



Reducing Food Loss and Waste

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SUMMARY Reducing food loss and waste can contribute to food security and sustainability. Measuring food loss and waste, identifying where in the food system it occurs, and developing effective policies along the value chain are essential first steps toward addressing the problem.

ON THE WAY FROM FIELD TO FORK, SUBSTANTIAL FOOD LOSS AND waste is common, posing a challenge to both food security and sustainability. Growing demand for food, stemming from both population growth and dietary changes associated with increasing wealth, is creating pressure on the world's available land and scarce natural resources and contributing to greenhouse gas emissions. Food loss and waste compound this pressure. The overall productivity of our food system is reduced by food loss and waste, which can result in lower incomes for food producers and higher costs for food consumers. Much of the burden falls on the poor.

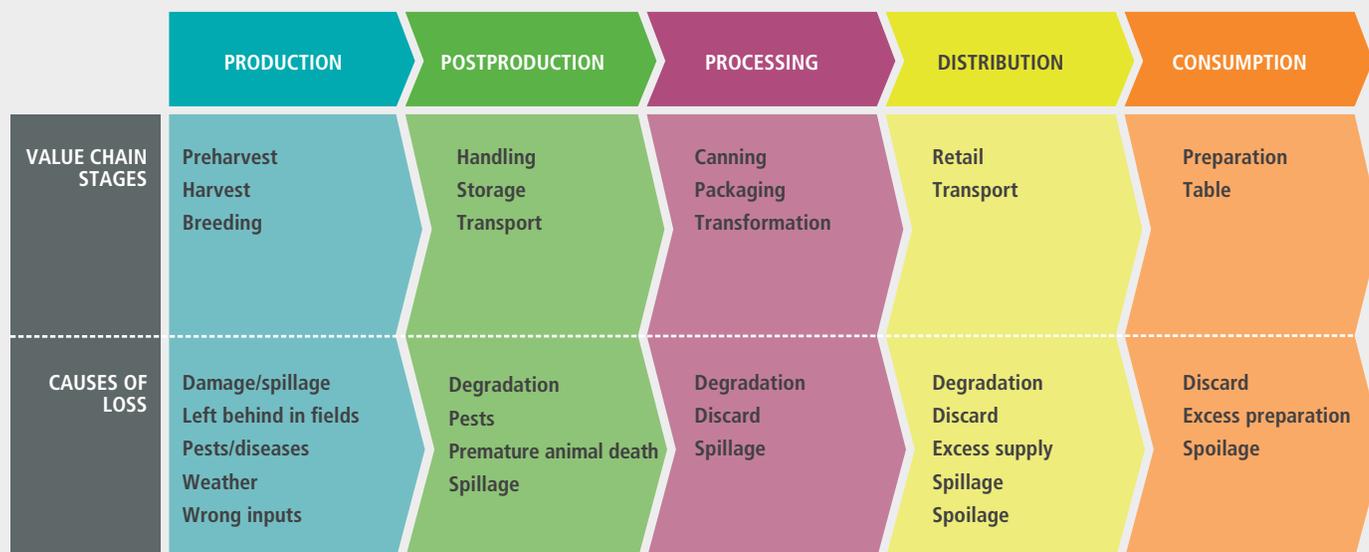
Food loss and food waste have recently caught the attention of both researchers and policymakers, and sparked interest in initiatives to understand and reduce their impacts. As policymakers look to achieve the Sustainable Development Goals (SDGs) and the climate change commitments of 2015, reducing food loss and waste may provide an efficient means to improve food security and sustainability.

Food loss and waste occur at different places along the food value chain: in production, postproduction procedures, processing, distribution, and consumption.¹ [Figure 1](#) shows the stages of the value chain at which food loss may occur, as well as the types of loss likely at each stage. These vary with different commodities and geographical locations. However, loss and waste are commonly the result of underlying inefficient, unjust, and unsustainable food systems.²

By reducing food loss and waste, we can improve food availability and food access—increasing the productivity of the food system without increasing agricultural inputs, the use of scarce natural resources, or the application of

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FIGURE 1 Food losses along the value chain



Source: Authors.

improved production technologies. However, success stories of reducing food waste and food loss are rare, and measurements of food loss and food waste remain highly inconsistent.³

DEFINITIONS OF FOOD LOSS AND WASTE

Food loss and waste have been defined in many ways, and disagreement remains over proper terminology.⁴ Although the terms “postharvest loss,” “food loss,” “food waste,” and “food loss and waste” are frequently used interchangeably, they do not refer consistently to the same aspects of the problem.⁵ Also, none of these classifications includes preharvest losses, such as crops lost to pests and diseases before harvest, crops left in the field, crops lost as a result of poor harvesting techniques or sharp price drops, or food that was not produced because of a lack of proper agricultural inputs and technology. To incorporate loss and waste along all stages of the value chain, from preharvest to table waste, we propose a more expansive definition using a new term: “potential food loss and waste” (PFLW), which includes these

important preharvest losses and unrealized potential production (Figure 2).

DIFFERING METHODOLOGIES

Differences in definitions of food loss and food waste can affect the methodologies used to measure and interpret loss.⁶ Two estimation methodologies have been used to study food loss and waste. The macro approach, which uses aggregated data from national or local authorities and large companies, provides a low-cost way to measure overall food loss and waste along an entire value chain. The drawbacks to this approach include its lack of representative and good-quality data, particularly for low- and middle-income countries and for specific stages of the value chain, including primary production, processing, and retail.⁷

The micro approach uses data on specific actors at different value chain stages. These data are highly specific to region and context, and thus more useful for disentangling the origins of food loss and waste along the value chain and providing insights

into potential prevention strategies. However, the micro approach is costly and time consuming to implement, and hampered by the inherent difficulty of collecting sufficient responses to represent an entire value chain or region. In addition, results from micro-level studies are often difficult to compare because the studies are adapted to specific objectives and stages of the value chain, and use different data collection and estimation methodologies. Neither the macro nor the micro approach calculates PFLW—clearly presenting an area where measurement of food loss and waste needs improvement.

WHAT IS NEEDED?

Our lack of clear knowledge about the real magnitude of food loss and waste is a major barrier to

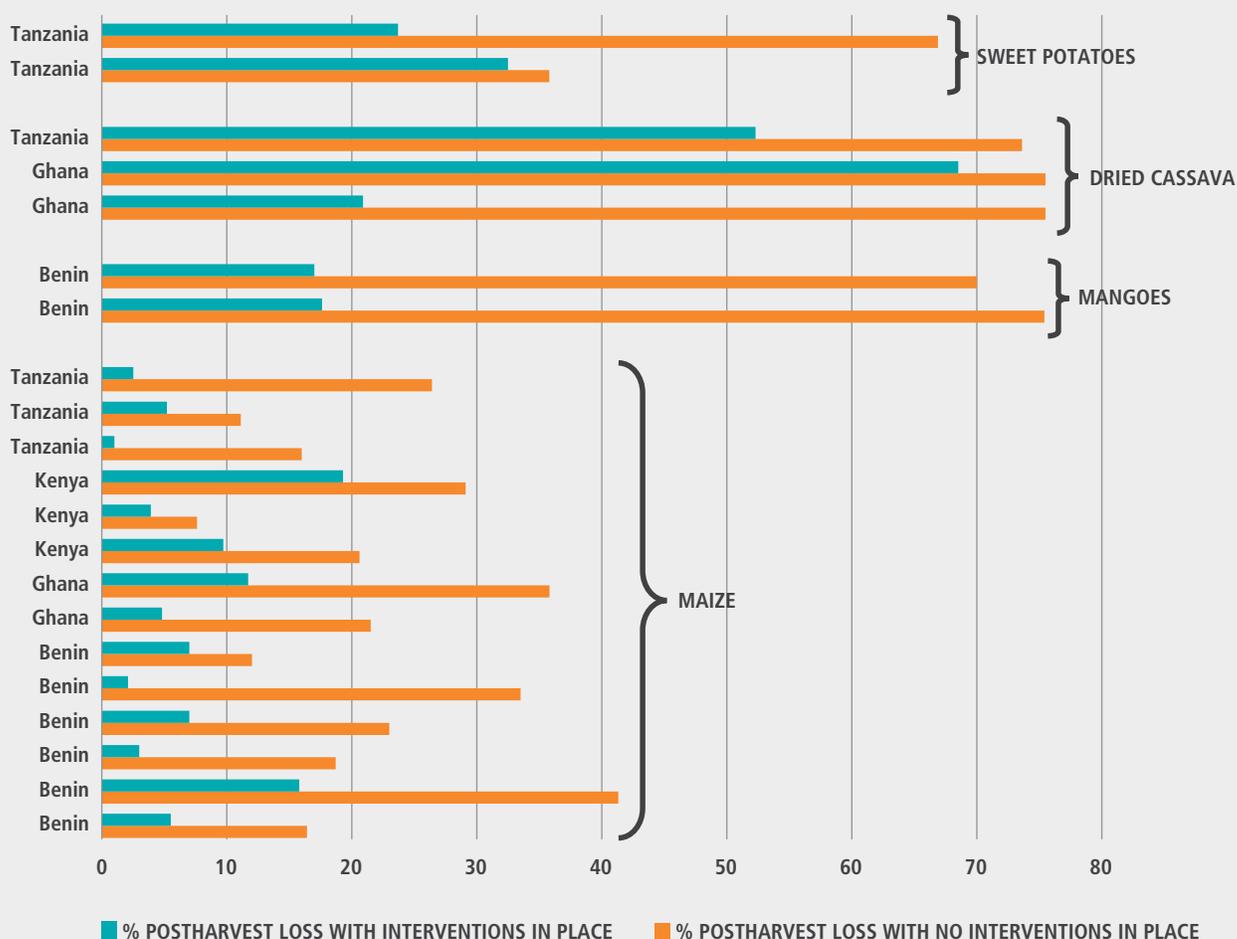
addressing the problem.⁸ Estimates of global magnitudes vary widely. An overview of recent studies on global food loss and waste magnitudes shows a range from 27 percent to 32 percent of all food produced in the world. Moreover, there are significant differences across studies at the commodity level.⁹ According to the Food and Agriculture Organization of the United Nations (FAO), cereal losses are estimated at 19–32 percent, root and tuber losses at 33–60 percent, and fruit and vegetable losses at 37–55 percent.¹⁰ A review of 213 papers on Africa south of the Sahara identified large differences in estimates attributable not only to the choice of methodology, but also to such factors as agroecological conditions, technology, and socioeconomic contexts affecting both production and postproduction (Figure 3).¹¹ Standardized estimation methods are clearly necessary. But these alone will not be

FIGURE 2 Food loss and waste terminology



Source: Authors.

FIGURE 3 Range of postharvest loss estimates by commodity from various studies in Africa



Source: Authors' interpretation based on H. Affognon, C. Mutungia, P. Sangingac, and C. Borgemeistera, "Unpacking Postharvest Losses in Sub-Saharan Africa: A Meta-Analysis," *World Development* 66 (2014): 49–68.

Notes: Each pair of bars represents a separate study of postharvest food loss and waste for a particular commodity.

be sufficient to identify the underlying causes and potential solutions to food loss and waste, and especially to PFLW, or to monitor specific progress on reduction targets.

As discussed above, a standard definition and terminology for food loss and waste is crucial. To be most useful, the definition should adopt a value chain approach and include preharvest losses. Rooted in this definition, goals for reducing food loss and waste must include both quantitative and

qualitative criteria, measurable in economic, caloric, or quality-adjusted weight terms.

In addition, assessments must identify loss and waste occurring at particular value chain stages, not just the overall loss. PFLW measurement must also take into account that food loss and waste often originate at different stages along the value chain in different geographical locations.¹²

Estimation methods used for low- and middle-income countries should differ from those used in high-income countries because of data availability.

The methodology for developing countries should measure food reductions at different stages of the value chain and should be applicable across crops and regions. Representative surveys of farmers, middlemen, wholesale buyers, and processors will allow for the characterization of inputs, harvesting, storage, handling, and processing practices for each of these agents, as well as for the estimation of product quantities, quality, and prices along the value chain. As a basis for estimating PFLW, the methodology should use the highest *potential* production level (the “production possibility frontier”) for a particular commodity and a specific region, expressed in either quantities or equivalent prices. Using potential, rather than actual, production guarantees the inclusion of losses relative to potential yield, preharvest losses, and harvest losses in the food loss calculation. By expressing the loss in terms of quantity or price, the methodology differentiates between losses in physical quantities and reductions in quality and value.

In developed countries, detailed data on food loss and waste in the processing, distribution, wholesale, and retail stages are often tracked by companies but not made available to researchers and policymakers. Transparency should be encouraged in order to systematize data collection and to increase access to reliable food loss and waste information. The methodology must capture both quantitative and qualitative food loss, as well as discretionary food waste in the processing, large distribution, and retail sectors. Food service waste and household waste are more challenging to capture—data will need to be collected on representative samples using a variety of methods (such as waste composition analysis, questionnaires, interviews, or waste diaries).¹³

WHAT HAS BEEN DONE SO FAR?

The issue of food loss and waste is high on the political agenda in industrialized countries, and food waste is likely to become an increasing problem in developing countries as standards of living improve. In 2015, the G20 agriculture ministers noted “with great concern the significant extent of food loss and waste throughout food value chains,” describing it as “a global problem of enormous economic,

environmental and societal significance.”²¹ Several initiatives to reduce food loss and waste have been undertaken by international organizations and research institutes, national and local governments, civil society actors, and retailers.

International organizations and research institutes

The Global Initiative on Food Loss and Waste Reduction (also known as SAVE FOOD), launched

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jointly by the FAO and the private sector trade-fair organizer Messe Düsseldorf in 2011, is probably the largest worldwide initiative to fight food loss and waste. The initiative is built on four pillars: research and assessment; support for evidence-based policies; awareness raising (such as “Think.Eat.Save”); and coordination of global initiatives, including collaboration with donors, national governments, the private sector, and other international organizations such as the Organisation for Economic Co-operation and Development (OECD) and the European Commission. The OECD’s Food Chain Analysis Network dedicated its fourth annual meeting in 2013 to the issue of reducing food waste, and the European Commission currently co-funds two initiatives: one aimed at reducing food waste in Europe (FUSIONS) and one aimed at estimating food loss in Africa south of the Sahara (APHLIS). The Natural Resources Institute and the Global Strategy to Improve Agricultural and Rural Statistics implement cost-effective methods to quantify

BOX 1 Case studies of food loss—Kenya and Nigeria

Food loss and waste occur at different points along the value chain, depending on the particular food crop and the particular context. A study in Kenya that looked at potatoes—an important food crop primarily cultivated by smallholders—found a variety of production factors causing loss and waste along the value chain, including poor land preparation and soil management, and ineffective pest and disease control.¹⁴ Losses also occur throughout the postharvest stages. Using a methodology to measure postharvest losses, the authors found that up to 95 percent of recorded damage and loss in the Kenyan potato value chain occurs at the production level, where diseases, the use of inappropriate harvesting tools, and an insufficiently trained workforce play a major role.

Another study, looking at the major production constraints in potato-producing areas of Kenya, has identified bacterial

wilt as the most common disease.¹⁵ Its prevalence is partly attributable to use of seeds from informal sources (because of the high cost of certified seeds) and to inadequate rotation of crops.¹⁶ Both of these factors tend to accelerate the spread of seed-borne diseases which, compounded by the lack of effective control methods, make bacterial wilt a major constraint for small-scale potato farmers. Potential solutions include suitable crop rotation (growing potatoes once every four seasons) and removal of volunteer potatoes (tubers left in the soil following a commercial potato harvest, which create a serious weed problem).¹⁷

A study of the cassava value chain in Nigeria used survey information collected from farmers, marketers, and processors to estimate losses.¹⁸ Local farmers and agroprocessing companies produce cassava; farmers, middlemen (mostly

women), and agroprocessing companies perform postharvest handling and processing activities to turn the cassava into *gari* for human consumption and starch for use by the food and beverage industry; and finally, middlemen and agroprocessing companies market and trade the cassava. In contrast to Kenya's potato value chain, in the Nigerian cassava value chain major losses occur postharvest, during *gari* and starch processing, rather than during production (Figure 4). This is consistent with a wider study that looked at losses of cassava in Ghana, Nigeria, and Vietnam, and found that a shortage of peeling capacity led to processing delays that caused losses.¹⁹ A shift to mechanical peeling would help to tackle this problem. Although efforts to date have made limited progress, it is estimated that improvements in processing could lower losses by about 44 percent.²⁰

FIGURE 4 Losses in the Nigerian cassava value chain

VALUE CHAIN STAGES	INPUT-SUPPLY	ON-FARM PRODUCTION	POSTHARVEST HANDLING	PRIMARY PROCESSING	MARKETING	CONSUMPTION
PRODUCTS	Cassava Tubers		Gari, Chips, Starch, Flour			Food Products
CAUSES OF LOSS	Farm 8.5%		Gari Processing 14.8%		Starch Factory 11.8%	Gari Market 9.5%
	HARVEST 5% STORAGE/SPOILAGE 1.6% SIZE/SMALL 1.9%		FRESH TUBERS 12.1% Transport 2.2% Too woody 4.1% Too small 5.8%		PROCESSING 5.5% STORAGE 6.3%	
			GARI LOSS 2.7% Processing 1.6% Storage/spoilage 1.1%		STORAGE 7% Moisture 4.5% Rodents 2.5%	

Source: FAO, *Post-harvest Losses along Value and Supply Chains in the Pacific Island Countries*, Brief (Rome: 2015). Reproduced with permission; data are derived from GIZ, *Food Losses in Cassava and Maize Value Chains in Nigeria—Analysis and Recommendation for Reduction Strategies* (Bonn: 2013).

loss and waste, and identify reduction opportunities. Finally, the World Resources Institute, in conjunction with the FAO, the United Nations Environment Programme, the Consumer Goods Forum, the World Business Council for Sustainable Development, FUSIONS, and the Water and Resources Action Program, coordinates the multistakeholder Food Loss and Waste Protocol initiative to develop a global, harmonized accounting and reporting standard. This protocol, which is still under review, is focused on how to measure food loss and waste but does not include preharvest loss.²²

National and local governments

To address food loss and waste, governments primarily engage in national and local awareness campaigns. These are often implemented in schools but can also be disseminated through online resources and radio podcasts. The governments of Belgium, France, Ireland, the Netherlands, and the United Kingdom have been particularly active in awareness campaigns.

Civil society

Consumer and retailer attitudes are important determinants of the amount of food wasted by supermarkets and households. Several civil society initiatives in high-income countries target food loss and waste by providing incentives and ideas for alternative use or by raising consumer consciousness. Approaches taken by these programs include recovering and redistributing food that would have been wasted (by harvesting crops that are left in the field and redistributing them to needy people—for example, Gleaning Networks and food banks); increasing consumer awareness (through lobbying, training, or communal cooking events—for example, Love Food Hate Waste, Feeding the 5000, and Green Cook); promoting bottom-up innovations to reduce food waste (for example, the Food Surplus Entrepreneurs Network); and encouraging the reuse of food waste (for example, The Pig Idea).

Retailers

Relatively few initiatives have been established at the retail level, but some supermarkets have adopted strategies to address food loss and waste. One such strategy is selling food that has passed its “best

before” date at discounted rates. Some supermarkets also engage in food redistribution with local associations or participate in awareness campaigns.

THE WAY FORWARD

The SDGs emphasize both increasing food security and reducing stress on natural resources. Reducing food loss and waste can make a critical contribution to these broad goals. SDG 12 focuses specifically on sustainable consumption and production patterns; SDG target 12.3 calls for halving global food waste at the retail and consumer levels, and reducing food

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losses along the value chain by 2030. In addition to these targets, the Committee of World Food Security has called on all public, private, and civil society actors to promote a common understanding of food loss and waste and to create an enabling environment for its “food use-not-waste” agenda, especially for monitoring, measurement, and reporting targets.²³ And in May 2015, the G20 agriculture ministers highlighted the global challenge of preventing and reducing food loss and waste, and encouraged all G20 members to strengthen their collective efforts.

In this context of international commitment, identifying the magnitudes, causes, and costs of food loss and waste across the value chain, including PFLW, is critical for setting priorities for action.

Identifying appropriate places for intervention will require an integrated value chain approach and the coordination of a wide diversity of actors, including multidisciplinary researchers, policymakers, and private sector and civil society actors. Addressing loss and waste will require a common understanding



Smallholders, in particular, who produce only small surpluses, often face substantial market failures that contribute to food loss and waste. Public sector investment can address some of these market shortcomings, such as the need for appropriate storage facilities.

of the concept²⁴ as well as a collaborative effort to collect better micro-data across different commodities and contexts. To achieve target 12.3, we need to set concrete targets at both regional and country levels, and specifically address the relevant differences between developing and developed countries. For developed countries, the focus should be on waste; for developing countries, the focus in the short term should be on food loss, but it should also give attention to how to leapfrog to best practices for reducing waste.

Both the public and the private sectors have roles to play in reducing food loss and waste. Governments should focus on ensuring that public-sector investments facilitate reductions in food loss and waste. Such investments include a broad gamut of areas related to food systems and can have multiple benefits: information on best practices, food safety, education, roads, regulations and standards, and addressing market failures.

Smallholders, in particular, who produce only small surpluses, often face substantial market failures that contribute to food loss and waste. Public-sector investment can address some of these

shortcomings, such as the need for appropriate storage facilities, efficient transport systems, policies that improve access to credit, support for market incentives for improved food safety (as in the case of aflatoxins), and access to crop varieties resistant to weather shocks.²⁵ For example, food quality and safety standards not only facilitate export of produce grown in Africa to international destinations, but also help ensure that smallholder farmers and their families fully benefit from high-quality, nutritious food grown locally.

The private sector also has a role to play, particularly when reducing food loss and waste can generate profits. For example, choosing appropriate crop varieties, dealing with preharvest pests, and making processing and retail decisions may be best addressed by the private sector.

Analyzing the factors affecting food loss and waste at the micro-, meso-, and macro-levels can help in identifying effective reduction interventions.²⁶ Looking at the micro-level causes of food loss and waste, studies point to credit constraints as one of the main bottlenecks to technology adoption to reduce food loss and waste.²⁷ Others point to the importance of education;²⁸ to contractual practices;²⁹ and to the growing need to improve infrastructure, particularly in rural areas.³⁰

Micro-level causes can be linked to broader meso- and macro-level causes that overarch different stages of the value chain. For example, strict food safety concerns and regulations can lead to safe food being rejected for import or removed from markets.³¹ Other systemic causes relate to inappropriate technologies, changing consumer demands, and low capacities to adopt innovations or respond to changing consumption patterns. Thus, context-specific cost-benefit analyses have to be systematically carried out to identify the most sustainable and efficient interventions for reducing loss and waste.

Finally, policymakers and value chain actors need to translate insights into action. International organizations have the power to bring this important topic to the table and create platforms for information exchange—such as the technical platform on measurement and reduction of food loss and waste launched by the International Food Policy Research Institute and FAO as a result of the

G20 summit in Turkey in December 2015.³² States also have a key role to play in creating a successful enabling environment, and all public and private value chain actors need to transform theory about

food loss and waste into concrete interventions in order to generate the multiple benefits of increased food availability and reduced environmental pressures. ■