

Global food security index 2014

SPECIAL REPORT: Food loss and its intersection with food security

Content

Preface	2
Food loss and its intersection with food security	3
Measuring food loss and its costs	3
What is food loss?	4
What is happening to our food? The food supply chain	6
Food loss in developing countries	8
Food waste in developed countries	9
Measuring food loss in the GFSI	11
Food loss in the Global Food Security Index	12
Priorities and solutions	13

Preface

Food loss and its intersection with food security is a special report that coincides with the third edition of the Global Food Security Index (GFSI), an Economist Intelligence Unit (EIU) study commissioned by DuPont. This report discusses food loss and food waste and their impacts on food security. It explores the global occurrence of food wastage in developing and developed countries and along the food supply chain.

Lucy Hurst, associate director of custom research for the Americas, was the research director for this project. Joshua Grundleger, analyst, was the project manager for the project and co-editor of this special report. Katherine Stewart, research associate, was co-editor of the report. Martin Vieiro, analyst, provided editorial and research support. Leo Abruzzese, global forecasting director and global director of public policy, served as senior adviser. Lolli Duvivier provided editorial support. Mike Kenny was responsible for layout and design. Madeline Baron and Carol Rose Little served as editorial assistants.

Food loss and its intersection with food security

- Food loss occurs mainly during the early phases of the food supply chain—at the production, post-harvest and processing stages—when food intended for human consumption is destroyed, degraded or otherwise unused. It can negatively impact food security because it is often the result of inefficient uses of supply chain resources and deficient national infrastructure.
- Food loss is more of an issue in developing countries given weaknesses in their food supply chains. It constrains food security by reducing the availability of nutritious food.
- Food waste differs from food loss and occurs during the final stages of the supply chain—distribution and consumption—when food is discarded.
- Food waste is more common in high-income, developed countries and does not cause food insecurity, but rather is the result of higher food availability and greater food security.

In an annual assessment of global hunger in 2013, the Food and Agriculture Organisation (FAO) of the United Nations reported that that “the world produces enough food to feed everyone”, yet at the same time an estimated one in eight people, or some 870m, suffer from chronic undernourishment.

1. At the centre of this gap between production and consumption are food loss and waste, which occur throughout the globe’s countless food supply chains.

Food loss poses tremendous problems for national food systems. At a minimum it represents the wastage of resources, including the land, water, labour and power used to generate food. It also reveals deficiencies within a country’s food supply chain (FSC), which create areas that may be restricting access to food.

Reduced access to food is one of the negative factors for food security. When food supply chains break down and food supplies become less physically or economically accessible, it is often the most vulnerable who are affected. Supply-chain wastage is a pernicious problem, and whether from insufficient storage for wheat or lack of efficient transfer from field to market, food loss indicates structural problems in the agricultural infrastructure necessary for food security.

The many consequences of food loss—whether to food security, the economy or the environment—and its causes vary significantly among regions, stages of the FSC and types of food products that are lost. To better comprehend the impact of food loss on food security, this special report by The Economist Intelligence Unit (EIU) explores how to measure the costs of food loss; it assesses where and when losses occur and examines the relationship between food loss and the Global Food Security Index (GFSI).

Measuring food loss and its costs

Measuring food loss is complicated, owing both to poor data availability and to the many ways in which the magnitude and costs of food loss can be assessed. Various measurement approaches focus on different aspects of loss, and accordingly reveal different costs of—and concomitantly different solutions to—food loss. Three main approaches consider loss in terms of weight, caloric level and economic cost. By quantifying food loss from these dissimilar perspectives, the nature of food loss can appear to be starkly different.

The most direct, and most commonly used, measure of food loss is weight. The total tonnes of food lost provide a sense of the magnitude of the problem. For instance, the most widely cited estimate of global food loss, as published by the FAO in 2011, indicates that “roughly one-third of food produced for human consumption is lost or wasted globally, which amounts to about 1.3 billion tonnes per year”.

However, considering food loss in terms of tonnes of food is difficult to assess—even the FAO figures rely on significant assumptions given the lack of global data—and is blunt and imperfect; it does not distinguish between types of food. Under this measure, a tonne of celery is

equivalent to a tonne of beef. Weight-based measures do not account for water, which constitutes a large component of many foods' weights. Nutritional content also fails to be captured by such an approach: in terms of food security, the loss of more nutrient-rich food products is arguably of greater concern than the loss of less nutritious ones.

Accordingly, caloric-based measures have sometimes been employed. Aggregate weights, by food type, can be converted into caloric estimates.

What is food loss?

The concept of food loss is seemingly straightforward, yet it is underpinned by considerable complexity and there is little consensus regarding its definition. In general, food loss occurs when edible food products are lost (left in the field or through spillage, for example), destroyed or discarded (processing, quality control), degraded (contamination, improper packaging) or consumed by pests at some stage during the food supply chain.

1. Most definitions of food loss consider reductions in quality, such as wilting or bruising, in addition to reductions of quantity. However, some organisations, including the FAO, go beyond this basic definition and include the diversion of food originally meant for human consumption to other uses, such as bio-energy or animal feed. This diversion of food represents a reduction in the planned food supply and may indicate poor planning or inefficiencies in the agricultural system

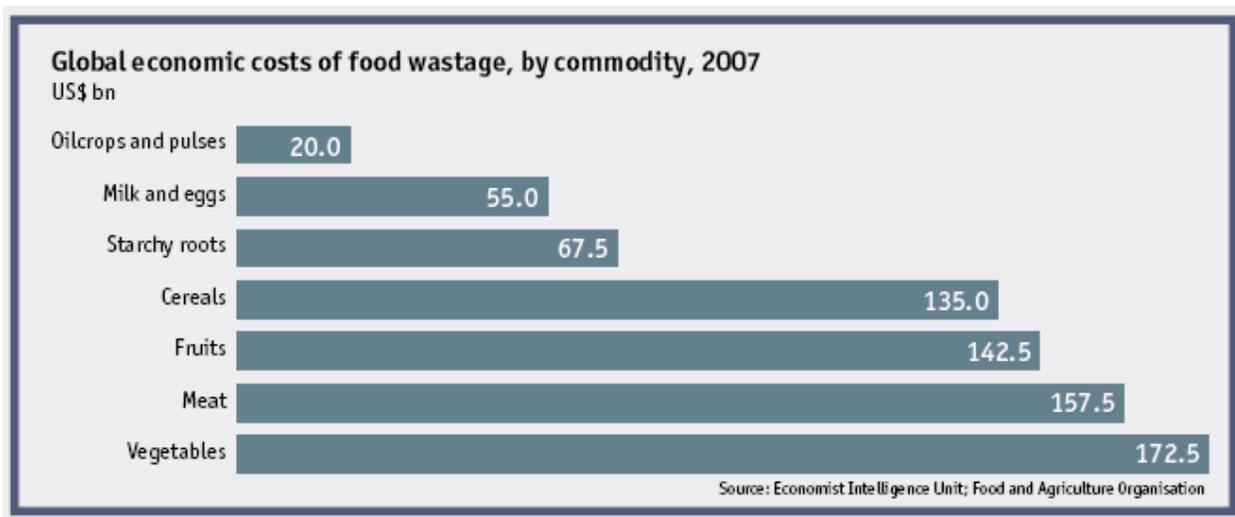
.2 Likewise, while most definitions only consider edible food loss, non-edible food loss—the loss of parts of food that are generally not consumed, such as bones, eggshells and apple cores—is sometimes considered. Even if non-edible food loss is excluded in principle, the physical difficulty of separating it from the edible portions of food loss often means that data sources are unable to distinguish the two issues in practice.

3. There is also a meaningful difference between the concepts of **food loss** and **food waste**. Whereas the former captures losses in the food supply chain that occur from harvesting through processing, food waste addresses losses that occur during distribution and consumption. Thus food waste explores consumer behaviour (including retail and wholesale distribution) and addresses different problems than food loss, which examines infrastructure and other structural aspects of the food supply chain. Each concept has a very different relationship with food security. This distinction is used throughout this report economic cost. By quantifying food loss from these dissimilar perspectives, the nature of food loss can appear to be starkly different.

The most direct, and most commonly used, measure of food loss is weight. The total tonnes of food lost provide a sense of the magnitude of the problem. For instance, the most widely cited estimate of global food loss, as published by the FAO in 2011, indicates that “roughly one-third of food produced for human consumption is lost or wasted globally, which amounts to about 1.3 billion tonnes per year”

However, considering food loss in terms of tonnes of food is difficult to assess—even the FAO figures rely on significant assumptions given the lack of global data—and is blunt and imperfect; it does not distinguish between types of food. Under this measure, a tonne of celery is equivalent to a tonne of beef. Weight-based measures do not account for water, which constitutes a large component of many foods’ weights. Nutritional content also fails to be captured by such an approach: in terms of food security, the loss of more nutrient-rich food products is arguably of greater concern than the loss of less nutritious ones.

Accordingly, caloric-based measures have sometimes been employed. Aggregate weights, by food type, can be converted into caloric estimates.



In 2013, for example, the World Resources Institute (WRI), a US-based global research organisation, found that “cereals comprise the largest share of global food loss and waste by caloric content—53%”. When considering calories, the US is particularly wasteful, losing or wasting an estimated 1,520 calories per person per day. Europe and developed Asia lose or waste less than half that amount, or fewer than 750 calories per person per day.

3. Despite inevitable data limitations, a calorie-based approach provides a better measure of the potential impact of food loss on individuals’ health. Nevertheless, a calorie-based approach only measures food loss in terms of the caloric energy lost, and not the nutritional quality of food lost, thus missing an estimation of a key aspect of food security.

While these approaches can be used to assess the direct costs of food loss, they do not fully capture some broader costs. More expansive approaches attempt to quantify food loss in economic terms. Overall, the economic costs of food loss are generally thought to be massive.

The FAO estimates that food worth over US\$750bn—based on 2009 producer prices—is lost or wasted annually. The economic cost approach also reveals different problems than other measures of food loss. Meat, for example, only accounts for a small share of wastage by

weight, but has considerable economic costs owing to its high production costs.

4. Similarly, environmental measures provide a perspective to understanding the problems of food loss. Brian Lipinski of WRI's Food, Forests and Water Programme, states that "even calories are not the best measure" because of the ways in which food loss impacts other issues.

5. WRI cited several significant costs to the environment, including the drain on natural resources, such as water and cropland, indicating that "food loss and waste are associated with approximately 173 billion cubic meters of water consumption per year... [and] 198 million hectares [of cropland] per year".

6. The inefficient use of resources can hurt food security, particularly in poorer countries that, for instance, have limited access to potable water or volatile agricultural production.

Measuring food loss through multiple lenses provides a more nuanced understanding of the drivers and wider implications of this issue. While cereals, for example, have significant nutritional costs, their environmental costs are lower than those of meat. This may imply that when dealing with the nutritional-quality aspects of food security, stakeholders should focus on cereal loss, whereas environment-related aspects may be better understood by analysing the FSCs of meat. By using such a multifaceted approach, policymakers and stakeholders can develop a more robust appreciation of the causes and ramifications of food loss and its impacts on food security.

What is happening to our food? The food supply chain

The FSC summarises the complex series of processes from the cultivation of food through consumer use. While FSCs differ across the globe, they can generally be broken down into five basic steps: production operations, post-production operations, processing operations, distribution and consumption. The amounts and causes of food loss differ depending on both

the stage of the FSC and the level of development of the geographical region under consideration. WRI states that data on food loss “suggest that efforts to reduce food loss and waste should focus on stages ‘close to the farm’ in most developing regions and focus on stages ‘close to the fork’ in developed regions”.

7. The first major stage of the FSC—agricultural production—encompasses the harvest of grains, vegetables and fruits and the breeding of animals. However, even before the harvesting process begins, food loss can occur owing to weather or pests. During the harvest, losses are frequently caused by mechanical damage and spillage. Food loss during the production phase also includes crops that are separated and removed post-harvest because they are unsuitable for consumption, often owing to the presence of pests or rot. While these losses technically occur during the growing phase, they are harvested and thus considered part of losses incurred during the production process. For meat, including cow, pig and poultry products, loss at the production stage generally entails animal death during breeding. Milk production loss accounts for decreased milk production own.

8. Globally, the largest losses occur during agricultural production, or “in the field”.

Production food loss is often caused by a combination of poor education, farming methods (including improper handling, inefficient harvesting methods and premature harvesting) and infrastructure. Pests, disease, overplanting (often motivated by the uncertainty of weather) and labour shortages also contribute to losses at this stage.

Food produced is then stored and transported until it is ready to be processed, which is broadly defined as post-harvest handling, storage and transport operations. For vegetables and milk products, losses are generally caused by degradation—the break-down of enzymes in products owing to temperature, moisture and oxygen content, which causes deterioration and spoilage — and spillage.

9. For animal products, including meat, losses at this stage include premature death, particularly during transport to slaughter and, in the case of fish, spillage and degradation during icing, packaging, storage and transport.

10. Post-harvest handling and storage food loss is often directly correlated with production loss, and many of the same causes apply during post-harvest. Improper handling of food, underdeveloped and insufficient infrastructure and inefficient agricultural procedures play a particularly large role during post-harvest handling. Because they are highly perishable and require extremely efficient production and post-harvest systems to minimise loss, fruits, vegetables, roots and tubers have the highest proportion of loss globally during the first two stages of the FSC, especially in warm and humid climates.

11. Accordingly, the primacy of vegetables, roots and tubers, such as cassava and potatoes, in developing countries' diets results in high food losses during production.

12. This diet, combined with agricultural infrastructure difficulties, including poor and underdeveloped harvesting mechanisms and processes, insufficient storage facilities, deficient transport systems and inadequate processing and packaging, contribute to developing economies experiencing the highest levels of food loss during these stages of the FSC.

The third stage of the FSC—processing—encompasses both domestic and industrial processing, and includes such operations as pasteurisation, canning preparation and packaging. Processing losses are mainly caused by spillage and degradation. Loss may also occur if food—or parts of food—is not suitable for processing and is thus discarded during preparation (washing, peeling or slicing) or is improperly processed. For instance, during juice production, once the juice of a fruit or vegetable is squeezed, the pulp is typically discarded. Trimming spillage and processing spillages for processes such as smoking or canning account for the majority of animal product food losses during this stage.

13. Global food loss during processing is low compared with other stages of the food supply chain. According to the FAO, there is little difference between the number of tonnes lost during processing in the countries with the highest overall levels of loss—the developed economies of Asia—and those with the lowest overall levels of loss—North America and advanced economies in the Pacific region. Additionally, development levels have little bearing on the amount of food lost at this stage.

14. More efficient processing systems in advanced economies tend to minimise food loss, despite larger quantities of food being processed, while high levels of loss relative to a smaller volume of processed food drive similar loss levels in developing countries.

While spillage and degradation are the primary causes of food loss throughout all the earlier stages of the FSC, once food enters the market system for the fourth stage of the FSC—distribution—spoilage and excess supply become the main drivers of food loss.

In the final phase—consumption—food enters the household or food establishment, where it remains until either eaten or thrown away. Much of the food loss that occurs during distribution and all of the food loss that occurs during consumption is consumer loss, which is typically acknowledged as food waste rather than food loss. Given the uncertain relationship with food security, food waste is not included in the GFSI's measure of food (see box on page 39 for details).

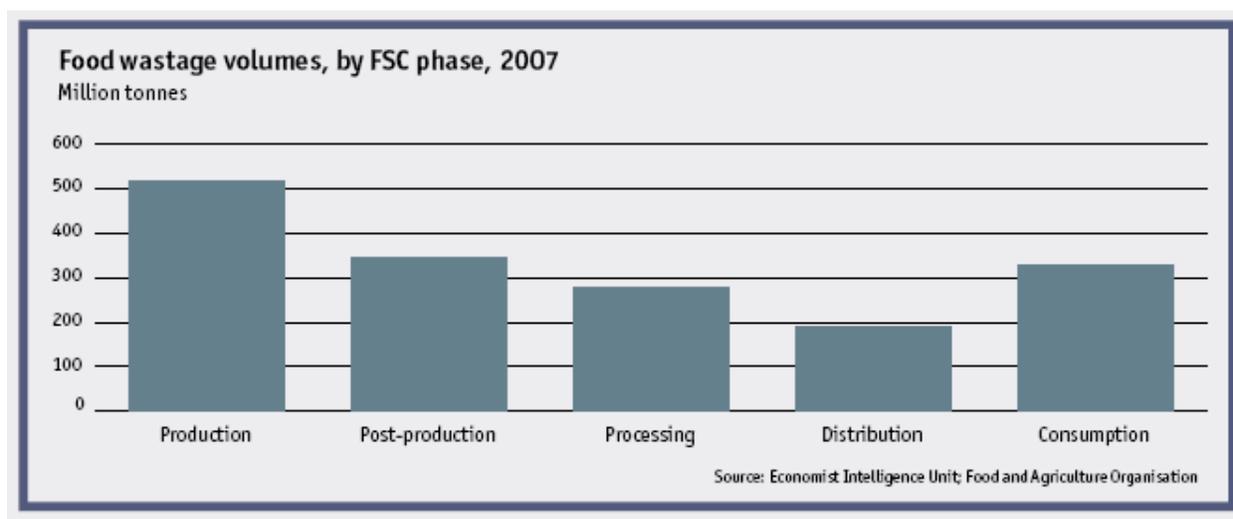
Food waste during consumption is a product of different issues than supply-chain food loss.

Food waste is mainly a phenomenon of the developed world, although it is also present throughout some of the richer areas of the developing world, including parts of Latin America, Asia and North Africa.

15 Higher incomes and food availability, which make food more dispensable, drive food waste in developed countries.

16. Food waste often occurs because people prepare too much food or food spoils before it is consumed. This dynamic speaks to the substantial role that income has on determining when food loss (as well as food waste) occurs in the FSC and what drives it. In food-insecure countries, where there is a dearth of food, food waste is less likely to occur because of the limited supply of food. Food is consumed when it is available or degraded food is consumed without being wasted. Food loss thus often represents failures within a country's infrastructure and within the FSC, thereby contributing to greater food insecurity. By contrast, food waste may

be more appropriately understood as a symptom of a generally wealthier, food-secure environment that has surplus resources.



Food loss in developing countries

Developing countries in Africa, Asia and Latin America experience considerable difficulties early in their FSCs, mainly owing to the lack of necessary infrastructure.

17. Approximately 70-80% of food losses in these countries occur during early stages of the FSC and many low- or lower-middle-income countries lose more than 7% of their food supplies before distribution and consumption. Divine Njie of the FAO's Agro-Food Industries Group says that "perishable products such as fruits, vegetables, milk, meat and fish pose the biggest challenge" for developing countries owing to the considerable obstacles in bringing them to market.

18. These obstacles, which coincide with early-stage FSC challenges, are a product of inadequate harvest techniques, poor post-harvest management, lack of necessary infrastructure

(both storage and transport), inefficient processing and defective packaging, as well as public market information systems that deal inefficiently with price information and consumer preferences.

19. Additionally, developing countries often have underdeveloped cold chains for food preservation during transport and storage. Sufficient cold storage capacity is essential to deliver fresh food and vegetables to market with minimal loss owing to spoilage. The Postharvest Education Foundation, a US-based non-profit public charity, explains that “fresh foods continue to metabolise and consume their nutrients throughout their shelf life, from harvest or slaughter through packing, distribution, marketing and sale”.

20. The nutrients in both animal and vegetable products, when exposed to inappropriate temperatures, undergo degradation that results in reduced quality or quantity of food. This introduces deleterious food security risks by reducing the supply of food and diminishing its nutritional content.

The scale of agricultural production is also a factor. A non-industrialised agricultural sector generally produces small quantities of food at comparatively high prices, which exacerbates the economic impact of food losses. Small-scale farming has a higher risk of food loss during this first stage of the FSC in many developing countries. Smallholder farmers see a higher percentage of food loss during cultivation and harvest owing to the agricultural methods they employ and the small-scale nature of their crop production.

21. By contrast, large-scale farmers, who use more efficient production methods owing to the scale of their operations and access to better inputs, can produce larger volumes at relatively low costs. Their access to proper seeds, fertilisers and machinery minimises losses early in the FSC.

The high levels of food loss during the early stages of the FSC contribute to the inadequate food supply that plagues a large portion of the developing world. According to the GFSI, nearly 70% of the lowest-performing countries in sufficiency of supply are low-income countries. Compounding this are the financial access issues faced by large portions of the populations—

smallholder farmers are generally net purchasers of food, and income and prices are major factors.

Another notable FSC trend in developing countries is that these economies experience a combination of high levels of food loss and low levels of food waste. For example, according to a recent FAO report, although South and South-east Asia have the second-highest levels of global food loss, accounting for approximately 25% of global food loss, their food waste is minimal. Food loss constitutes nearly 80% of all food wastage—loss plus waste—in the region.

22. The majority of Asia, which tends to be poor, suffers from infrastructure problems, including poor-quality roads, hot and humid weather (which drives early spoilage) and poor packaging, all of which result in large quantities of food lost during production, storage and transit.

23. While the economies of Asian countries are expanding rapidly, this economic expansion has not yet resulted in improved agricultural infrastructure and methods, although some Asian farmers have begun using fertilisers and farming ploughs. It has also not raised incomes sufficiently to drive high levels of food waste in most Asian countries.

Furthermore, the benefits of economic growth in Asia have been unevenly distributed across populations, limiting the food supply for the majority of people, a problem exacerbated by substantial food loss early in the food supply chain.

24. This issue exists across all developing regions. Sub-Saharan Africa, the poorest of the regions, despite low overall agricultural production, has high food loss. However, the region also has the lowest food waste, in tonnes, owing to a dearth of food. The insufficient food supply in the region means that even if food has undergone degradation or gone bad by the time it reaches the consumer, it is likely to be eaten anyway.

Food waste in developed countries

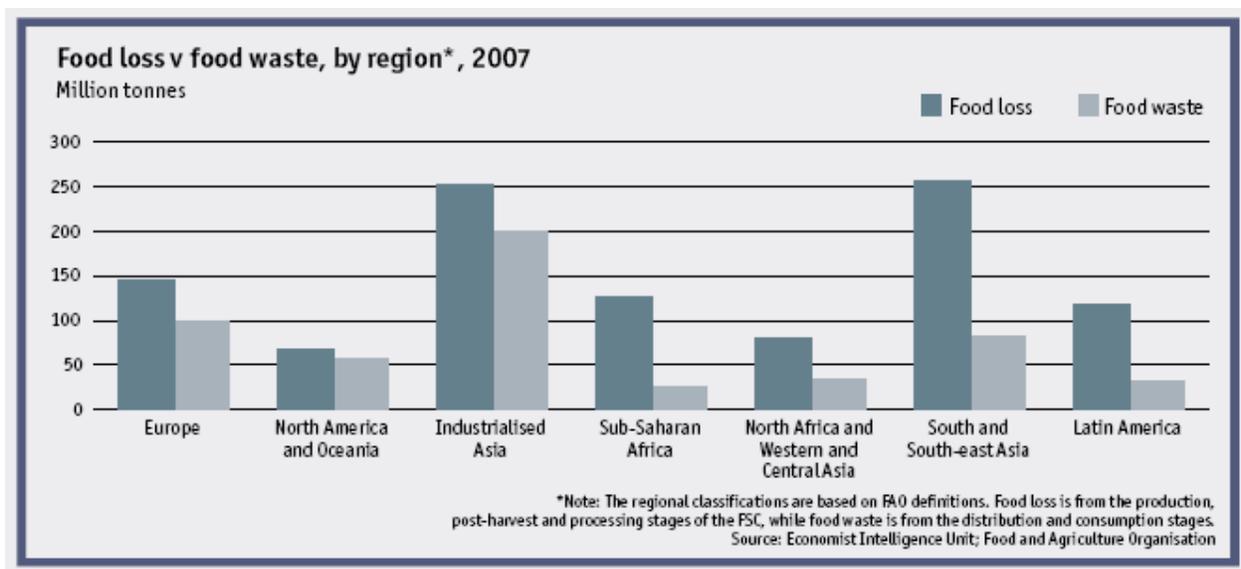
Advanced and high-income countries face a very different set of food loss and waste problems. In general, most food loss here is actually in the form of food waste occurring at the end of the

food supply chain in grocery stores, restaurants and households. The US Department of Agriculture (USDA) estimates that 31% of food intended for human consumption at the retail and consumer level in the United States was wasted in 2010.

25. In Europe, 89m tonnes, the equivalent of 180 kg per head, are wasted between processing and consumption every year, according to the EU statistical service Eurostat.

26. According to the FAO, the quantity of food that is thrown away every year in industrialised countries (222m tonnes) almost matches the 230m tonnes of food produced in Sub-Saharan Africa, which demonstrates the stark contrast that exists between food waste in the richest parts of the world and food insecurity in the poorest.

27. Developed countries do not lose as many fresh fruits and vegetables during the earlier stages of the FSC as a result of their significantly more robust cold-chain capacity. Additionally, advanced harvesting mechanisms, infrastructure that ensures efficient storage and transport and competent processing techniques minimise loss between the agricultural production and distribution phases. Among developed regions, North America and Oceania are more efficient than Europe, since east European countries have mildly less developed agricultural infrastructures.



28. However, substantial loss does occur in developed economies during later stages of the FSC. According to the FAO, Europe, North America and Oceania have the highest levels of food waste globally, behind industrialised Asia. These regions have the highest levels of GDP per capita, the highest disposable incomes and the most developed grocery sectors, and thus more food to waste. Despite the fact that many industrialised countries in Asia have significant early-stage FSC food loss owing to inadequate infrastructures, their high levels of physical and financial access to food also yield high levels of food waste.

As a share of the population, North America and Oceania have the highest waste and loss per capita, at just under 350 kg of food wastage per person, while Europe has only slightly less.

29. High per-capita food waste is largely a product of the higher levels of food security in North America and Oceania. Because food security is driven by many factors—including wealth, adequate food supply and access to safe and nutritious food that has not undergone degradation—many consumers in developed countries have the luxury of being able to waste food.

In developed economies, consumer behaviour is a main driver of food going to waste. Two of the most common causes of food waste occur when too much food is cooked, prepared or served (observed in large portion sizes in restaurants) or when food is not used in time.

30. In addition to planning issues that prevent food from being used in time, poor comprehension of food date labelling results in extensive food waste. The Food Law and Policy Clinic (FLPC) at Harvard Law School believes that the average American household discards edible food worth between US\$275 and US\$455 per year owing to confusion over date label terminology, including “sell-by” and “best if used by.”

31. Lack of awareness or knowledge of efficient food use, such as appropriate storage, and cultural attitudes that undervalue food compound the problem.

32. Consumers are not the sole contributors to food waste in developed countries: retailers and companies such as wholesalers and packaged-goods firms also yield considerable waste. Emily Broad Leib, director of Harvard's FLPC, notes that perceived product liability risks and poor tax incentives deter food companies from donating unsellable products.

33. While there have been few lawsuits involving date labels, the industry still operates in a cautionary environment that encourages food companies to be overly conservative in their decisions about food donations. The US has a robust system of food banks, and these reduce food waste by accepting donations from food companies, but the tax incentives for donating are minimal and do not offset the perceived risks.

Planning for agricultural loss can also contribute to food waste in developed economies. The need to balance the anticipated impacts of natural disasters, such as bad weather and pest attacks, and consumer demand results in more crops being produced than are required. Given that FSC systems in advanced economies are extremely efficient and there is little food loss during the early stages of the supply chain, these surplus quantities often make it to the end of the FSC, where it is easy and inexpensive for consumers to waste.

