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Food Loss and Waste Measurement Linked to the Food Loss Analysis Methodology

Executive Summary

The Sustainable Development Goal 12, (SDG 12) seeks to “ensure sustainable consumption and production patterns.” The third target under this goal (Target 12.3) *calls for halving per capita global food waste at the retail and consumer levels and reducing food losses along production and supply chains (including post-harvest losses) by 2030.*

Improving data collection on food loss and waste (FLW) is a priority for monitoring progress toward achieving the SDGs. As part of the SDG monitoring process, FAO recently published new estimates for food loss through the Food Loss Index, that indicates, globally, around 14 percent of food produced is lost from post-harvest up to, but excluding, the retail stage of the food supply chain. FAO has also carried out a number of case studies in several countries to identify critical loss points in food supply chains and has developed guidelines on the measurement of harvest and post-harvest losses for a number of commodity groups. FAO’s work to build capacities in countries to reduce food losses at critical loss points in food supply chains continues.

This paper documents FAO’s initiatives to support countries in collecting data toward monitoring progress, informing policy and actions to reduce food losses and waste, toward achieving SDG target 12.3.

Suggested action by the Regional Conference

The Regional Conference is invited to:

- discuss the importance of data collection for monitoring progress toward achieving SDG target 12.3;
- discuss current approaches toward obtaining reliable data on food loss and waste;
- discuss the importance of food loss and waste data for policy development;
- discuss the types of public policies and programmes that can address food loss and waste reduction;

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- share suggestions for building strategic partnerships involving the private sector, civil society, producer and youth organizations, South-South triangular cooperation and development partners to sustainably reduce food loss and waste;
- encourage countries to set targets on FLW reduction.

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Introduction

1. On 25 September 2015, the 193 Member States of the United Nations (UN) adopted the *2030 Agenda* for Sustainable Development with 17 Sustainable Development Goals (SDGs) that have 169 targets. The 2030 Agenda has set a global target for food loss and waste reduction. The Sustainable Development Goal 12, (SDG 12) seeks to “ensure sustainable consumption and production patterns.” The third target under this goal (Target 12.3) calls for halving per capita global food waste at the retail and consumer levels and reducing food losses along production and supply chains (including post-harvest losses) by 2030.
2. Tackling the food loss and waste challenge, toward meeting the SDG 12.3 target, can bring about benefits for society as a whole by improving food security and nutrition (SDG 2), reducing greenhouse gas (GHG) emissions (SDG 13), lowering pressure on water (SDG 14) and land (SDG 15) resources and can increase productivity and economic growth (SDG 8).
3. Moving ahead toward implementing effective actions to reduce food loss and waste, however, necessitates better information than currently available on how much and where food is lost or wasted. These data will be key, as interventions to reduce food loss and waste require an understanding of where in the food supply chain, for which products, and in which regions or countries food loss and waste occurs. Data should also indicate the magnitude of the losses and waste as well as their underlying causes and drivers. It therefore follows that FAO’s work on measurement and actions to reduce food loss and waste is critical to tracking progress made by countries.
4. This paper documents FAO’s initiatives to support countries in collecting data toward monitoring progress, informing policy and actions to reduce food losses and waste, toward meeting SDG target 12.3.

Food Loss and Waste and their Causes

5. Food production in itself represents a significant investment of our limited natural resources, including water, soil and energy, as well as labor and time. It also involves emitting GHGs throughout the various steps of the food supply chain thus contributing to global warming. Losing and wasting food that has been produced means that GHGs have been emitted and natural resources wasted to no purpose. Furthermore, food losses and waste reduces the efficiency and sustainability of the food system and can negatively impact food security and nutrition.
6. Food losses are related to food suppliers’ decisions and activities from agricultural production up to, but not including, the retail stage (Box 1). In the case of grains, for example, this includes harvesting, field drying, threshing, drying, de-hulling or shelling, farm level storage, transport to and storage at the wholesale or bulk storage level and milling. Equivalent activities for perishable fruits and vegetables, meat, milk and fish in moving the commodity from field (or landing site) to the market are fewer in number and supply chains are often shorter due to the need for the fresh food items to reach consumers in a shorter time before the products deteriorate to such an extent that they cannot be sold. Food supply chains may also include processing and transport to retail.

BOX 1 DEFINITIONS RELATED TO FOOD LOSS AND WASTE

- ▶ **Food** refers to any substance, whether processed, semi-processed or raw, intended for human consumption. It includes drink, chewing gum and any substance used in the manufacture, preparation or treatment of food but does not include cosmetics, tobacco or substances used only as drugs.⁵ Food products can be of animal or plant origin and are considered food from the moment that: (i) crops are harvest-mature or suitable for their purpose; (ii) animals are ready for slaughter; (iii) milk is drawn from the udder; (iv) eggs are laid by a bird; (v) aquaculture fish is mature in the pond; and (vi) wild fish are caught with fishing gear.
- ▶ **The food supply chain** consists of the following segments: (i) agricultural production and harvest/slaughter/catch; (ii) post-harvest/slaughter/catch operations; (iii) storage; (iv) transportation; (v) processing; (vi) wholesale and retail; and (vii) consumption by households and food services. Agricultural production, harvest and post-harvest/slaughter/catch operations refer to activities where produce is still on the farm or the producer's premises. Post-harvest/slaughter/catch operations include cleaning, grading, sorting and treatments (e.g. for disinfestation on the farm or in a packing facility). Processing includes primary processing operations (e.g. drying, dehusking, deshelling), which often take place on the farm and secondary processing (product transformation). The moment food is consumed or removed from the food supply chain defines the end point of that chain.
- ▶ **A food system** gathers all the elements (environment, people, inputs, processes, infrastructures, institutions, etc.) and activities that relate to the production, processing, distribution, preparation and consumption of food along with the outputs of these activities, including socio-economic and environmental outcomes.⁶
- ▶ **Food loss** is the decrease in the quantity or quality of food resulting from decisions and actions by food suppliers in the chain, excluding retail, food service providers and consumers.
- ▶ **Food waste** is the decrease in the quantity or quality of food resulting from decisions and actions by retailers, food services and consumers.
- ▶ **Quantitative food loss and waste** (also referred to as physical food loss and waste) is the decrease in the mass of food destined for human consumption as it is removed from the food supply chain. As such, quantitative food loss refers to the decrease in the mass of food destined for human consumption from decisions and actions by food suppliers in the chain. Quantitative food waste is the physical decrease in food mass resulting from decisions and actions by retailers, food services and consumers.
- ▶ **Qualitative food loss and waste** refers to the decrease in food attributes that reduces its value in terms of intended use. It can result in reduced nutritional value (e.g. smaller amounts of vitamin C in bruised fruits) and/or the economic value of food because of non-compliance with quality standards. A reduction in quality may result in unsafe food, presenting risks to consumer health. Qualitative food loss refers to the decrease in food attributes that reduces the value of food in terms of its intended use – it results from decisions and actions by food suppliers in the chain. Qualitative food waste is the same but results from actions by retailers, food services and consumers.

7. Food losses tend to be more significant for fruits and vegetables than for cereals and pulses, especially in situations where cold storage or processing conditions are inadequate. In lower-income countries, more fresh fruit and vegetable loss is attributed to poor infrastructure than in industrialized countries. In fact, many lower-income countries lose significant amounts of food during storage, often due to poor storage facilities, including refrigerated warehouses. Other causes of food loss include the poor functioning of supply chains due to limited technical capacity, poor production and

- handling practices, coupled with inadequate institutional and legal framework and climatic conditions of high temperatures and high humidity under which many of these food supply chain activities operate. These conditions lead to reduction in quantities and quality of foods available to consumers with impacts on food security and nutrition, as well as farmers' incomes.
8. The causes of food waste at the retail level are linked to product shelf life, the failure of food products to meet aesthetic standards in terms of colour, shape, and size and variability in demand, particularly for fresh produce. Waste at the consumer level is often caused by poor purchase practices and meal planning, excess buying influenced by large portion size, confusion over labels (best before and use by) and poor storage.

The Food Loss Index and the Role of FAO

9. FAO in 2011 provided a broad preliminary estimate which suggested that approximately 1/3 or 30 percent of the world's food was lost or wasted every year. This estimate raised considerable awareness of the issues. However, in order to provide greater clarity on the issues, this is currently in the process of being replaced with two separate indicators: the Food Loss Index and the Food Waste Index. The Food Loss Index (FLI) was designed and is being calculated by FAO. It provides new estimates for part of the supply chain from post-harvest up to (but not including) retail. The Food Waste Index, covering waste by consumers and retailers, is being developed by the UN Environment Programme (UNEP), but the first estimates are yet to be released.
10. FAO's work on measurement is critical to tracking progress on reducing food losses against the Food Loss Index. The initial estimates of the FLI tell us that 14 percent of the world's food is lost from production before reaching the retail level. Estimated levels of losses vary across regions and groups of commodities. At the regional level, estimates range from 5-6 percent in Australia and New Zealand to 20-21 percent in Central and Southern Asia. In terms of groups of products, roots, tubers and oil-bearing crops report the highest levels of loss, followed by fruits and vegetables. It is not surprising that fruits and vegetables incur high levels of loss given their highly perishable nature. As for roots, tubers and oil-bearing crops, results are mainly driven by cassava and potato losses, given the significant amount of data reported for these commodities, and their relatively high level of perishability.
11. Surprisingly little is actually known about the magnitude of food loss and waste. The SDG monitoring framework is expected to contribute to bridging this knowledge gap through enhanced efforts to collect data that enable estimation of total food loss and waste at the highest possible disaggregated levels. Toward that end, FAO has developed a comprehensive methodology with guidelines for data collection for various food groups, based on pilots implemented in selected countries. The guidelines are complemented by questionnaires that can be adapted to the needs of specific countries or existing surveys.
12. These efforts address the challenges behind the persistent and dire data scarcity, despite the fact that post-harvest loss reduction was high on the UN development agenda as early as the 1970s. In particular, it seeks to address the lack of an internationally agreed

definition of food losses and of guidelines on cost-effective methods to reduce the complexity and cost of data collection. To this end, FAO has worked to consolidate definitions, both with external partners and through internal consultations, and has agreed on definitions of food loss and waste from several perspectives. It has also developed guidelines that offer cost-effective statistical methods and are complemented by field test reports providing practical experience and solutions for specific contexts.

The state of global knowledge on Food Loss Data

13. One challenge in developing the Food Loss Index is that of moving beyond a single global estimate, toward an information base that can be relevant for decision-making within countries on policies and investments. To this end, FAO has conducted a major meta-analysis synthesizing the results of a large number of existing studies that report on the measurement of food loss and waste in countries all over the world and have shared this online. The purpose of this exercise was to supplement available official data, which still covers only 7 percent of the total possible combinations of countries and commodities, with information from more than 480 publications and reports from various sources (governments, universities, and international governmental and non-governmental organizations, etc.). Work to further improve analysis of existing data is ongoing, along with efforts to improve collection of information in supply chains through surveys and other means.
14. The meta-analysis illustrates how food loss and waste varies across and within stages in the food supply chain, regions and commodity groups. This information is available and can be accessed in the online “Food Loss and Waste” database, the largest online interactive collection of data with more than 20 thousand data points. Data can be queried, downloaded, and plotted in an interactive and structured way. The database can be used by anyone who wishes to know more about food losses and waste.

Identifying critical loss points and their Underlying Causes

15. The FAO Case Study Methodology for Food Loss Analysis in Food Supply Chains (FLA methodology) is designed to promote a widespread understanding of the major causes of food losses, the losses that are most important in specific supply chains, and the likely impact of potential solutions with respect to their technical and economic feasibility, food quality and safety requirements, social acceptability and environmental sustainability.
16. The FLA methodology also provides a useful tool for identifying critical loss points in a systematic and comparable manner and allows for the identification of trends and common solutions. The methodology is also designed to complement national analyses. It has, so far, been effective in directing attention to the food loss situation in a range of countries

Critical loss points are the points along the food supply chain where food losses have the highest magnitude, the greatest impact on food security and the largest economic dimensions.

Source: SOFA 2019

and commodities by several stakeholders. In some cases, governments, with the support of donors, have moved on to pilot the implementation of the recommended interventions to generate evidence about their impact on losses and economic returns. Since 2015, FAO's Global Initiative on Food Loss and Waste (Save Food) has carried out a number of case studies in almost 30 countries to identify critical loss points for crops, milk and fish produced by smallholders.

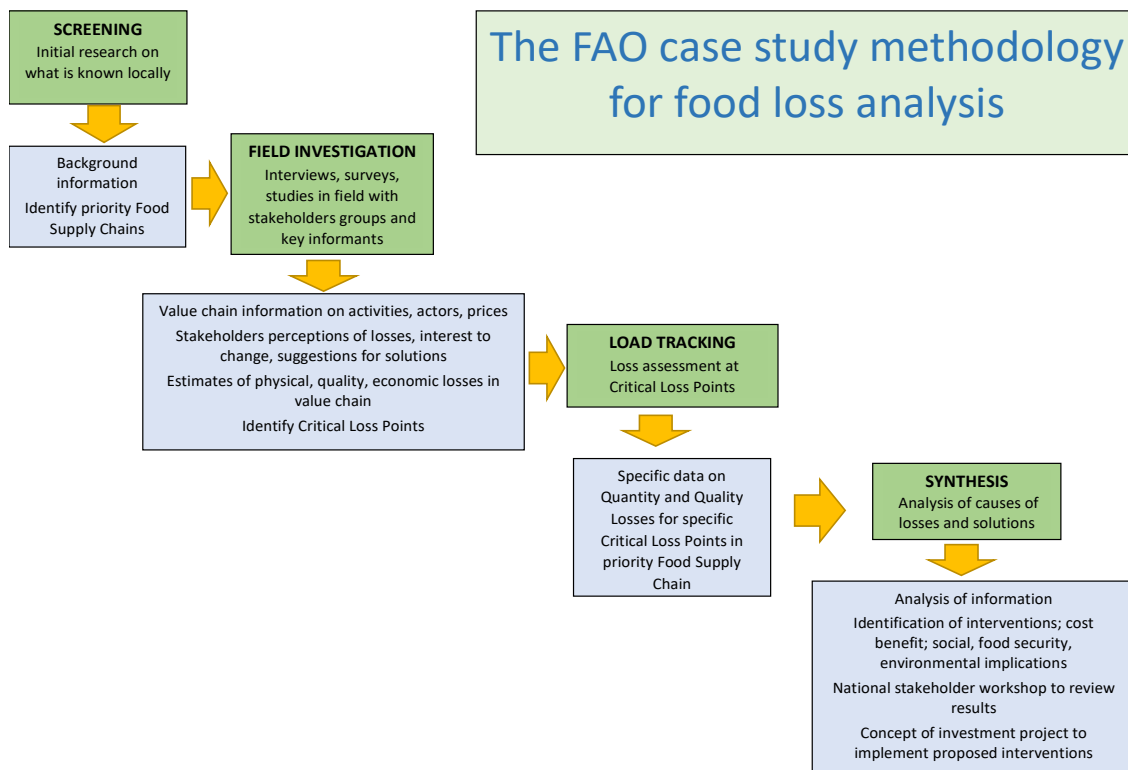
17. Findings to date suggest that harvesting is a common critical loss point for all commodities (identified in over 70 percent of case studies). Indeed, for grains and legumes, critical loss points were consistently found during harvesting and on-farm storage, particularly in African countries, regardless of location or climate. Likewise, for fruits, roots and tubers, harvesting appears to be a critical loss point along with packing (handling, and treatment operations) and transportation. For fruits, most reported causes relate to the stage of maturity, timing and scheduling; poor handling and harvesting methods; adverse climatic conditions; and attacks by pests, insects and effects of diseases. These findings are useful in targeting interventions to reduce losses as they suggest the need for great attention to the timing and methods of harvesting. Farmers need training to identify maturity indices, to improve their timing of harvest and to protect crops from weather shocks, pests, insects and diseases. Critical loss points in fruit and vegetable supply chains have also been identified in a number of Asian countries, and actions are being taken to address the reduction of losses at these points (Box 2).

Box 2. Case of critical loss points in the mango supply chain in the Philippines

In the framework of a partnership with the University of the Philippines, Los Banos, FAO has supported work to build an evidence base on the critical loss points and their underlying causes in the mango supply chain in the Philippines as a basis for reducing losses. Cuts and punctures (1%) and mechanical damage due to compression (1.9%), abrasion (2.8%), bruising (2.0%) and marking from the bamboo basket in which mangoes were transported (3.8%) were identified as the main cause of loss in mangoes on arrival in wholesale markets. The proportion of mangoes showing mechanical damage over time in retail, increased to 90% over 5 days, resulting in decay and significant economic loss. Transportation, was, therefore the critical loss point in the supply chain, with poor and inadequate packaging as the underlying cause. With the introduction of plastic crates for the transportation of the mangoes, in lieu of bamboo baskets, the level of compression damage to mangoes was significantly reduced during transportation, with better quality mangoes arriving in wholesale markets. The quality and shelf life of the mangoes in retail was also maintained. Thus by identifying and addressing the underlying cause of losses during transportation, the critical loss point, not only was loss in the supply chain reduced, but the level of waste in retail was also reduced with the derivation of greater economic benefit owing to better quality and shelf-life. From an environmental standpoint, the benefits of reducing food loss and waste in terms of land and water use, as well as reduced GHG emissions, will have to be weighed against the environmental impact of creating more plastic waste (FAO, 2019).

Source: UPLB Report prepared for FAO in the Framework of a Letter of Agreement (LoA).

18. The identification of critical loss points and the major causes of losses are also elements of the preliminary work required to compile the Food Loss Index and to monitor losses at the subnational, national and global levels. Food Loss Assessments can help in focusing data collection efforts and with the identification of policy-relevant questions to be included in questionnaires for further impact assessment estimations.



Policy Relevance of FLW Data

19. Food loss and waste reduction should be seen not only as a goal in its own right but also as a means toward achieving other objectives. The formulation of effective policies towards food loss and waste reduction requires comprehensive information as to how much and where, both geographically and along the supply chain, various foods are lost or wasted. The current lack of comparable and reliable information, however constitutes a major obstacle to the development of effectively targeted policies to reduce food losses or waste.
20. Clearly, public interventions should focus on providing public goods and/or reducing negative externalities associated with food loss and waste. Two fundamental objectives generally underlie public policies for reducing food loss and waste: improved food security and nutrition, and environmental sustainability.
18. Clarity about the objective(s) being pursued is essential for identifying the most appropriate policies and entry points for reducing food loss and waste. A focus on food security will tend to favour interventions early in the food supply chain, where positive food security impacts will be felt throughout the rest of the supply chain. To increase resource-use efficiency and move closer to reaching environmental objectives, food loss and waste reduction needs to take place after the environmental impact has occurred. Finally, where in the world reductions occur matters when pursuing food security and nutrition or environmental objectives, the only exception being a decline in GHG emissions which has the same impact on climate change wherever it occurs.
19. Different countries may have different objectives to guide their choices. Low-income countries will likely focus on improving food security and nutrition, in addition to the sustainable management of land and water resources. This calls for a focus on reducing food loss and waste early in the supply chain, including at farm level, and in traditional supply chains where impacts will be the greatest and losses tend to be the highest. Policy options to increase supply chain efficiency might, for example, include incentives to support the adoption of technologies and innovations to improve handling and reduce losses, or to enhance resource efficiency.
20. Industrialized countries with lower levels of food insecurity and malnutrition will likely place the emphasis on environmental objectives, in particular reducing GHG emissions. This calls for interventions later in the supply chain, such as adjusting marketing standards for fresh fruits and vegetables, clarification of food labeling issues such as *best before and use-by dates*, and tax exemptions to facilitate food donations. There may be trade-offs between objectives, and choices may have to be made about which objectives to prioritize.
21. Awareness must be raised, targets must be set by countries and capacities must be built in order to facilitate countries to measure and take appropriate action toward reducing food loss and waste. The development of partnerships between private and public stakeholders, both nationally and internationally to facilitate joint investments with short, medium and long-term returns for all food system actors, is also critical. Improving statistics on food loss and waste will go a long way toward supporting the development of effective policies to reduce food loss and waste.