





Critical Transition 6.

Reducing Food Loss and Waste

 Reducing Food Loss & Waste	 Better Futures Additional Investment Requirements 2030 (USD billions)	 Better Futures Business Opportunity (USD billions)	 Economic Prize from Hidden Cost Reductions (USD billions)	
	2030	2030	2030	2050
	\$30	\$255	\$455	\$1,100

Food loss and waste refers to food and its associated inedible parts that is intended to be consumed by people, but that leaves the supply chain somewhere between being ready for harvest or slaughter and being consumed. It includes food that is not eaten by consumers and is disposed of by them.¹¹⁵ By weight, approximately one-third of all food produced is lost or wasted. By calories, food loss and waste runs to an estimated 24 percent.¹¹⁶

The direct economic losses associated with food loss and waste are estimated at \$1.25 trillion.¹¹⁷ Further to this, lost and wasted food is responsible for an estimated eight percent of greenhouse gas emissions, consumes a quarter of all water used by agriculture, and wastes an area of land the size of China.¹¹⁸

Strategies for reducing food loss and waste are central to transforming food and land use systems because of their potential impact. They could reduce greenhouse gas emissions, reduce the pressure on climate, water and land resources, and create financial savings for farmers, companies and households. They could also help to deliver nutrition-sensitive food security. For example, a 35 percent reduction in post-harvest loss of tomatoes in the Kano state of Nigeria, where 42 percent of children are Vitamin A deficient, would result in additional availability of Vitamin A for up to 1.1 million children a day.¹¹⁹

SDG12 sets a 2030 target of “halving per capita global food waste at the retail and consumer levels and reducing food losses along production and supply chains, including post-harvest losses”.¹²⁰ In line with the targets set out in the 2019 World Resources Report, *Creating a Sustainable Food Future*, this report adopts a lower level of ambition, namely a 25 percent reduction in food loss and waste by 2050. But it is conceivable that technological advances, such as technologies to extend the shelf life of perishable food and climate-smart cold storage, could enable greater reductions.

Goals and benefits

A reduction in food loss and waste would yield the following benefits.

- **Environment.** It would remove pressure to convert natural ecosystems for agriculture, with associated benefits to biodiversity, and would reduce greenhouse gas emissions and freshwater use.
- **Health.** Perishable foods such as fruit and vegetables are particularly prone to loss and waste. More than 40 percent by weight are lost or wasted worldwide. Increased consumption of fruit and vegetables is critical to healthier diets.¹²¹ Reducing food loss and waste would increase the availability of fruit and vegetables for consumption and release resources for more productive uses.
- **Inclusion.** Reducing loss and waste would reduce household expenditure on food.
- **Food security.** Reducing loss and waste would allow us to meet increased demand for food for a growing population without increasing production.

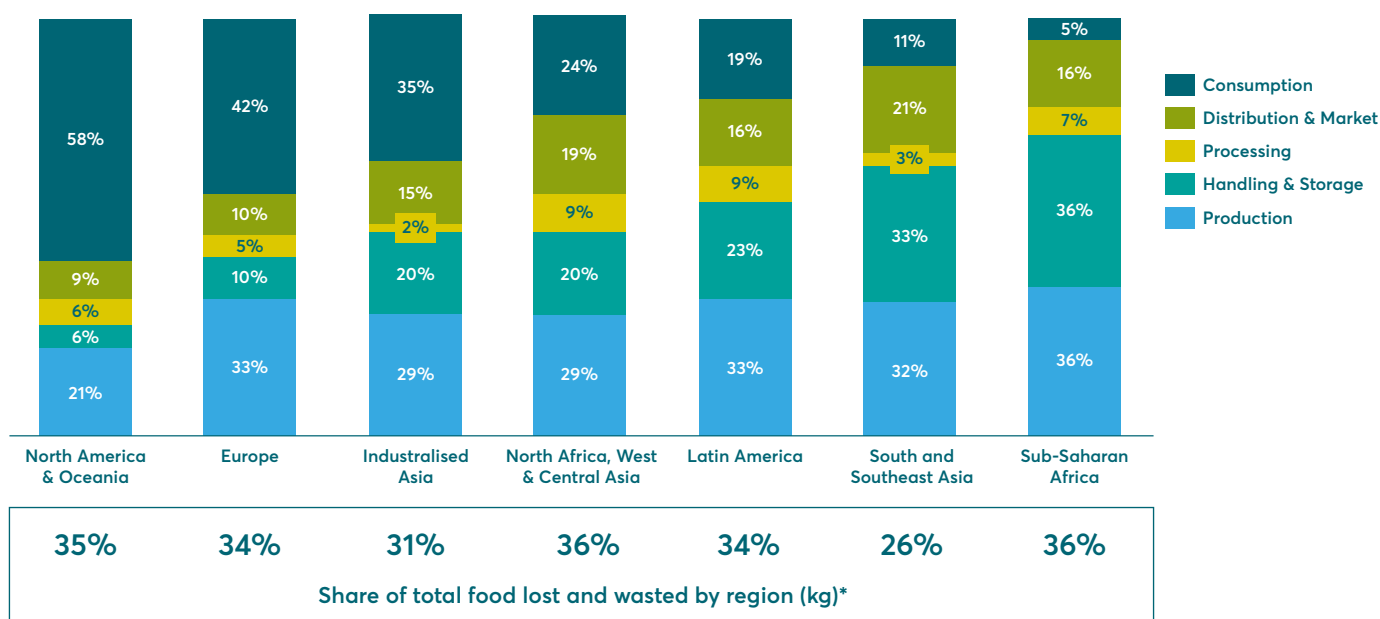
The annual economic gain from this transition is an estimated \$460 billion by 2030, and \$1.1 trillion by 2050. A reduction in economic costs of \$230 billion a year by 2030 would be the biggest driver of the gain.

The nature and scale of food loss and waste varies across geographies (Exhibit 24) and stages of the food value chain (Exhibit 25). High-income regions have a relatively high share of food loss and waste during the consumption stage. Arguably, social norms in these areas are not strong enough to encourage food efficiency, such that high earners tend to buy more food than they need. Low-income regions have a higher share of loss and waste during handling and storage, with a six-fold difference at this stage between sub-Saharan Africa and North America, probably because of poorer logistics infrastructure, especially cold storage.

EXHIBIT 24

Distribution of total global food loss and waste by region and stage across the supply chain

Share of tonnage per region (2007)

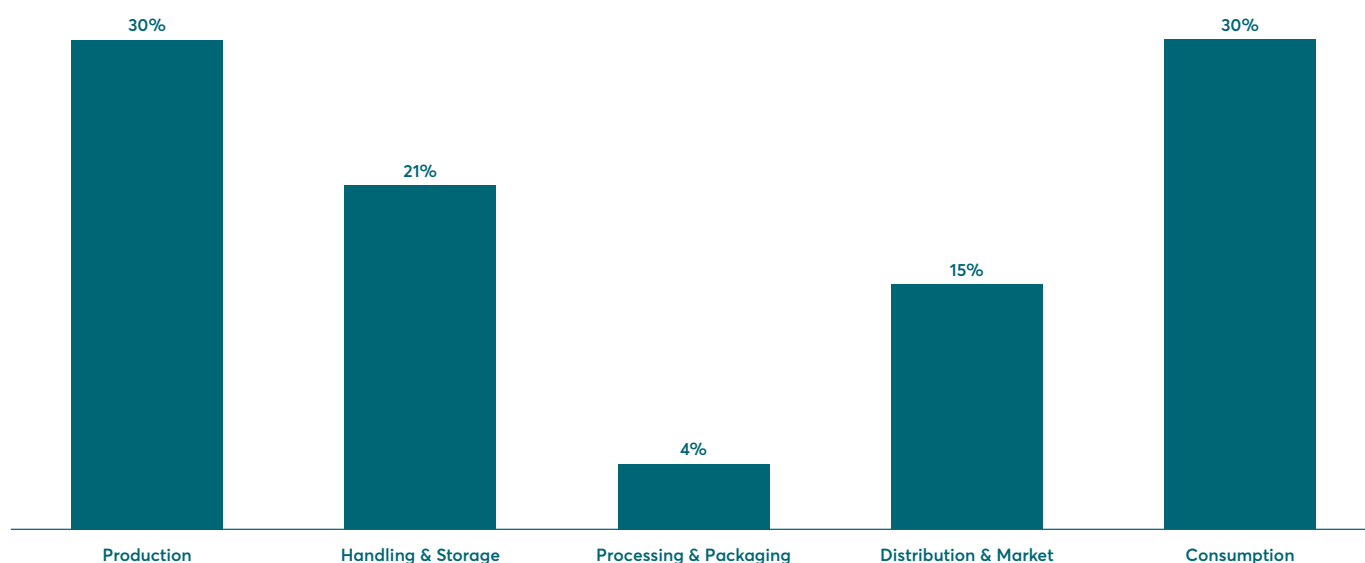


*Values displayed are of food loss and waste as a percentage of food supply, defined here as the sum of the "Food" and "Processing" columns of the FAO Food Balance Sheet
 Note: numbers may not sum to 100 due to rounding

Source: WRI analysis based on: 'Global Food Losses and Food Waste: Extent, Causes and Prevention,' Rome: UNFAO, 2011

Distribution of total global food loss and waste across the supply chain

100% = 1.3 billion tons (2007)



Source: WRI analysis based on: 'Global Food Losses and Food Waste: Extent, Causes and Prevention,' Rome: UN FAO, 2011

Many countries are already making commitments to cut food loss and waste. By early 2019, countries that are home to 49 percent of the world's population had set targets for reducing loss and/or waste in line with SDG target 12.3. A number of countries include these targets in their Nationally Determined Contributions (NDCs) under the Paris Agreement. Côte d'Ivoire, for example, has included in its NDC a target to develop efficient mechanisation of agriculture and improvements in packaging, harvesting and conservation infrastructure. It also aims to develop storage and conservation units that will reduce high post-harvest losses.

Some governments are using "sticks" to encourage corporates to reduce loss and waste. For example, France has banned supermarkets from sending surplus food to landfill and requires stores of a certain size to sign donation contracts with non-profit organisations. Failure can result in fines of up to €75,000- or two-years imprisonment.

Various countries are adjusting their regulations to enable reductions in food loss and waste. Argentina, Ghana, Italy and several states in the United States have passed legislative measures and tax incentive schemes that make redistributing surplus food easier.¹²² In 2018, the government of Ghana launched the One District, One Warehouse initiative, under which 50 warehouses will be built with capacity of 1,000 metric tonnes to provide storage for farmers and their produce. Cities are also making commitments to reduce food loss and waste. In 2018, the Pacific Coast Collaborative – comprising British Columbia, California, Oregon and Washington, and the cities of Oakland, Portland, San Francisco, Seattle and Vancouver – committed to halving food waste by 2030.¹²³

Momentum to reduce food loss and waste is increasing in the private sector as well. Some 32 of the world's 50 largest food companies (by revenue) across the food supply chain are involved in programmes that have set a food loss and waste reduction target consistent with SDG target 12.3.¹²⁴ Most are food retailers and manufacturers with headquarters in Europe or North America. See Box 31 on Olam's successful food loss initiative which resulted in significant savings for rice farmers.

Olam and YieldWise Food Loss initiative

In Nigeria, as part of an outgrower programme around Olam's commercial rice farm and integrated mill, Olam and partners have been working with around 16,700 smallholder rice farms to improve yields for the domestic market and reduce dependence on imports.

In 2018, with research partners Sustainable Food Lab and Wageningen Research Centre, Olam brought together farmers, field coordinators and women's groups to quantify rice losses as part of the Rockefeller YieldWise Food Loss initiative. A key task was to establish a complete picture of where losses occur from farm to mill. At peak harvest time, a pilot study was conducted with field observations, farmer surveys and direct value chain measurements across 80 rice farms in four states.

Average losses were estimated at 35 percent with major hotspots in the initial harvesting stages. For farmers, this equated to an income loss of about \$520 per hectare. For Olam Rice Nigeria, it was a major procurement opportunity loss, and for Nigerian consumers it was the equivalent of 97 million servings of rice. The pilot provided a testing ground on how to scale and replicate this approach and apply it to other Olam value chains and externally. During 2018, the Nigeria Rice Outgrower Initiative was recognised by the Financing for Sustainable Development Office of the United Nations as one of three high-impact success stories identified for global recognition by the United Nations Economic and Social Council.

Barriers to progress

Despite these encouraging trends, progress is too slow. There are barriers to overcome. First, food loss and waste is not yet a leadership priority in many countries or companies. Policies, including fiscal incentives and penalties, are not strong enough to drive significant changes in behaviour. In higher-income countries, food is relatively affordable, and the costs of food loss and waste are invisible to consumers. Even the catering and food services sector, which should care because food loss and waste hurt their already low margins, has been slow to tackle waste. One estimate valued food loss and waste in the hospitality and food service sectors in the United Kingdom at £2.5 billion a year.¹²⁵

In many countries, policies on food safety, quality, labelling, packaging, trade and customs, tax incentives, agricultural extension services and the use of unsold food for animal feed or energy have the unintended consequence of encouraging food loss and waste. In addition, lack of data on the volumes, value and environmental and economic consequences of food loss and waste means that governments and companies are often unaware of the scale of the problem or the opportunity it represents. Lack of detailed data means they are also unable to identify hotspots and take targeted action. Moreover, while there are smart, cost-effective solutions, most are not getting enough finance to scale fast. There may be a case for targeting concessional or blended financing at these solutions, especially for upstream and midstream losses in developing countries.

Finally, while consumers do care about food waste, the low cost and ready availability of food in higher-income countries mean that most do not yet care enough to change their behaviour. Wasting food is not yet considered socially unacceptable in the same way as smoking indoors, littering or throwing away single-use plastics.

Priority actions

This transition will be complete when avoiding food loss and waste is the norm at every stage of food value chains in every country. To make progress at the speed and scale needed, governments, business and civil society should work together on the following priorities.

Develop ambitious national strategies

Countries need to develop national strategies with explicit targets to reduce food loss and waste. Since these strategies will be implemented from end to end of food value chains, their development will require collaboration between farmers, food processors, retailers, consumers and civil society organisations. National strategies should be linked to efforts to reduce greenhouse gas emissions as part of the NDCs to the Paris Agreement. Box 32 outlines a number of successful national public-private partnerships.

BOX 32

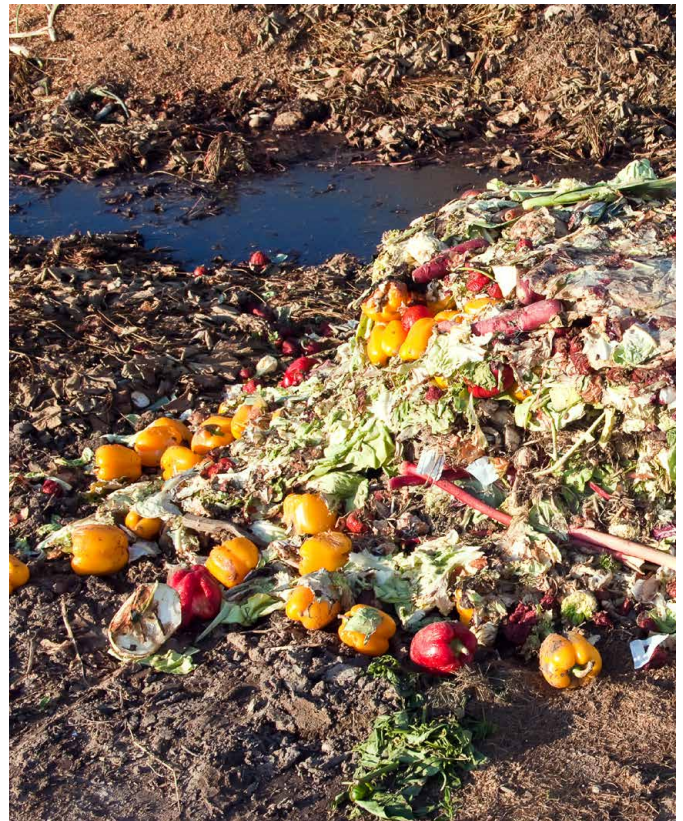
National-level public-private partnerships to reduce food loss and waste

In 2007, the UK government launched the Courtauld Commitment, a national public-private partnership for reducing food loss and waste. Between 2007 and 2012, the United Kingdom achieved a 21 percent reduction in household food waste. Over the period, the total cost of implementing the initiative was £26 million, while the total financial benefits to the government and citizens arising from it were worth £6.6 billion, a benefit-cost ratio of 250 to 1.¹²⁶

Since then, national public-private partnerships have started in a number of other countries. The United States has the Food Loss and Waste 2030 Champions group.¹²⁷ The Netherlands launched the United against Food Waste public-private partnership in 2017, as part of a national agenda to halve food waste by 2030.¹²⁸ In 2018, four EU REFRESH pilot countries – Germany, Hungary, Spain and China – launched voluntary partnerships or national platforms.¹²⁹ In Indonesia, a coalition of companies, government agencies and non-governmental organisations recently launched the Food Loss and Waste Action Partnership – Indonesia.¹³⁰ And in 2018, the Australian government launched the ten-year Fight Food Waste Cooperative Research Centre, a public-private partnership that involves 46 industry and ten research partners to investigate methods for increasing food donation and developing household and business behaviour change programmes.¹³¹

Require larger companies to report on food loss and waste

Governments can require companies above a given size to report on their food loss and waste in the same way that they require them to report annual greenhouse gas emissions. This requirement should apply particularly to the “big waste” sectors: hospitality, catering, food processing, farming and grocery retailing. Governments should help companies to measure food loss and waste by providing funding to develop open-source data tools. Companies need these to get accurate data and to value the likely return from reducing it, and thus seal the business case for the necessary investment. Companies can lead the way by being transparent about their performance, ideally measuring progress against the targets in their country’s NDCs (see action above).



Introduce more policy sticks and carrots

One policy opportunity lies in clarifying the food safety liabilities of supermarkets, restaurants and other food producers when they donate leftover food to charities. Clearer rules will encourage these businesses to contribute more. Governments can also follow France's example and take a tougher policy line. For instance, they should charge businesses significantly more for sending food waste to landfill (partly because of the methane emissions associated with organic landfill waste). These charges could be directly linked to investment in more circular approaches to waste management, ensuring that food that is no longer fit for human consumption goes to the highest-value alternative use, either animal consumption or composting for fertiliser.

Adopt voluntary corporate targets

To drive progress on national strategies, leading businesses, especially in big waste sectors, can commit to voluntary food loss and waste targets across the value chain. One approach is a "10x20x30 campaign". At least ten large downstream corporates commit to food loss and waste targets. They engage their own 20 largest suppliers to do the same, with a shared goal to halve loss and waste by 2030. This approach uses the concentration of large companies in these sectors to advantage, harnessing their scale and market power to drive change up the supply chain and across geographies. Tesco, the United Kingdom's largest supermarket chain, pioneered the approach in 2017 when it encouraged 27 of its major suppliers to establish targets, measurements and actions.¹³²

Corporates can also collaborate with peers to roll out food loss initiatives across the supply chain (see Box 33 on the food loss resolution from the Global Agribusiness Alliance).

Food loss resolution from the Global Agribusiness Alliance

The Global Agribusiness Alliance (GAA) comprises leading agricultural companies and aims collectively to tackle the environmental and social challenges facing agricultural supply chains and rural communities. In 2017, GAA members adopted a voluntary resolution to halve their food and agricultural losses by 2030, and to work with suppliers and customers to the same end, a target aligned with SDG target 12.3.

Step up business innovation

As well as meeting corporate responsibilities, business has a strong commercial incentive to innovate. The opportunities arising from reducing loss and waste across the value chain are worth \$255 billion a year.¹³³ One company pursuing them is Royal DSM which has created Pack-Age, a product for the cheese industry that allows cheese to mature without developing a rind that has to be thrown away.¹³⁴ Meanwhile, Protix uses food waste to feed insects for high-value protein for animal feed (Box 30 in critical transition 5). It operates in 12 countries and expects to employ over 100 people by the end of 2019.

Technology companies are also interested. Winnow, a UK tech start-up, helps chefs and catering businesses across 40 countries to reduce food waste by using artificial intelligence techniques to guide clients in adjusting menus and correcting portion sizes. The company claims that kitchens using Winnow typically see food waste halve in 12 months, saving its customers \$33 million.¹³⁵

Apps too are being used. For example, OLIO, a UK-based tech start-up with over 1.2 million users, connects neighbours with one another and with local businesses so that surplus food can be shared rather than wasted. They report having shared nearly two million portions of food, saving the equivalent of five million car miles of greenhouse gas emissions.¹³⁶

Scale private and philanthropic investment

While there are promising examples of private finance flowing to food loss and waste ventures, the potential to scale investment is enormous. Improving efficiency in value chains in developing countries is one opportunity attracting interest. For example, ARCH Emerging Markets Partners is a private equity organisation currently raising \$100 million for an east Africa cold-chain solutions fund. Through this venture, ARCH aims to help prevent fresh produce from perishing, raise rural incomes and enhance regional food security at the same time as making global exports a possibility for its storage clients.

From a commercial perspective, the venture is tapping into rapidly growing food demand and agribusiness activity in the region. Similarly, the World Bank and Fukoku Mutual Life Insurance Company has recently launched a \$300 million Sustainable Development Bond focused on reducing food loss and waste.¹³⁷ Financial institutions are also using investment roundtables and competitions to boost progress on this transition. For instance, in 2018, Rabobank hosted Food Loss Challenge – Asia, an investment competition for start-up enterprises.¹³⁸

Private philanthropy could greatly increase its grant-making and investment impact from what is currently a very low base. Financing income-sensitive, climate-smart storage technologies could be a priority. The governments of Australia, Canada, the United Kingdom and the United States have partnered with the Bill and Melinda Gates Foundation to establish AgResults, a \$145 million initiative that uses pay-for-results prize competitions to encourage



the private sector to invest in high-impact agricultural innovations. The \$12 million AgResults Kenya On-Farm Storage Challenge Project, which ran from 2012 to 2018, reached nearly 329,000 smallholder farmers in Kenya and sold over 1 million improved storage devices, resulting in approximately 413,000 metric tonnes of improved storage capacity.¹³⁹

Campaign at the grass roots

Civil society and governments should leverage behavioural science to design grassroots campaigns that engage social media, religious communities and other groups in making wasting food as unacceptable as littering has become in many countries. The aim should be to stimulate a shift in social norms as large and swift as the movement against plastic pollution sparked by the Blue Planet television series.

Civil society movements can build on the distaste for waste that already exists in many cultures. Efforts to reduce food loss and waste in Japan draw on the distinctively Japanese concept of *mottainai* or regret for wasting the intrinsic value of a resource or object. In a number of countries, bottom-up, domestic-led campaigns by civil society organisations, such as Denmark's Feedback and Stop Wasting Food, have raised public awareness of food loss and waste. These campaigns have recruited celebrity chefs and other figures whom the public respects and listens to as their spokespeople to encourage a mass shift in behaviour.¹⁴⁰

References

115. Flanagan, K., Robertson, K., and Hanson, C. (forthcoming). *Reducing Food Loss and Waste: Setting a Global Action Agenda*. Washington, DC: World Resources Institute.
116. FAO. 2011. *Global Food Losses and Food Waste: Extent, Causes and Prevention*. Rome: FAO; Kumm, M., H. de Moel, M. Porkka, S. Siebert, O. Varis, and P.J. Ward. 2012. "Lost Food, Wasted Resources: Global Food Supply Chain Losses and Their Impacts on Freshwater, Cropland, and Fertiliser Use." *Science of the Total Environment* 438: 477–89.
117. SYSTEMIQ analysis. See Technical Annex for full source list.
118. FAO. 2015. *Food Wastage Footprint & Climate Change*. Rome: FAO.
119. Gain Health. n.d. "Key Achievements.". Available online at: <https://www.gainhealth.org/programs/postharvest-loss-alliance-for-nutrition/#key-achievements>.
120. See: <https://champions123.org/target-12-3/>
121. FAO. 2011. *Global Food Losses and Food Waste: Extent, Causes and Prevention*. Rome: FAO.
122. Michail, N. 2019. "Argentina's Food Waste Law Incentivizes Industry to Donate Surplus." Food Navigator LatAm.com, April 17. Available online at: <https://www.foodnavigator-latam.com/Article/2019/04/17/Argentina-s-food-waste-law-incentivizes-industry-to-donate-surplus>; Lemos, L. 2018. "How Governments around the World Are Encouraging Food Waste Initiatives." Winnow Solutions. Available online at: <http://blog.winnowsolutions.com/how-governments-around-the-world-are-encouraging-food-waste-initiatives>; Zero Waste Europe. 2016. "The Italian Recipe against Food Waste.". Available online at: <https://zerowasteurope.eu/2016/10/the-italian-recipe-against-food-waste/>; Gunders, D., and J. Bloom. 2017. *Wasted: How America Is Losing up to 40 Percent of Its Food from Farm to Fork to Landfill*. New York: Natural Resources Defense Council. Available online at: <https://www.nrdc.org/resources/wasted-how-america-losing-40-percent-its-food-farm-fork-landfill>
123. C40. 2018. "C40: 23 Global Cities and Regions Advance towards Zero Waste.". Available online at: https://www.c40.org/press_releases/global-cities-and-regions-advance-towards-zero-waste. Accessed January 3.
124. Flanagan, K., A. Clowes, B. Lipinski, L. Goodwin, and R. Swannell. 2018. *SDG Target 12.3 on Food Loss and Waste: 2018 Progress Report*. Washington, DC: World Resources Institute.
125. WRAP. 2013. *An Overview of Waste in the UK Hospitality and Food Service Sector*. Banbury, UK: WRAP.
126. Hanson, C., and P. Mitchell. 2017. *The Business Case for Reducing Food Loss and Waste*. Washington, DC: Champions 12.3.
127. USDA (United States Department of Agriculture). 2018. "U.S. Food Loss and Waste 2030 Champions." November 6. Available online at: <https://www.usda.gov/oce/foodwaste/Champions/index.htm>.
128. REFRESH. 2018. "Dutch Taskforce Connects Initiatives against Food Waste.". Available online at: <https://eu-refresh.org/dutch-taskforce-connects-initiatives-against-food-waste>.
129. REFRESH and WRAP Global. 2019. *Building partnerships, driving change - A voluntary approach to cutting food waste*. Available online at: <http://tinyurl.com/va2019fw>
130. Flanagan, K., Clowes, A., Lipinski, B., Goodwin, L. and Swannell, R. 2018. *SDG Target 12.3 on Food Loss and Waste: 2018 Progress Report*. Washington, DC: WRI.
131. Fight Food Waste CRC. 2018. "Our Programs and Projects.". Available online at: <https://fightfoodwastecrc.com.au/our-programs-and-projects/>.
132. Flanagan, K., Robertson, K., and Hanson, C. 2019. *Reducing Food Loss and Waste: Setting a Global Action Agenda*. Washington, DC: World Resources Institute.
133. SYSTEMIQ analysis. See Technical Annex online for full source list.
134. See: <https://www.dsm.com/markets/food-specialties/en/products/dairy/PackAge.html>
135. UBS. 2019. *The food revolution. The future of food and the challenges we face*. Available online at: <https://www.ubs.com/global/en/wealth-management/chief-investment-office/our-research/discover-more/2019/food-revolution.html>
136. See: <https://olioex.com/about/>
137. See: <https://www.worldbank.org/en/news/press-release/2019/03/20/world-bank-and-folksam-group-join-global-call-to-action-on-food-loss-and-waste>
138. See: <https://www.rabobank.com/en/press/search/2018/20181012-rabobank-food-loss-challenge-asia-announces-20-startups-for-the-pitch-day-in-singapore.html>
139. See: <https://agresults.org/projects/kenya>
140. Askew, K. 2018. "It's Going to Require Openness and Courage: Nestlé, Unilever, Arla, Salling Join Danish Push to Halve Food Waste." Food Navigator.com. Available online at: <https://www.foodnavigator.com/Article/2018/08/16/Danish-push-to-halve-food-waste>.