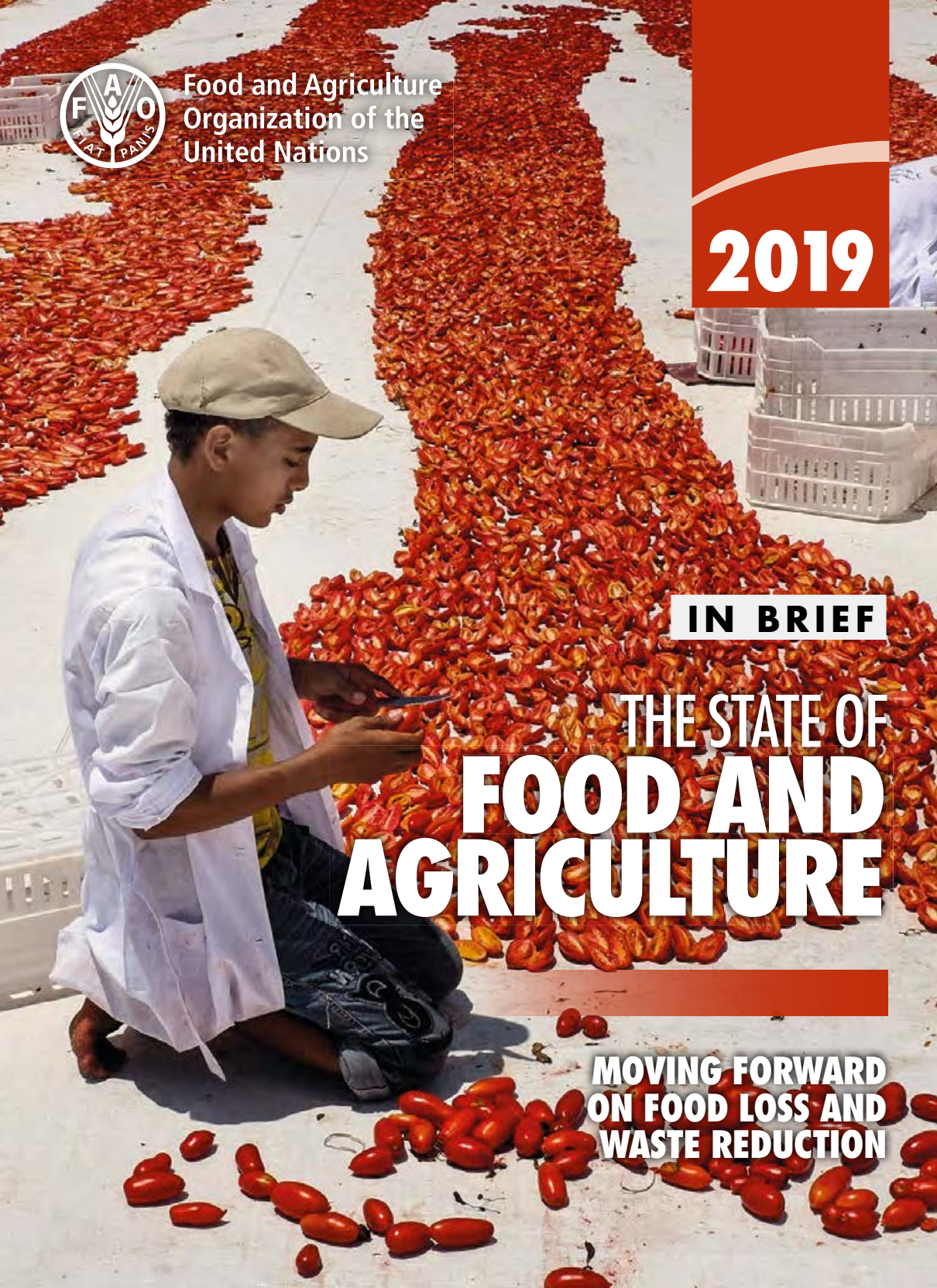
Food and Agriculture
Organization of the
United Nations
2019
IN BRIEF
THE STATE OF
FOOD AND
AGRICULTURE
MOVING FORWARD
ON FOOD LOSS AND
WASTE REDUCTION

This booklet contains the key messages and content from the publication *The State of Food and Agriculture 2019*. The numbering of the tables and figures corresponds to that publication.

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FOREWORD

I am heartened to see that the world is paying more attention to the issue of food loss and waste and is calling for more decisive action to address it. The growing awareness and increase in calls for action are rooted in the strong negative moral connotations associated with food loss and waste. These are partly based on the fact that losing food implies unnecessary pressure on the environment and the natural resources that have been used to produce it in the first place. It essentially means that land and water resources have been wasted, pollution created and greenhouse gases (GHGs) emitted to no purpose. I also frequently wonder how we can allow food to be thrown away when more than 820 million people in the world continue to go hungry every day.

International attention on the issue of food loss and waste is firmly reflected in the 2030 Agenda for Sustainable Development. Specifically, Target 12.3 of the Sustainable Development Goals (SDGs), which embody this agenda, calls for the halving by 2030 of per capita global food waste at the retail and consumer levels and the reduction of food losses along production and supply chains, including post-harvest losses. Many countries are already taking action to reduce food loss and waste, but the challenges ahead remain significant and we need to step up efforts. Furthermore, as this report argues, efforts to meet SDG Target 12.3 could contribute to meeting other SDG targets, not least that of achieving Zero Hunger, in line with the integrated nature of the 2030 Agenda.

However, as we strive to make progress towards reducing food loss and waste, we can only be truly effective if our efforts are informed by a solid understanding of the problem. Three dimensions need to be considered. Firstly, we need to know – as accurately as possible – how much food is lost and wasted, as well as where and why. Secondly, we need to be clear about our underlying reasons or objectives for reducing food loss and waste – be they related to food security or the environment. Thirdly, we need to understand how food loss and waste, as well as the measures to reduce it, affect the objectives being pursued. This report sheds light on these three dimensions in order to help design more informed and better policies for food loss and waste reduction.

Concerning the first dimension, the surprising fact is how little we really know about how much food is lost or wasted, and where and why this happens. A broad estimate, prepared for FAO in 2011, suggested that around a third of the world's food was lost or wasted every year. This estimate is still widely cited due to a lack of information in this field, but it can only be considered as very rough. It is therefore in the process of being replaced by two indices, thanks to efforts by FAO and UN Environment to estimate more carefully and more precisely how much food is lost in production or in the supply chain before it reaches the retail level (through the Food Loss Index) or is subsequently wasted by consumers or retailers (through the Food Waste Index). Initial estimates made by FAO for the Food Loss Index, which I am pleased to release through this report, tell us that globally around 14 percent of the world's food is lost from production before reaching the retail level. Estimates for the Food Waste Index are under preparation by UN Environment and will complement the Food Loss Index to provide a better understanding of how much food is lost or wasted in the world. These indices will allow us to monitor progress towards SDG Target 12.3 over time, starting from a more solid baseline.

However, to intervene effectively we also need to know where in the food supply chain losses and waste are concentrated and the reasons why they occur. Evidence presented in this report shows that losses and waste tend to be higher for some specific commodity groups, although they can occur at all stages of the food supply chain to different degrees. However, what really struck me is the vast range in terms of percentages of food loss and waste for the same commodities and the same stages in the supply chain both within and across countries. This suggests that there is considerable potential to reduce food loss and waste where percentage losses are higher than in other places. However, it also shows that we cannot generalize about the occurrence of food loss and waste across food supply chains but must, on the contrary, identify critical loss points in specific supply chains as a crucial step in taking appropriate countermeasures.

Regarding the second dimension, although the SDGs include the reduction of food loss and waste as a target in its own right, we need to be clear about why we are pursuing it – or what is the underlying objective. Individual actors, from farmers and fishers right up to consumers, may have a private interest in reducing food loss or waste to increase their profits or income, their personal well-being or that of their families. However, this private incentive is not always strong since reducing food loss and waste may require investing money or time which, in the perception of these actors, could outweigh the benefits. There may also be barriers that prevent private actors from making these investments, e.g. credit constraints or a lack of information about options for reducing food loss and waste. On the other hand, there may be a stronger public interest in reducing food loss

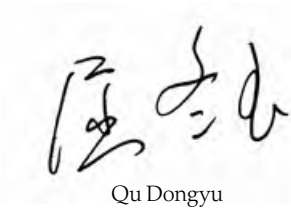
and waste because it contributes to other public objectives. This calls for public interventions in the form of investments or policies that create incentives for private actors to reduce food loss and waste or remove the barriers that prevent them from doing so. The broad public objectives that this report considers are twofold: improving the food security situation of vulnerable groups and reducing the environmental footprint associated with food that is lost or wasted.

A key argument in this report is that the linkages between food loss and waste, on the one hand, and food security and environmental impacts, on the other, are complex and need to be thoroughly understood. Positive outcomes from reducing food loss and waste are far from guaranteed, and the impacts will differ according to where food loss and waste is reduced. It is exactly for this reason that policymakers need to be clear about the objectives they choose to pursue. Focusing on one objective will indeed have implications for where food loss and waste reductions can be most effective.

For instance, if the objective is to improve food security, reducing on-farm losses – particularly on small farms in low-income countries with high levels of food insecurity – is likely to have strong positive impacts. It may directly improve food security in the affected farm households and may also have positive effects in local areas, and even beyond, if more food becomes available. Reducing food loss and waste further along the food supply chain may improve food security for consumers, but farmers may actually be negatively affected if demand for their produce declines. On the other hand, while reducing consumer food waste in high-income countries with low levels of food insecurity may have some impact on vulnerable people locally through food collection and redistribution initiatives, the impact on the food insecure in distant low-income countries is likely to be negligible.

If the objectives for reducing food loss and waste are essentially environmental, the situation changes. In the case of GHGs, these accumulate throughout the supply chain. Therefore, cutting waste by consumers will have the biggest impact because food wasted at this stage represents a larger amount of embedded GHG emissions. In the case of land and water, the environmental footprint is tied mainly to the primary production phase. Therefore, reducing food loss and waste at any stage of the food supply chain can contribute to reducing overall land and water use at the global level. However, if you want to address local land and water scarcity, measures to reduce food loss are likely to be more effective if they occur at the farm level or at stages in the supply chain close to the farm level.

I invite you to read this report carefully as it examines the complex ways in which food loss and waste – and the measures taken to address it – affects food security and the environment. The report does not claim to have all the answers, particularly as it acknowledges the important information gaps that stand in the way of a comprehensive analysis. Among other things, the report attempts to highlight precisely where there is a need for a more thorough understanding of the issues, both through more and better data and improved and expanded analysis. It is my hope that it can make a contribution to the debate on how to address the problem of food loss and waste most effectively and in ways that actually make a difference in terms of improved food security and environmental sustainability, following the spirit of the 2030 Agenda.



Qu Dongyu
FAO Director-General

SUMMARY

FRAMING THE ISSUES TO FACILITATE ACTION

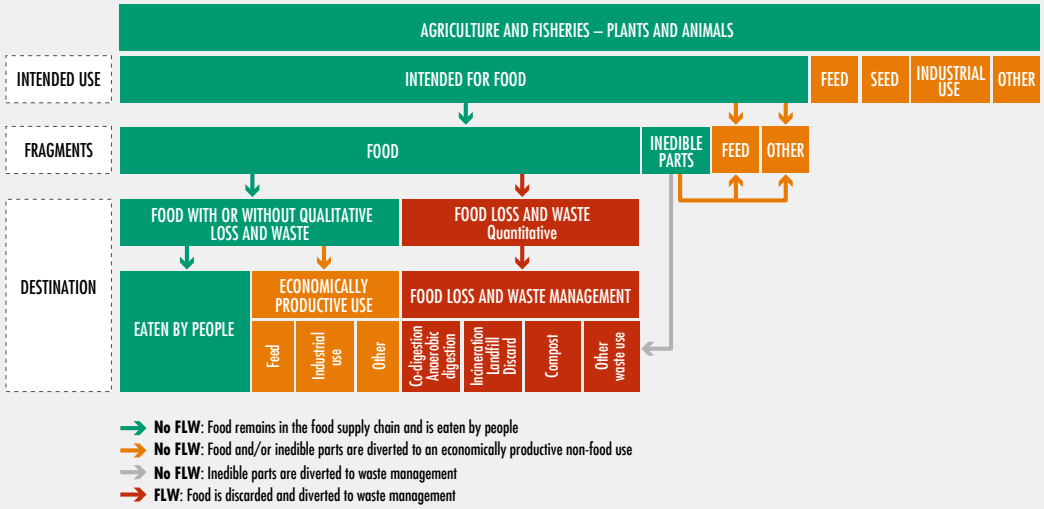
Reducing food loss and waste is widely seen as an important way to reduce production costs and increase the efficiency of the food system, improve food security and nutrition, and contribute towards environmental sustainability. Growing attention to food loss and waste is reflected in the Sustainable Development Goals (SDGs). SDG Target 12.3 calls for *halving per capita global food waste at the retail and consumer levels and reducing food loss along production and supply chains (including post-harvest losses) by 2030*. Reducing food loss and waste also has the potential to contribute to other SDGs, including the Zero Hunger goal (SDG 2), which calls for an end to hunger, the achievement of food security and improved nutrition, and the promotion of sustainable agriculture. The expected positive environmental impacts from reducing food loss and waste would also affect, among others, SDG 6 (sustainable water management), SDG 13 (climate change), SDG 14 (marine resources), SDG 15 (terrestrial ecosystems, forestry, biodiversity), and many other SDGs.

REDUCING FOOD LOSS AND WASTE IS AN IMPORTANT TARGET OF THE SUSTAINABLE DEVELOPMENT GOALS (SDGs), AS WELL AS A MEANS TO ACHIEVE OTHER SDG TARGETS, IN PARTICULAR RELATING TO FOOD SECURITY, NUTRITION AND ENVIRONMENTAL SUSTAINABILITY.

While the reduction of food loss and waste appears as a clear and desirable objective, actual implementation is not simple and its complete elimination may not be realistic. This report acknowledges the need to reduce food loss and waste, presents new insights on what is known and what is not, and provides guidance on how to target interventions and policies depending on policymakers' objectives and the information available.

When considering actions and policy options, the report argues that food loss and waste reduction should be seen as a way to achieve other objectives, notably improved efficiency in the food system,

FIGURE 2
A CONCEPTUAL FRAMEWORK FOR FOOD LOSS AND WASTE (FLW)



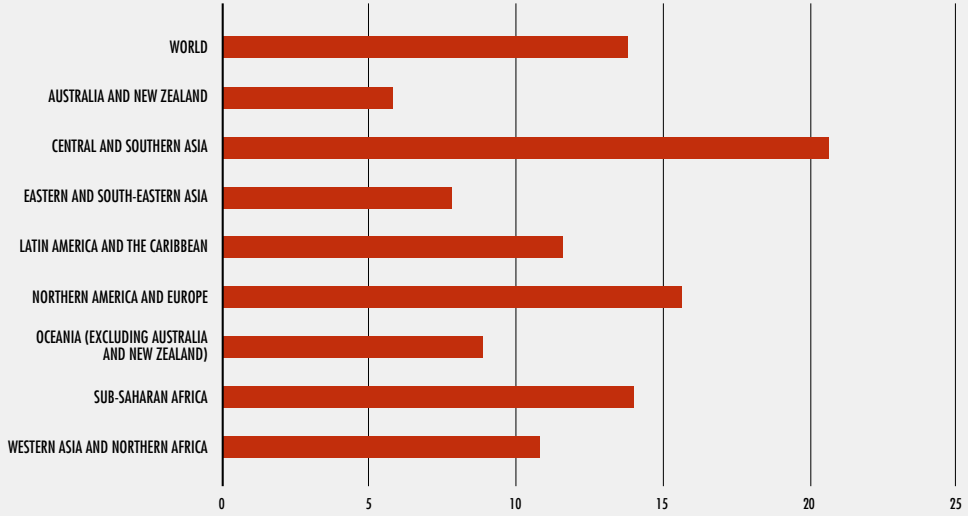
NOTE: "Industrial use" includes biofuels, fibres for packaging material, creating bioplastics (e.g. polylactic acid), making traditional materials such as leather or feathers (e.g. for pillows) and rendering fat, oil or grease into a raw material to make soaps, biodiesel or cosmetics. It does not include anaerobic digestion, as the latter is intended to manage waste. "Other" includes uses such as fertilizer and ground cover. The length of the bars is not representative of the total volume or value of the products concerned.
SOURCE: FAO.

food security and nutrition, and environmental sustainability. How policymakers prioritize these different dimensions, and the information available on how food loss and waste affects them, will shape the most appropriate mix of interventions and policies to reduce food loss and waste.

KNOWING WHAT CONSTITUTES FOOD LOSS AND WASTE AND HOW TO MEASURE IT PRECEDES TAKING ACTION

The notion of food being lost or wasted is deceptively simple, but in practice there is no commonly agreed definition of food loss and waste. FAO has worked towards the harmonization of concepts related to food loss and waste, and the definitions adopted in this report are the result of a consensus reached in consultation with experts in this field. This report understands food loss and waste as the decrease in quantity or quality of food along the food supply chain. Empirically it considers **food losses** as occurring along the food supply chain from harvest/slaughter/catch up to, but not including, the retail level. **Food waste**, on the other hand, occurs at the retail and consumption level. This definition also aligns with the distinction implicit

FIGURE 3
FOOD LOSS FROM POST-HARVEST TO DISTRIBUTION IN 2016, PERCENTAGES GLOBALLY AND BY REGION



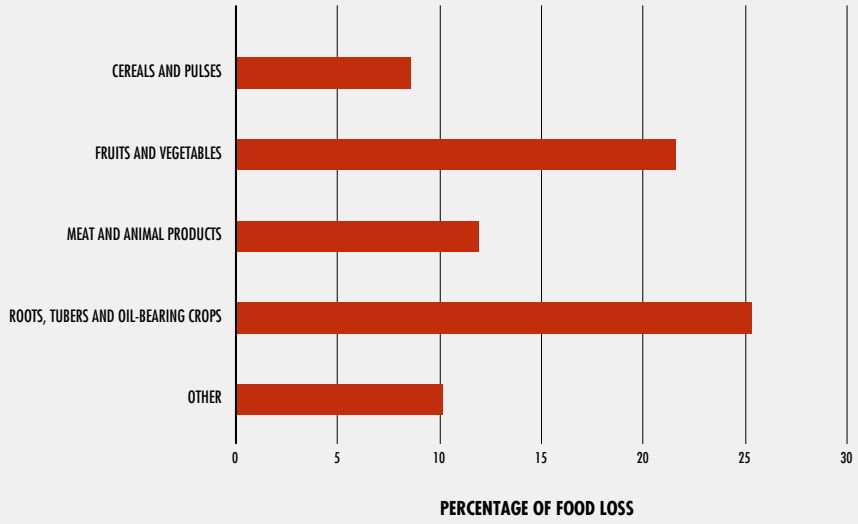
NOTE: Percentage of food loss refers to the physical quantity lost for different commodities divided by the amount produced. An economic weight is used to aggregate percentages at regional or commodity group levels, so that higher-value commodities carry more weight in loss estimation than lower-value ones.
SOURCE: FAO, 2019.

in SDG Target 12.3. This report also asserts that, although there may be an economic loss, food diverted to other economic uses, such as animal feed, is not considered as quantitative food loss or waste. Similarly, inedible parts are not considered as food loss or waste.

Food loss and waste has typically been measured in physical terms using tonnes as reporting units. This measurement fails to account for the economic value of different commodities and can risk attributing a higher weight to low-value products just because they are heavier. The report acknowledges this by adopting a measure that accounts for the economic value of produce.

Agreeing on a consistent approach to monitor SDG Target 12.3 is an important step in framing the debate on food loss and waste and will provide guidance on where to intervene. Efforts are underway by FAO and the United Nations Environment Programme to measure progress towards SDG Target 12.3 through two separate indices: the **Food Loss Index (FLI)** and the **Food Waste Index (FWI)**.

FIGURE 4
FOOD LOSS FROM POST-HARVEST TO DISTRIBUTION IN 2016, PERCENTAGES BY COMMODITY GROUPS



NOTE: Percentage of food loss refers to the physical quantity lost for different commodities divided by the amount produced. An economic weight is used to aggregate percentages at regional or commodity group levels, so that higher-value commodities carry more weight in loss estimation than lower-value ones.
SOURCE: FAO, 2019.

GLOBALLY, AROUND 14 PERCENT OF FOOD PRODUCED IS LOST FROM THE POST-HARVEST STAGE UP TO, BUT EXCLUDING, THE RETAIL STAGE.

This report releases the first estimates for the FLI, prepared by FAO, which indicates that globally – in terms of economic value – around 14 percent of food produced is lost from post-harvest up to, but not including, the retail level. For the FWI, covering retail and consumption, significant work has been carried out to prepare the methodological framework, but the first estimates are yet to be released.

VARIATIONS IN LEVELS OF FOOD LOSS AND WASTE CAN PROVIDE PRELIMINARY GUIDANCE ON WHERE TO INTERVENE

To gain further insight into the location and extent of food loss and waste across stages in the food supply chain, as well as between regions and commodity groups, FAO has also conducted a meta-analysis of existing food loss and waste studies all over the world. The meta-analysis finds a wide range of values for percentage losses at each stage in the food supply

chain. For example, in sub-Saharan Africa the observations on fruits and vegetables report on-farm losses ranging from 0 to 50 percent, a very broad range. An intervention to reduce these losses needs to target the upper end of this range to have maximum impact.

Generally levels of loss are higher for fruits and vegetables than for cereals and pulses. However, even for the latter, significant levels are found in sub-Saharan Africa and Eastern and South-Eastern Asia, while they are limited in Central and Southern Asia. Studies on waste at the consumer stage are confined to high-income countries; waste levels are particularly high for highly perishable foods such as animal products and fruits and vegetables.

IT IS ESSENTIAL TO ADDRESS THE CAUSES OF FOOD LOSS AND WASTE. THIS WILL REQUIRE INFORMATION ON WHERE FOOD LOSS AND WASTE OCCURS IN THE FOOD SUPPLY CHAIN AND THE DETERMINANTS BEHIND IT.

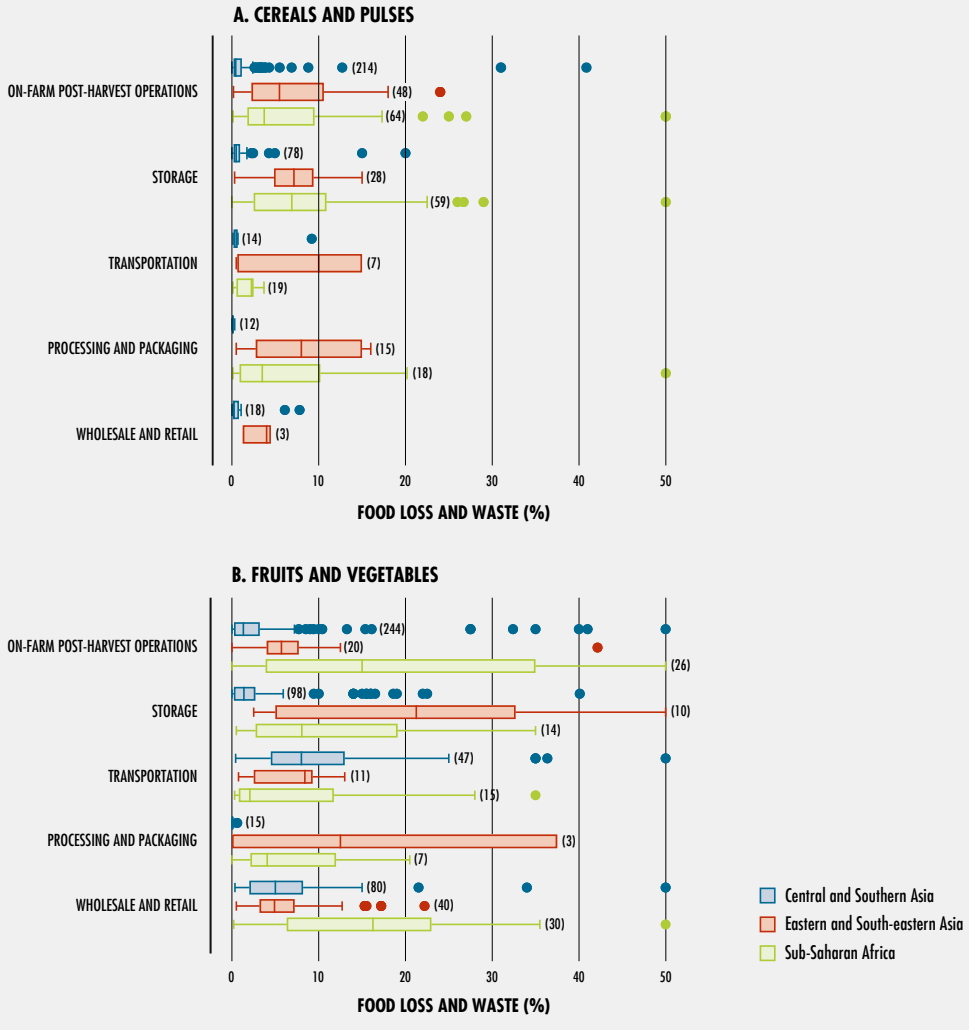
Causes of food loss and waste differ widely along the food supply chain. Important causes of on-farm losses include inadequate harvesting time, climatic conditions, practices applied at harvest and handling, and challenges in marketing produce. Significant losses are caused by inadequate storage conditions as well as decisions made at earlier stages of the supply chain, which predispose products to a shorter shelf life. Adequate cold storage, in particular, can be crucial to prevent quantitative and qualitative food losses.

During transportation, good physical infrastructure and efficient trade logistics are of key importance to prevent food losses. Processing and packaging can play a role in preserving foods, but losses can be caused by inadequate facilities as well as technical malfunction or human error.

The causes of food waste at the retail level are linked to limited shelf life, the need for food products to meet aesthetic standards in terms of colour, shape and size, and variability in demand. Consumer waste is often caused by poor purchase and meal planning, excess buying (influenced by over-large portioning and package sizes), confusion over labels (best before and use by) and poor in-home storing.

Surveys into the extent, location and causes of food loss and waste are complex and costly. As a result, only 39 countries have officially reported data on an annual basis between 1990 and 2017 to FAO. Efforts are ongoing to improve data on losses and waste at a finer scale. Starting in 2015, FAO's Global Initiative on Food Loss and Waste (Save Food) has carried out case studies to identify critical loss points in the food supply chain where food losses have the highest magnitude, the greatest impact on food security, and the largest economic dimensions. They indicate that harvesting is the most frequently identified critical loss point for all types of food. Inadequate storage facilities and poor handling practices were identified as the main causes of on-farm storage losses. For fruits, roots and tubers,

FIGURE 6
RANGE OF REPORTED FOOD LOSS AND WASTE PERCENTAGES BY SUPPLY CHAIN STAGE, 2000–2017



NOTE: The number of observations is shown in brackets. The dates, 2000–2017, refer to when the measurements were taken; however, the date of publication was used if the study dates were not available or were unclear.
SOURCE: FAO, 2019.

packaging and transportation also appeared critical. Such results are valuable in providing guidance when identifying potential interventions for food loss reduction.

EVEN WITH LIMITED INFORMATION, GETTING THE INCENTIVES RIGHT AND OVERCOMING CONSTRAINTS FACILITATE ACTIONS

This report aims to provide guidance on policy and interventions to reduce food loss and waste even in the face of the limited information available. This is based on an incremental argument starting from the **business case** for reducing food loss and waste, where incentives and adequate information can encourage the private sector to reduce food loss and waste in their own interest. This may also bring benefits to society, and providing information in these situations is particularly important. The incremental approach then continues by making the **economic case** for food loss and waste reduction, looking beyond the business case, and is based on the broader benefits that can accrue to society. These may result in improved incomes for other actors in society; improved food security and nutrition; and environmental sustainability.

The business case for reducing food loss and waste rests on the private gains that can be realized by stakeholders who reduce levels of food loss and waste. The assumption is that actors in the food supply chain make rational decisions that maximize their profits (in the case of producers or suppliers) or their well-being (in the case of consumers). Reducing food loss and waste generally entails costs, and suppliers and consumers will only undertake the necessary efforts if these are outweighed by the benefits. Thus, incentivizing the business case will involve identifying options that either increase the net benefits or provide better information on the existing net benefits. Any policies that affect food prices (e.g. subsidies) or the costs of managing waste will also affect the incentives. However, a number of factors may prevent actors from taking fully rational decisions. In particular, food operators and consumers may have inadequate information on how much food they lose or waste, on the reduction options available, or on the benefits of doing so. Stakeholders may also face constraints that prevent or deter them from implementing actions to reduce food loss and waste. For example, without financial help private actors in developing countries (especially smallholders) may not be able to bear the high upfront cost associated with implementing such actions. Improving credit access could be an option even in the absence of detailed information on losses.

THERE IS A RATIONALE FOR PUBLIC-SECTOR INTERVENTION

The broader case for reducing food loss and waste looks beyond the business case to include gains that society can

reap but which individual actors may not take into account, namely: (i) increased productivity and economic growth, referred to in this report as the economic case; (ii) improved food security and nutrition; and (iii) mitigation of environmental impacts of losing and wasting food, in particular in terms of reducing greenhouse gas (GHG) emissions as well as lowering pressure on land and water resources. The last two societal gains, in particular, are typically seen as externalities of reducing food loss and waste.

The rationale for government intervention aimed at influencing decisions by individual suppliers and consumers rests on two pillars. First, the incentive for individual actors to reduce food loss or waste – the business case – may be weak and/or these actors may face constraints in implementing them. Therefore, the business case alone may not lead to a significant reduction in losses and waste. Second, private actors are unlikely to take account of the negative implications their levels of food loss and waste have on society. These potentially large negative externalities provide a strong justification for public intervention.

Governments can intervene in different ways. They can raise awareness of the benefits of reducing food loss and waste and convince suppliers or consumers of the business case for doing so; or they can influence the business case through various types of actions or policies (e.g. through taxes and subsidies).

When taking action to reduce food loss and waste, the type of externality – food security and nutrition as opposed to environmental impacts – will determine which type of intervention is most appropriate along a value chain and in which geographical location. However, an intervention to reduce food loss and waste should take account of the distributional consequences; some actors may benefit, others may lose out.

FOOD SECURITY AND NUTRITION IMPACTS DEPEND ON WHERE FOOD LOSS AND WASTE REDUCTIONS OCCUR ALONG THE SUPPLY CHAIN ...

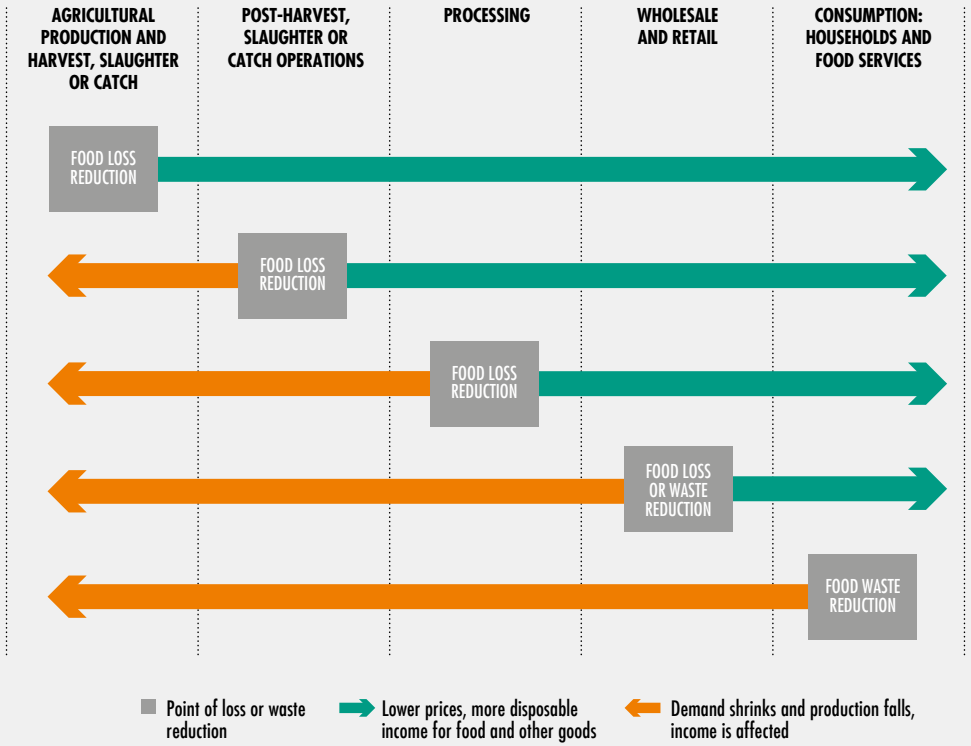
Food loss and waste has potential effects on food security and nutrition through changes in the four dimensions of food security: food availability, access, utilization and stability. However, the links between food loss and waste reduction and food security are complex, and positive outcomes are not always certain. Reaching acceptable levels of food security and nutrition inevitably implies certain levels of food loss and waste. Maintaining buffers to ensure food stability requires a certain amount of food to be lost or wasted. At the same time, ensuring food safety involves discarding unsafe food, which then is counted as lost or wasted, while higher-quality diets tend to include more highly perishable foods.

How the impacts on the different dimensions of food security play out and affect the food security of different

population groups depends on where in the food supply chain the reduction in losses or waste takes place as well as on where nutritionally vulnerable and food-insecure people are located geographically. Importantly, not everybody stands to gain.

Reducing on-farm losses – particularly for small-scale farmers in low-income countries – can allow farmers to improve their diets due to increased food availability and gain higher incomes if selling part of their produce. It can also lead to increased supply and lower prices further along the food supply chain and eventually for consumers. On the other hand, if a processor reduces losses, while this will also lead to increased supply and lower prices further down the food

FIGURE 12
POTENTIAL PRICE AND INCOME EFFECTS OF FOOD LOSS AND WASTE REDUCTIONS AT VARIOUS POINTS IN THE FOOD SUPPLY CHAIN



SOURCE: FAO.

supply chain and eventually for consumers, it may result in farmers seeing reduced demand for their produce and thus lower income and worsening food security. Reducing consumers' food waste may improve their food availability and access, in addition to that of possible direct beneficiaries of food redistribution schemes, but farmers and other supply chain actors may be worse off as they are selling less and/or at lower prices. Also in international food supply chains, reducing food waste by consumers and retailers in high-income countries may negatively affect poor farmers in lower-income countries if they are the primary suppliers.

... AS WELL AS WHERE THEY OCCUR GEOGRAPHICALLY

The exact impact of a reduction in food loss and waste will depend on how closely markets are integrated and how effectively price changes are transmitted. A key factor here is distance or proximity to the location of the reduction. Reducing on-farm losses on small farms in lower-income countries may have a strong local food security impact. On the other hand, reducing food waste among consumers in high-income countries does not mean that these surpluses are available for poor and food-insecure people in a distant country with high levels of food insecurity.

The prevalence of food insecurity can be relevant for determining food loss and waste reduction strategies for a given country's food insecurity challenges. In lower-income countries, where food insecurity is often severe, increasing access to food is critical; and access itself is likely to be closely associated with availability. Preventing food losses at the local level in smallholder production can both alleviate food shortages and increase farmers' incomes, thus improving access. If reductions in losses are large enough to affect prices beyond the local area, the urban food insecure could also benefit. At the other extreme, in high-income countries, the problem of access is relevant for a much smaller share of the population; for many, the priority is nutrition and quality of diet. For these countries, more targeted interventions, such as food redistribution, can contribute to access to food; however, eliminating remaining levels of food insecurity will also have to rely on a broader set of social policies.

THE LARGEST IMPROVEMENTS IN FOOD SECURITY ARE LIKELY TO OCCUR BY REDUCING FOOD LOSSES IN THE EARLY STAGES OF THE SUPPLY CHAIN, ESPECIALLY ON-FARM, IN COUNTRIES WITH HIGH LEVELS OF FOOD INSECURITY.

REDUCING FOOD LOSS AND WASTE LESSENS THE ENVIRONMENTAL IMPACT OF FOOD PRODUCTION FOR A GIVEN LEVEL OF FOOD CONSUMPTION

Food production is resource-intensive and has significant environmental impacts. If food is lost or wasted, this entails poor use

of resources and negative environmental impacts. It is forecast that a growing population and rising incomes will lead to an increase in demand for agricultural products, exerting even more pressure on the world's natural resources. This emphasizes the urgency of reducing food loss and waste since it will always improve resource use efficiency and lower GHG emissions per unit of food consumed because more food reaches the consumer for a given level of resources used.

However, improved efficiency does not necessarily reduce the total resources used or GHGs emitted. The overall environmental impact will be the result of price changes associated with the reduction of food loss and waste, which will determine – indirectly – its effect on natural resource use and GHG emissions. For example, if the additional supply arising from fewer losses has the effect of decreasing prices for a product, then consumers may demand more of the product, counterbalancing the positive effect of the improved efficiency of the food system.

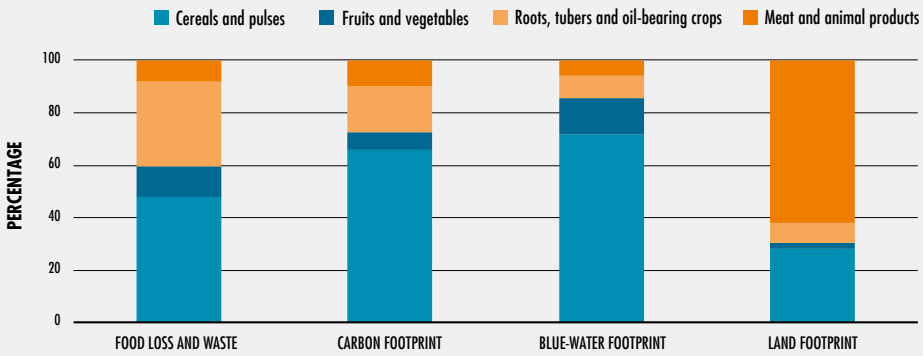
CLARITY IN THE ENVIRONMENTAL OBJECTIVES BEING PURSUED WILL BE KEY WHEN DESIGNING AND IMPLEMENTING INTERVENTIONS

The first consideration for an environmentally oriented policymaker is choosing which environmental objective to target (carbon, land or water footprints) and defining the commodities on which to focus. Empirical evidence at the global level on the environmental footprints for major commodity groups suggests that, if the aim is to reduce land use, the primary focus should be on meat and animal products, which account for 60 percent of the land footprint associated with food loss and waste. If the aim is to target water scarcity, cereals and pulses make the largest contribution (more than 70 percent), followed by fruits and vegetables. In terms of GHG emissions associated with food loss and waste, the biggest contribution is again from cereals and pulses (more than 60 percent), followed by roots, tubers and oil-bearing crops. However, the environmental footprint for different commodities also varies across regions and countries, due, *inter alia*, to differences in crop yields and production techniques.

THE EFFECTIVENESS OF REDUCING FOOD LOSS AND WASTE IN GENERATING DESIRABLE ENVIRONMENTAL OUTCOMES DEPENDS ON HOW IT AFFECTS PRICES

An intervention to reduce food loss or waste, if sufficiently large, will affect prices upstream and downstream in the supply chain relative to where the intervention occurred. The transmission of prices, combined with the location along the supply chain of the actual environmental damage, will determine the environmental outcome of a food loss and waste intervention. In the case of

FIGURE 13
RELATIVE CONTRIBUTIONS OF THE MAIN FOOD GROUPS TO OVERALL FOOD LOSS AND WASTE AND THEIR CARBON, BLUE-WATER AND LAND FOOTPRINTS



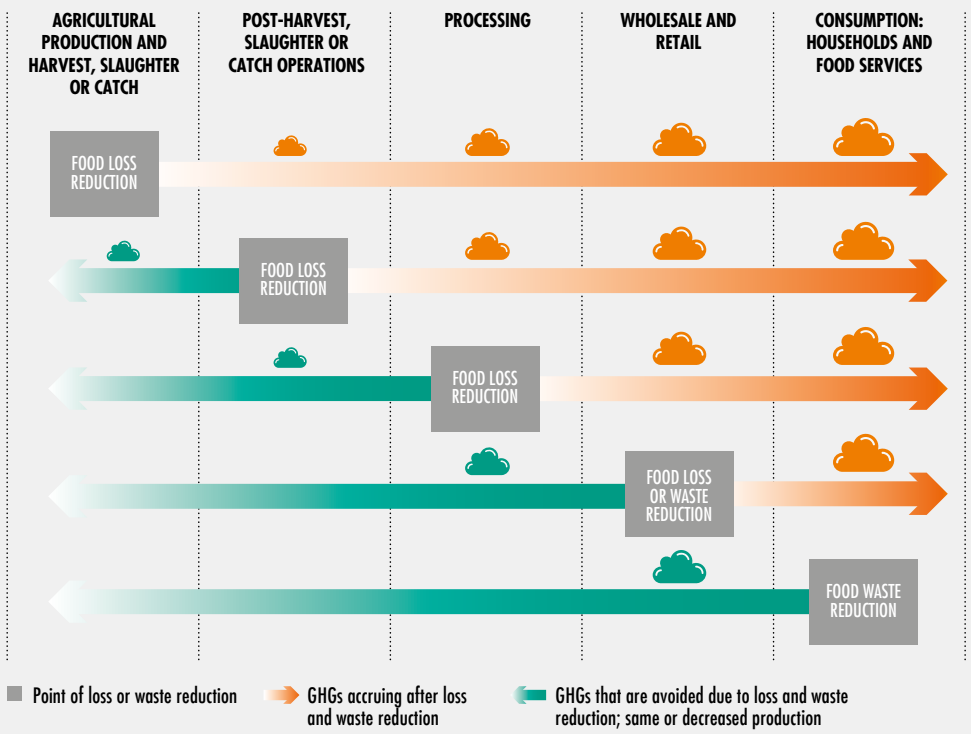
Note: The environmental footprints are calculated by multiplying the amount of food lost and wasted by its environmental impact factors. The carbon, blue-water and land impact factors were taken from FAO (2013), which provides environmental impact factors for different products, regions and supply chain stages. The carbon impact factor expresses tonnes of CO_2 equivalent emitted, the land impact factor indicates hectares of land used, and the blue-water impact factor indicates cubic metres of water used, all per tonne of food lost or wasted. The stacked bars present the relative contribution of a food group to total food loss and waste and to each of the environmental footprints of food loss or waste. The estimations of food loss and waste differ from the ones presented in Figure 4 with respect to the inclusion of the retail level, the share of food loss and waste being measured in terms of quantity (rather than economic value), and the use of loss and waste data for only those commodities for which an impact factor was available. Thus, food products that do not belong to any of the groups included in the figure (e.g. coffee beans) are excluded from the graph due to the lack of data for impact factors, despite contributing around 20 percent to food loss and waste. These data refer to 2015.
SOURCE: FAO, 2013 and 2019.

land use and water, since the environmental impact occurs mostly in primary production, an intervention anywhere in the supply chain will lead to an environmental improvement as lower prices incentivize producers to reduce their production and consequently their use of natural resources. Alternatively, if the objective is to reduce the carbon footprint, which may grow throughout the supply chain, interventions at the consumption stage will have the greatest return per unit of avoided food loss and waste.

The transmission of price changes is likely to be stronger between suppliers who have a direct link, as opposed to indirect links through other market agents. If this is the case, an intervention at the specific point or close to the point of the environmental impact is most

TO BE ENVIRONMENTALLY EFFECTIVE, INTERVENTIONS TO REDUCE FOOD LOSS AND WASTE NEED TO CONSIDER WHERE FOOD LOSS AND WASTE HAS THE GREATEST IMPACT ON THE ENVIRONMENT – BOTH IN TERMS OF FOOD PRODUCTS AND THE STAGE OF THE FOOD SUPPLY CHAIN.

FIGURE 16
CARBON IMPACT OF FOOD LOSS AND WASTE REDUCTION ALONG THE FOOD SUPPLY CHAIN



SOURCE: FAO.

likely to induce actors generating the negative impact to make adjustments in production and use of associated natural resources. If interventions occur downstream, price effects are likely to be diluted and smaller by the time they reach actors generating the environmental impact, so the impact on critical areas will be marginal. For example, reducing consumer waste may lead to a small change in water use in many geographically dispersed locations but not necessarily where it is most needed. For GHG emissions the situation is different since the carbon footprint is global in nature and the geographic location of reduced GHG emissions is irrelevant.

As a rule of thumb, interventions targeted at critical loss points that come immediately after most of the environmental damage have the greatest impact in terms of environmental sustainability.

FOOD LOSS AND WASTE REDUCTIONS HAVE TO BE PLACED IN THE BROADER CONTEXT OF SUSTAINABILITY, EVALUATING SYNERGIES AND TRADE-OFFS

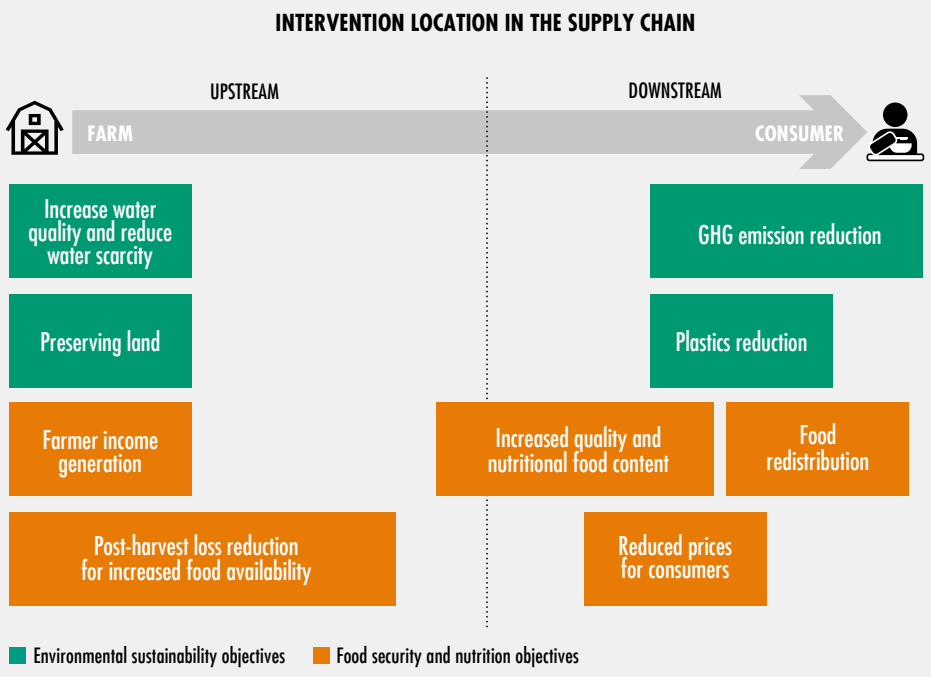
Although improvements resulting from food loss and waste reduction are not trivial, empirical studies show that other types of interventions result in larger reductions in some environmental impacts, e.g. improved agricultural production methods and dietary changes. However, the same evidence shows that the strongest impact is obtained by combining different interventions, including food loss and waste reduction. In addition, possible trade-offs with other environmental objectives need to be considered. For example, food loss and waste can be reduced by increasing the use of cold storage and packaging; but expanded cold storage may lead to higher energy use and increased use of packaging could generate more plastic waste. In such cases, enhancing energy efficiency in cold storage chains or looking at the entire packaging–product system in life cycle analyses could play a role in reducing the total environmental burden of measures adopted.

PUTTING ALL THE PIECES TOGETHER – SOME GUIDING PRINCIPLES FOR POLICYMAKERS

This report is based on an incremental approach that builds on the business case for private investments and efforts to reduce food loss and waste through private incentives. It expands the rationale beyond the business case, to one for public interventions to reduce some of the barriers that prevent producers and consumers from reducing food loss and waste, provide public goods or reduce negative externalities. At the same time, it should be recognized that broader policies to promote overall rural development may allow producers along the supply chain to make investments that will also reduce food losses.

It is possible to provide some guiding principles for interventions. Clarity about the objective(s) being pursued is essential for identifying the most appropriate policies and entry points for reducing food loss and waste. If the focus is on economic efficiency, an attractive option is to enable the business case for food loss and waste reduction, wherever it may present itself along the supply chain or geographically. 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 reach environmental objectives, food loss and waste reductions need to take place

FIGURE 17
OBJECTIVES OF LOSS AND WASTE REDUCTION MEASURES AND THEIR ENTRY POINTS ALONG THE FOOD SUPPLY CHAIN



SOURCE: FAO.

downstream in the supply chain relative to where the environmental impact occurs. Finally, location matters when pursuing food security and nutrition or environmental objectives, the only exception being a fall in GHG emissions, which has the same impact on climate change wherever it occurs.

Different countries will 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, where impacts will be the strongest and losses tend to be the largest.
High-income countries with low levels of food insecurity will likely place the emphasis on environmental objectives, in particular reducing GHG emissions. This will call for interventions later in the supply chain, in particular retail and consumption, where levels of loss or waste are expected to be the highest.

THE ROAD AHEAD

There may be trade-offs between objectives, and choices may have to be made about which objectives to prioritize. A critical issue is that of policy coherence, which requires that all options are weighed together for their impact so that solutions which promote one objective do not unintentionally harm another.

Policy coherence is important also because the amount of food loss and waste that can feasibly be reduced will depend on the costs and benefits relative to the status quo. Public policies affecting food prices, e.g. food subsidies, may unintentionally lead to greater food loss and waste.

However, first and foremost, it is important to assess whether, and to what extent, an initiative achieves its objective. This requires solid measurement of the magnitude of the problem and effective monitoring and evaluation of interventions. Efforts towards improved data collection are under way, not least in the framework of monitoring progress towards SDG Target 12.3 through the Food Loss and Food Waste indices. A key component of this is the development of standards and concepts, as well as guidelines and capacity building. The expectation is that this will allow countries themselves to improve data collection and effective measurement of food loss and waste. Improving statistical knowledge about food loss and waste is a priority area for FAO, and should be for the international community, as well as all countries interested in monitoring their progress towards reaching the SDGs.

Working for #ZeroHunger

THE STATE OF THE WORLD

2019

THE STATE OF FOOD AND AGRICULTURE

MOVING FORWARD ON FOOD LOSS AND WASTE REDUCTION

The need to reduce food loss and waste is firmly embedded in the 2030 Agenda for Sustainable Development. Food loss and waste reduction is considered important for improving food security and nutrition, promoting environmental sustainability and lowering production costs. However, efforts to reduce food loss and waste will only be effective if informed by a solid understanding of the problem.

This report provides new estimates of the percentage of the world's food lost from production up to the retail level. The report also finds a vast diversity in existing estimates of losses, even for the same commodities and for the same stages in the supply chain. Clearly identifying and understanding critical loss points in specific supply chains – where considerable potential exists for reducing food losses – is crucial to deciding on appropriate measures. The report provides some guiding principles for interventions based on the objectives being pursued through food loss and waste reductions, be they in improved economic efficiency, food security and nutrition, or environmental sustainability.

The State of Food and Agriculture 2019
(full text)

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