as Green House Gas (GHG) emission, economic and social impacts
- 2 Causes and drivers of FLW in five food supply chain stages
- 3 Projection of FLW generation in 2020 - 2045
- 4 Recommendations for FLW management strategies and policies in 2020 - 2045

The data collection method in this study employed mixed methods (a combination of quantitative and qualitative methods). Quantitative data collection was carried out through secondary data, waste generation survey, and questionnaire survey. Meanwhile, for qualitative, the data collection methods used are literature studies, in-depth interviews, and focus group discussions in Stakeholder Meetings. The analysis was divided into Calculation of FLW Generation, Life Cycle Assessment (LCA), Economic Loss Calculation, Nutrition Loss Calculation, Social Life Cycle Assessment (S-LCA), Analysis of Causes and Drivers of FLW Generation, and System Dynamics Analysis.

This study utilized the Food Balance Sheet (FBS) from the Food Security Agency (BKP) of the Ministry of Agriculture and Statistical Agency of Indonesia (BPS) as a reference for food commodities in Indonesia. The limitation of FLW discussed in the results of this study do not incorporate pre-harvesting food loss, FLW from processed food products but those listed in the FBS, as well as FLW that occurred during the food import-export process.

<sup>1</sup>FAO. (2011). Global food losses and food waste – Extent, causes, and prevention. Rome.

<sup>2</sup>FAO. (2015). Food wastage footprint and climate change.

<sup>3</sup>United Nations. (2020). Goals 12 Ensure sustainable consumption patterns. Retrieved from <https://sdgs.un.org/goals/goal12>

<sup>4</sup>Ministry of Environment and Forestry. (2018). *Pengelolaan Sampah Sektor Lingkungan Hidup dan Kesehatan*.

<sup>5</sup>The Economist Intelligence Unit. (2017). Fixing Food – Towards a More Sustainable Food System.

# FLW GENERATION IN INDONESIA

In the course of 2000 - 2019, FLW generation in Indonesia reached 23-48 million tons/year (Figure A), or equivalent to 115-184 kg/capita/year.

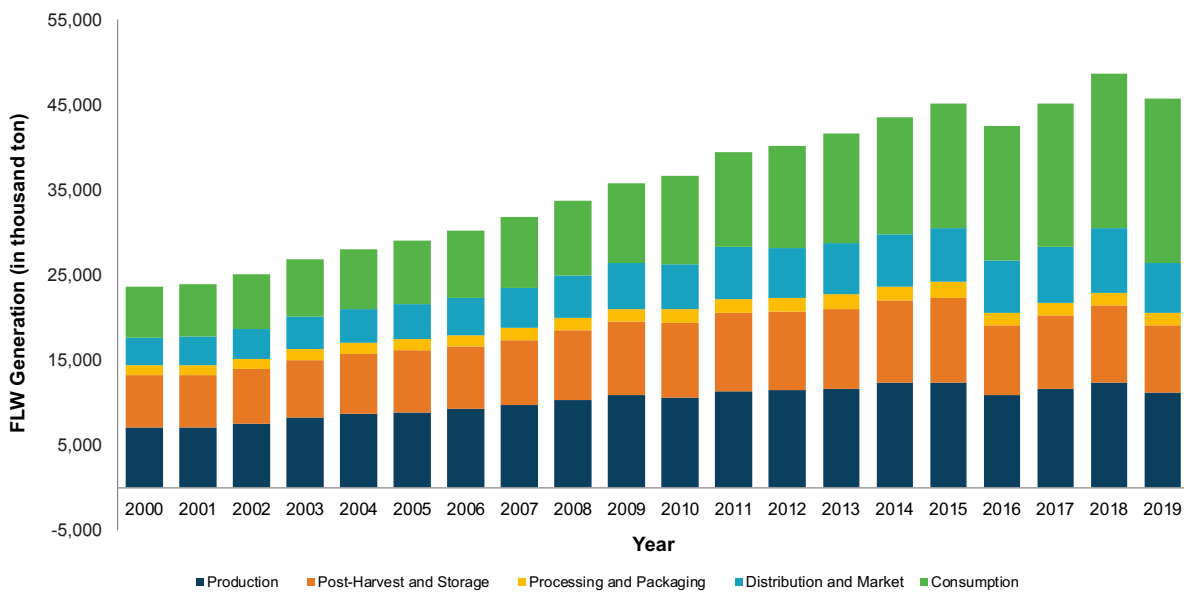


Figure A. Food Loss and Waste Generation in Indonesia from 2000 - 2019 per Food Supply Chain Stage (in thousand tons).

Food loss occurs in the first three stages, while food waste arises in the last two stages. The percentage of food loss in 20 years shows declining, from 61% in 2000 to 45% in 2019, with an average of 56%. Conversely, the percentage of food waste generation in 20 years increases, from 39% in 2000 to 55% in 2019, with an average of 44% (Figure B).

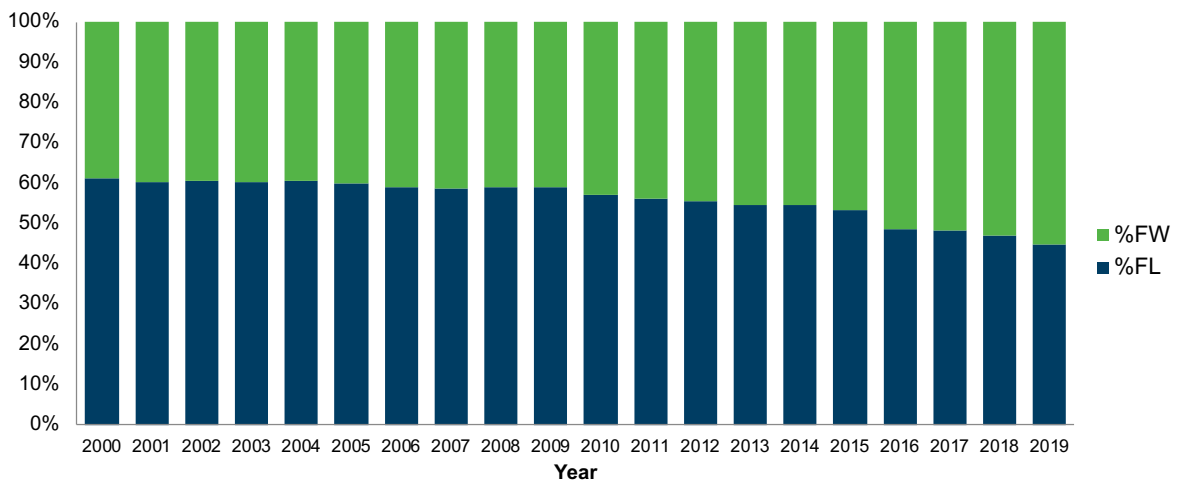


Figure B. Percentage of Food Loss (FL) and Food Waste (FW) Generation to Total FLW in 2000 - 2019.

The critical loss point in which the largest FLW generation occurs is at the consumption stage, with food waste generation of 5-19 million tons/year. In terms of food type, the largest FLW generation is contributed by the crop sector, precisely cereals, totaling 12-21 million tons/year. Meanwhile, the most inefficient type of food is the horticulture sector, especially vegetables – in which the loss reaches 62.8% of the total domestic supply of vegetables in Indonesia (Figure C).



Figure C. Proportion of FLW Generation to Total Domestic Supply 2000 - 2019 in 5 Sectors (top) and in 11 Food Categories (bottom).

## ENVIRONMENTAL IMPACT OF FLW: GREENHOUSE GAS EMISSIONS

In this study, LCA global warming potential from GHG is conducted to determine the environmental impact of FLW. The scope of LCA is from material extraction to the final stages of the life cycle neglecting land-use change, infrastructure and out-of-process activities in the supply chain, such as worker transportation, water for sanitation, and others. The FLW generation in the extended food supply chain stage will result in a larger emission load than the emission load of FLW generation in the previous stage. It emerges since the emission load in the food supply chain, which is closer to the end-of-life includes the emission load from the previous stages.

With an average emission of 2,324.24 kg CO<sub>2</sub>-eq/1 ton FLW, the total global warming potential of FLW in Indonesia over the past 20 years is reckoned at 1,702.9 Mton CO<sub>2</sub>-eq or equivalent to 7.29% average GHG emission in Indonesia over 20 years. The biggest contributor to the global warming potential for 20 years is 2018, while the biggest global warming potential among the five stages of the food supply chain is the consumption stage (Figure D). In addition, it is also found that the average emission resulting from 1 ton of food waste generation is about 4.3 times greater than the emission of 1 ton of food loss generation. The average percentage over 20 years of GHG emissions from food loss is 23%, and food waste is 77% (Figure E).

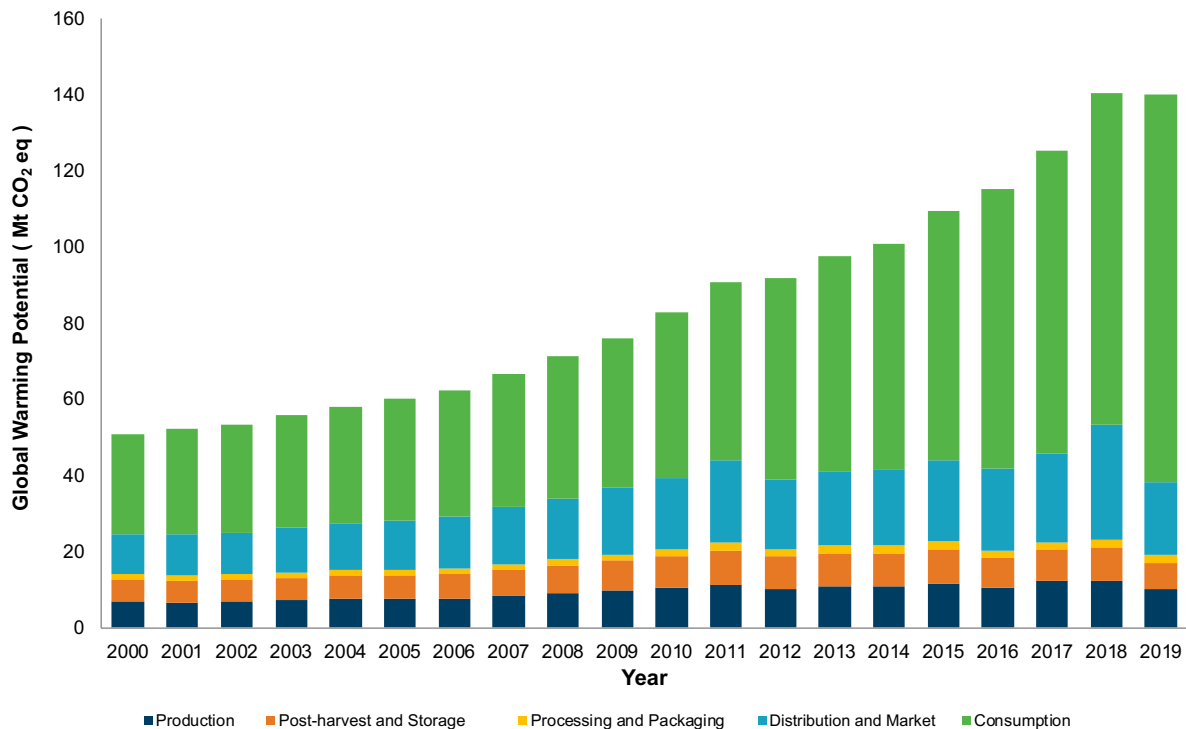


Figure D. Contribution of 5 Stages of Food Supply Chain to Total FLW-Associated GHG Emissions per Year.

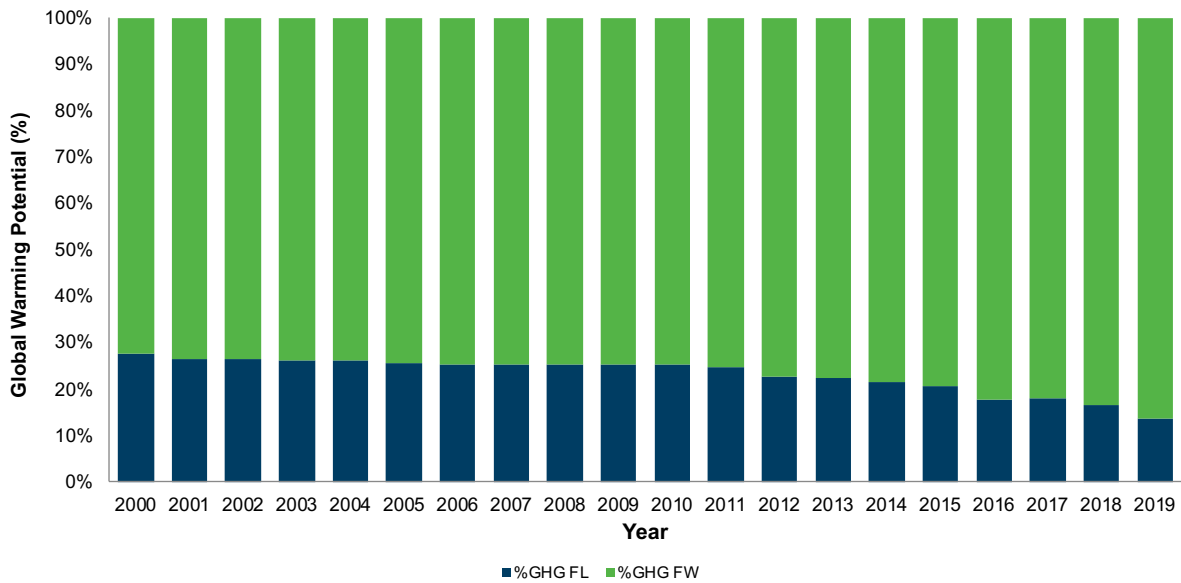


Figure E. Percentage of GHG from Food Loss (FL) and Food Waste (FW) in 2000 - 2019.

When juxtaposed with the five food commodity categories, it shows that the crops, fishery, and horticultural commodity categories are the three main emission contributors with each producing an average of around 39.67%, 22.32% and 20.21% respectively. Given analysis of the contribution per process, the biggest emission hotspot originates from the use of fertilizers and chemicals, especially from the cereals production processing, diesel combustion throughout food supply chain, diesel combustion from fishing vessels, and diesel combustion from production stage to consumption stage. Meanwhile, when various end-of-life scenarios are compared, reducing food waste generation in households is the most significant effort to reduce GHG emissions. For example, when household food waste is reduced by 5%, GHG decreases by 2.98%. Meanwhile, when reductions were carried out with the same value in food waste at hotels, restaurants, catering (HORECA) and food loss at production and post-harvest, the reduction in GHG emissions was only 0.53% and 0.6%, respectively.



# ECONOMIC IMPACT OF FLW: POTENTIAL ECONOMIC LOSS

The amount of FLW generation in Indonesia during 2000 - 2019 attained 23-48 million tons/year, which prompts the economic loss of IDR 213-551 trillion/year or equivalent to 4%-5% of Indonesia's GDP/year. There is a possibility that the potential economic loss is of greater value as the data used in calculating economic loss implements available food price data, namely 64-88 commodities out of 146 commodities contained in FBS. The food supply chain stage causing the largest economic loss is the food waste stage, with a value of IDR 107-346 trillion/year. In the scope of types of food (Figure F and Figure G), crops, particularly cereals, has the largest economic loss. However, this type has good process efficiency. Thus, the proportion of cereal wasted is smaller than the proportion of cereals consumed. Meanwhile, the economic loss value of the horticulture sector, especially vegetables, is not as large as crops, but the efficiency of the process is still not good, causing the proportion of vegetables to be wasted is very high compared to the vegetables consumed.

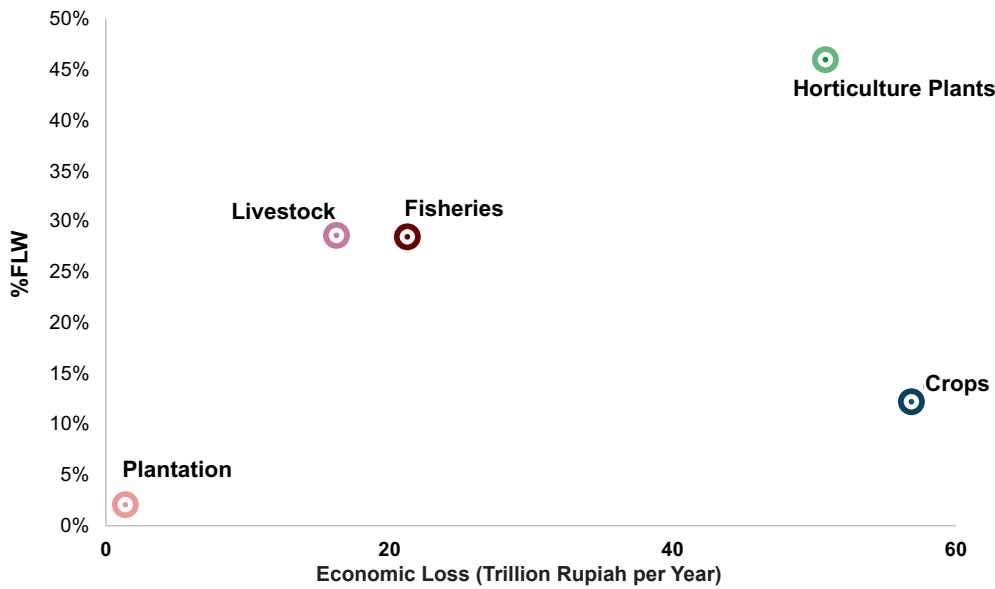


Figure F. Comparison of % FLW to Economic Loss in 5 Food Sectors.

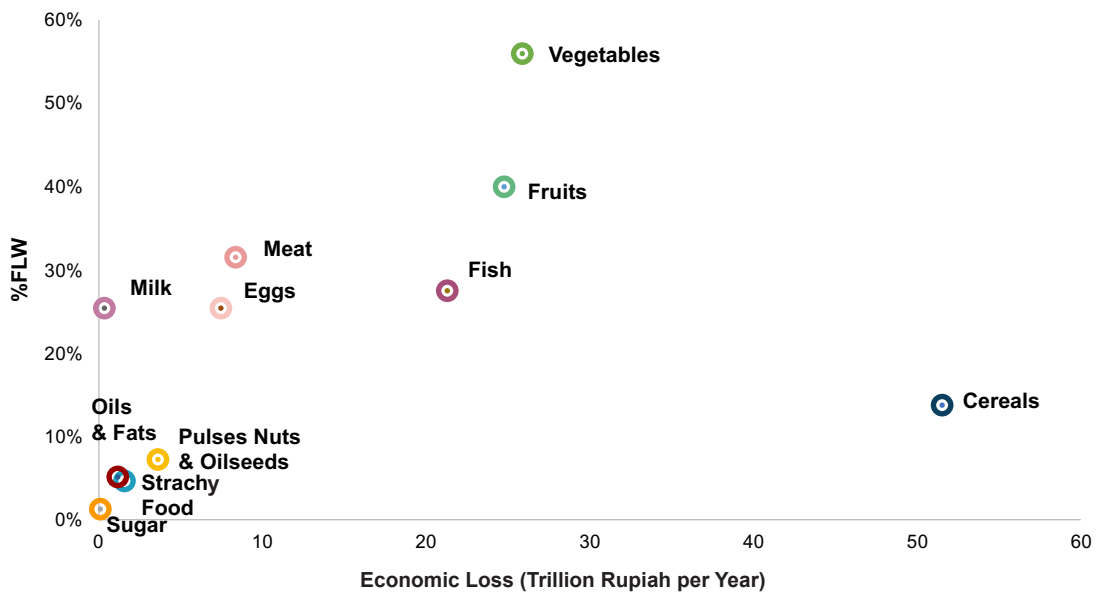


Figure G. Comparison of % FLW to Economic Loss in 11 Food Categories.

## SOCIAL IMPACT OF FLW: NUTRITION LOSS

FLW generation of 23-48 million tons/year in Indonesia from 2000 - 2019 has led to nutrition loss. This study reviews the nutrition loss in FLW especially energy, protein, vitamin A, and iron (Table A).

The energy loss is 618-989 kcal/capita/day or equivalent to the energy required by nearly 61-125 million Indonesian population (29-47% of Indonesian population). There are 45.7% of Indonesian population with energy deficiency<sup>6</sup>. This implies that 62-100% of the energy deficiency population can be fed with energy from the edible FLW.

The protein loss of FLW is 18-32 grams/capita/day or equivalent to the protein recommended to 68-149 million population on average per year (30-50% of Indonesian

population). With 36.1% of Indonesian population has protein deficiency<sup>7</sup>, it denotes that 91-100% of the protein deficiency population can be fed with the protein from edible FLW.

Vitamin A loss of FLW is 360-953 Ug RE/capita/day which is equal to the need for vitamin A of 134-441 million people per year (63-166% of Indonesian population).

The iron loss of FLW is 4-7 mg/capita/day or equivalent to the iron needs of 96-189 million people per year (46-72% of Indonesian population). With the number of iron deficiency in pregnant women reaching 40.9% of Indonesian population<sup>8</sup>, it signifies that 100% of the pregnant women population with iron deficiency can be fulfilled with edible FLW.

Table A. Nutrition Loss per Individual per Day Due to FLW Generation.

Nutrition Content	Range of FLW Nutrition Loss per individual per day	Nutrition Intake per individual per day	% Indonesian population that can be fed edible FLW	Total of Nutrition deficiency in Indonesia
Energy	618-989 kkal	2,100 kkal	29-47%	45.7%*
Protein	18-32 gr	57 gr	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). Diet Total: Survei Konsumsi Makanan Individu Indonesia.)

\*\* Ministry of Health. (2018). Basic Health Research.

<sup>6</sup>Health Research and Development Agency. (2014). Diet Total: Survei Konsumsi Makanan Individu Indonesia.

<sup>7</sup>Ibid

<sup>8</sup>Ministry of Health. (2018). Basic Health Research.

## CAUSES & DRIVERS OF FLW IN INDONESIA

In this study, 10 direct causes and 8 indirect drivers of FLW were identified in Indonesia. Based on FAO<sup>9</sup>, the factors that may cause FLW could be divided into direct causes and indirect drivers. The direct cause is the action that directly causes FLW by actors in the food supply chain. On the other hand, the indirect driver is the systemic economic, cultural, and political conditions of the food system that affect actors in the food supply chain in their operation - including affecting the FLW generation. These results were obtained according to the analysis of the results of focus group discussions, expert interviews, and practitioner interviews through weighting and the Pareto Method. Of the 18 causes and drivers, 10 are classified as "Very Important" (Table B).

Table B. Causes and Drivers of FLW in Indonesia.

Causes and Drivers of FLW in Indonesia			
Type	Very Important	Type	Medaretey Important
D	Lack of implementation of Good Handling Practice (GHP)	I	Market price
D	Insufficient quality of the storage space	I	Inefficient supply chain
I	Market quality standards and consumer preferences	D	Misinterpretation of expiry date and best before
I	Lack of information/education for food workers and consumers	D	Inadequate food preparation
D	Excess food portion and consumers behavior	I	Lack of food waste regulation
D	Technology limitations	I	Limited access to capital
I	Market competition and limited consumer purchasing power	D	Poor harvesting time
D	Poor harvesting techniques	D	Overproduction
I	Limited access to infrastructure		
D	Poor quality of packaging/container		

### Information:

D = Direct causes

I = Indirect drivers

<sup>9</sup>FAO. (2019). The State of Food and Agriculture 2019. Moving forward on food loss and waste reduction. Rome.

# MANAGEMENT STRATEGY & PROJECTION OF FLW GENERATION IN INDONESIA

The strategy for FLW management at the national level is divided into

## 5 Major Directions (Figure H)

- 1 Behavioral Change
- 2 Improving Food Support System
- 3 Strengthening Regulations & Optimizing Funding
- 4 Utilizing FLW
- 5 Development of FLW Study & Data Collection

In the establishment of strategy of FLW management in Indonesia, it prioritizes areas categorized into three: high priority, medium priority, and lower priority. This priority is determined based on hotspot for FLW generation, hotspot for causes and drivers of FLW generation, and hotspot for FLW GHG emissions. The strategy considers the implementation period which is governed according to input from the expert panel (expert judgment) on the ground of accomplishment schedule. The strategy implementation period are separated into three categories; the short term (1 year), medium term (5 years) and long term (25 years).

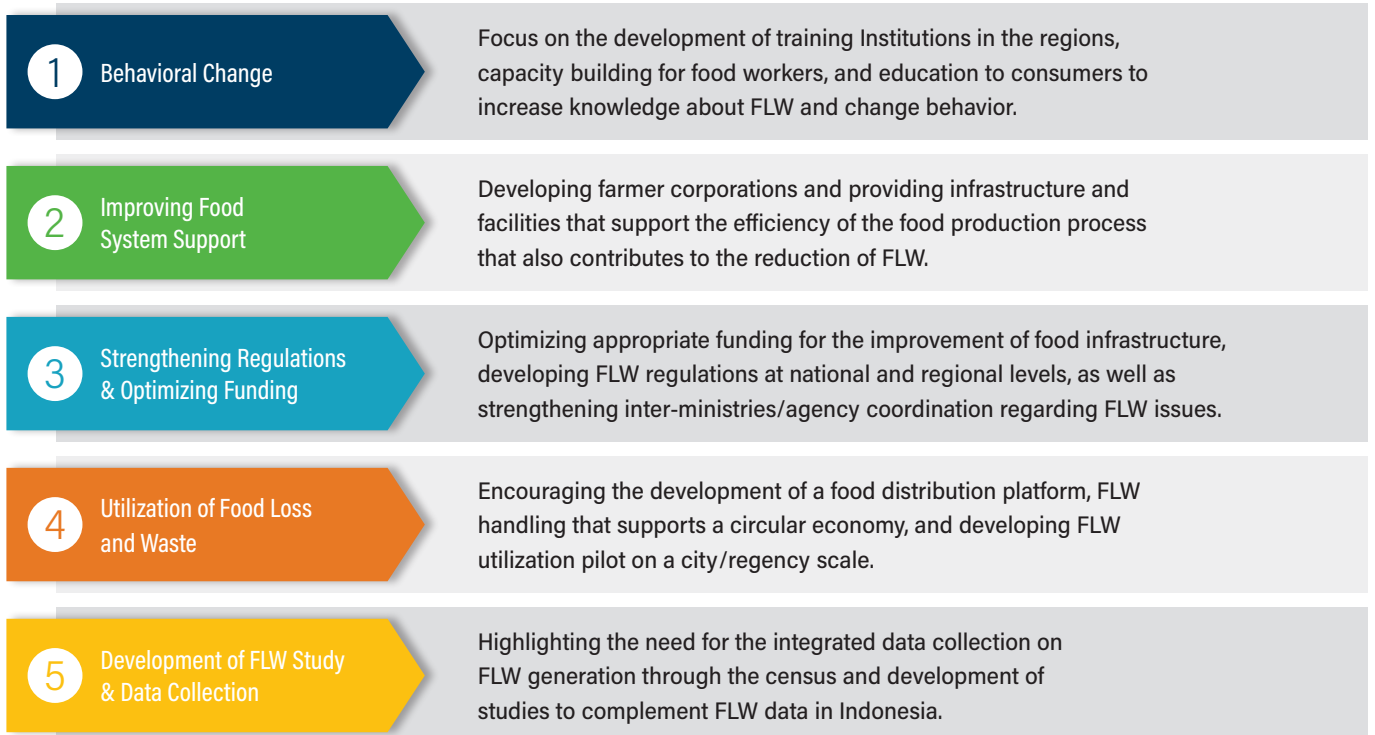


Figure H. Five Major Directions of Strategy of FLW Management in Indonesia.

To comprehend the Indonesian condition with and without a strategy for FLW management, it is necessary to conduct FLW generation projections for 2020 - 2045 using a system dynamics model with one "food" aggregate. Based on the projection of the next 25 years, without any control (Business as Usual/BAU), it is calculated that Indonesia's FLW generation in 2045 may reach 112 million tons/year or 344 kg/capita/year. Meanwhile, according to the strategy scenario, it is reckoned that FLW generation in 2045 can be confined at 49 million tons/year or 166 kg/capita/year (Figure I). The assumptions of strategy scenario formulated consist of (1) % food loss production decreases from 4.37% in 2022 to 3% in 2045, (2) food spoilage time in storage increases from 8 months in 2022 to 10 months in 2045, (3) shipping to processing delays decreased from 5 days in 2022 to 4 days in 2045, (4) % food loss in processing and packaging decreased from 1.2% in 2022 to 0.8% in 2045, (5) food spoilage time in distribution increases from 18 months in 2022 to 24 months in 2045, (6) food supply chain delays decrease from 7 days in 2022 to 4 days in 2045, and (7) food waste generation consumption is targeted to decrease as much as 35% from 2022 to 2030.

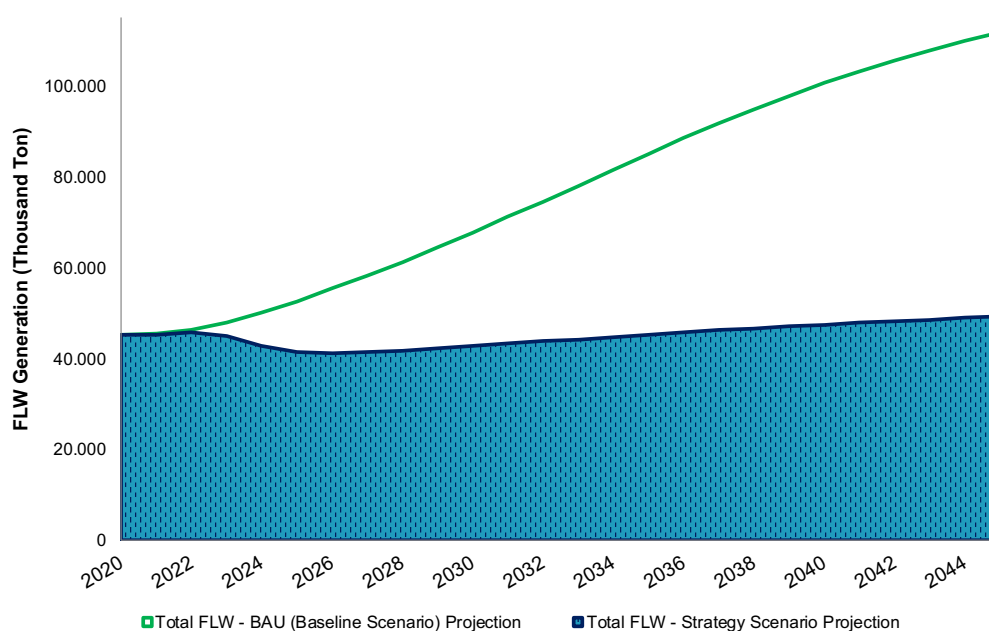


Figure I. Total FLW Generation of BAU Projection to Strategy Projection.

The percentage of FLW generation reduction in 2020 - 2045 of the strategy projection analysis is the result of the discrepancy between BAU generation scenario and strategy generation scenario to BAU generation scenario in that year (Table C). The percentage projection result of food loss generation reduction reaches 16.60% (2030) and 33.61% (2045), the percentage projection of food waste generation attains 51.25% (2030) and 68.94% (2045). From this projection, it indicates that in order to achieve the SDG 12.3 target, that is, "By 2030, halve per capita global food waste at the retail and consumer levels and reduce food losses along production and supply chains, including post-harvest and processing stages", Indonesia is required to reduce the minimum food waste generation by 2.83% per year. Meanwhile, for the total FLW with the strategy scenario composed in 2045, it is estimated that the FLW reduction can reach 55.88%.

Table C. Projection Results of % FLW generation in 2020 - 2045.

Year	FL Reduction	FW reduction	FLW reduction
2030	16.60%	51.25%	36.90%
2045	33.61%	68.94%	55.88%



**FOOD LOSS**

unhusked rice that wasted during the harvest process



**FOOD WASTE**

expired food/unsold in the store



**FOOD LOSS**

vegetables that are wasted while being transported



**FOOD WASTE**

wasted vegetables in the market



**FOOD LOSS**

fruit damaged during the distribution



**FOOD WASTE**

household waste



**FOOD LOSS**

vegetables that are wasted while being transported



**FOOD WASTE**

household waste



**FOOD LOSS**

unhusked rice wasted during the harvest process



**FOOD WASTE**

wasted food in the market



**FOOD LOSS**

unhusked rice that wasted during the packaging process



**FOOD WASTE**

household waste



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