REDUCING CONSUMER FOOD WASTE using Green and Digital Technologies

Fact sheet

Why this report?

The world is facing a food-waste crisis. It is estimated that 931 million tonnes of food were wasted by households, retailers, restaurants and other food services in 2019. Around 61% of this waste occurs within households.

Reducing food waste offers multiple benefits for people and the planet, contributing to improving food security, cutting pollution, saving money, reducing the pressures on nature and climate, and creating opportunities for economy and society. It is for this reason that the UN's Sustainable Development Goal (SDG) 12.3 sets a clear target of halving per capita global food waste by retailers and consumers by 2030.

The UN Food Systems Summit in 2021 highlighted innovation as the key to transforming the way food is produced and disposed of. Green and digital technologies are playing an increasing role in reducing consumer food waste and driving food consumption towards more sustainable patterns. Cities in both developed and developing countries are well positioned to harness new opportunities arising from green and digital technologies.

What's it about?

UNEP DTU Partnership and United Nations Environment Programme present the results of the project 'Build Back Better: Using Green and Digital Technologies to Reduce Food Waste at Consumer Level in a new report.

The report analyses the causes of consumer food waste and the opportunities for reducing it through different means: behavioural change, technological solutions, and public and private initiatives to mitigate the problem. It also gives a thorough presentation of how green and digital technologies could be used to reduce consumer food waste and what could be done to further unlock this potential.

By combining global research cutting across multiple disciplines with city case studies, it aims to provide a comprehensive and integrated approach to support countries and cities in combating food waste and in Building Back Better a more sustainable economy. This fact sheet summarizes the main lessons from the report in terms of the state of food waste, its implications for SDGs and the key messages.

The full report can be downloaded **here**

UNEP DTU PARTNERSHIP

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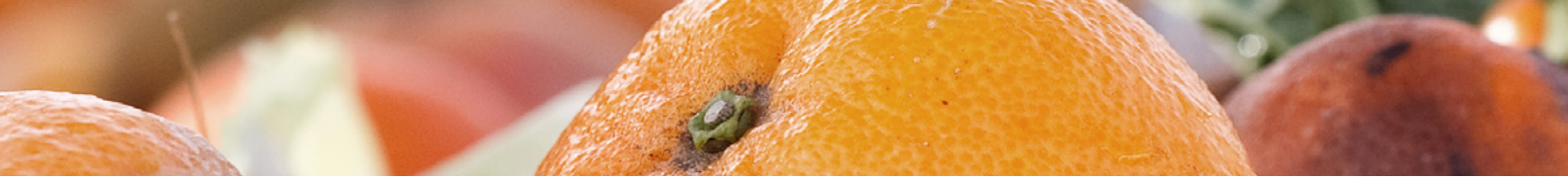


State of food waste and its consequences

In 2019, 931 million tonnes of food were wasted globally by households, retailers, restaurants and other food services, amounting to 17% of the total food available to consumers according to estimates in UNEP's Food Waste Index Report. This waste is occurring while 690 million people are affected by hunger, and three billion are unable to afford a healthy diet, numbers which have been rising sharply under COVID-19. Global annual waste generation is expected to rise from 2.01 billion tonnes in 2016 to 3.40 billion tonnes over the next 30 years, a trend that is especially strong in developing countries in Asia and Africa. Food-waste generation can be expected to follow a similar trend and geographical pattern unless concerted action is taken.

The substantial amount of food that is lost or wasted every year also has major environmental implications in terms of climate change, loss of biodiversity, freshwater, marine and air pollution, and the use of land and water resources.

In terms of economy, the estimated costs of food loss and waste totals US$ 1 trillion per year with environmental costs amounting to US$ 700 billion and social costs to US$ 900 billion (at 2012 prices).

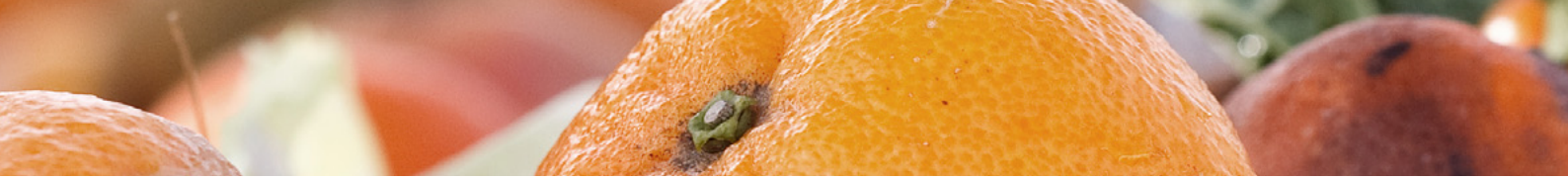
This makes food waste a key action area for sustainable development as well as for economic efficiency.

FOOD WASTE IS A GLOBAL PROBLEM

The UNEP Food Waste Index Report published in 2021 found that in nearly every country that has measured food waste, it is substantial, regardless of the income level of the country (see below table). Lower-middle-income countries have higher waste rates than countries with higher income levels. This is a surprising finding because previous narratives suggested that household food waste was a problem limited to high income countries, leading to slower action in middle- and lower-income countries than would be merited.

Income group	Average food waste (kg/capita/year)		
	Household	Food service	Retail
High-income countries	79	26	13
Upper middle-income countries	76	Insufficient data	
Lower middle-income countries	91	Insufficient data	
Low-income countries	Insufficient data		

Average food waste by World Bank income classification. There are relatively small differences in household food waste between countries at different income levels, with lower-middle-income countries having the largest rates. Source: UNEP Food Waste Index Report, 2021.



Implications for the SDGs

SDG 12.3 calls for a halving of food waste by retailers and consumers and a reduction of food loss across supply chains by 2030. The delivery of this target helps countries reach numerous other SDGs, from Zero Hunger to Climate Action, including Life on Land, Life under Water and Sustainable Cities.

Food waste affects several environmental, economic and social SDGs. Food-waste prevention and recycling efforts can create jobs and incomes, but associated costs and benefits may be unequally distributed across genders, age groups and social classes.

The UN Food Systems Summit 2021 identified four 'levers of change' that have the potential to deliver wide-ranging positive change beyond their immediate focus. The four levers are human rights, finance, innovation and gender equality, which can bring about significant progress in both the transformation of food systems and the achievement of the 17 SDGs.

Comparative analysis of five cities

The report presents a comparative analysis of how five cities – Bangkok, Belgrade, Bogota, Doha and Kampala - tackle the food-waste challenge using green and digital technologies in different national contexts and from different starting points.

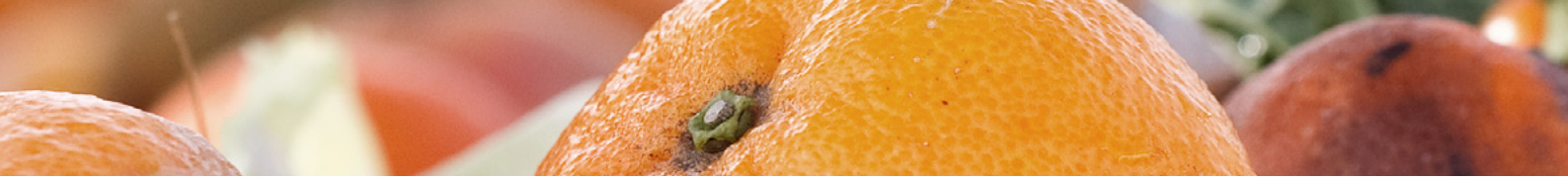
Urban areas are becoming hotspots of food waste in both developed and developing countries. The five city examples presented in the report confirm that food waste is becoming a large environmental, social and economic problem that urgently needs to be addressed.

Cities also show diversity in the patterns, drivers and factors influencing consumer food waste, including socio-economic circumstances, the food-security situation and various development statuses in respect of food consumption and supply chains. Progress has been made in improving policy frameworks, upgrading waste infrastructure, supporting green-tech based business models, and fostering partnerships across different sectors.

All five cities have identified an urgent need to raise consumer awareness of food waste and to provide more information and support to empower consumers to act on food-waste reduction.

Yet some common challenges remain to be addressed if cities are to be transformed into future innovation hubs for action on food waste:

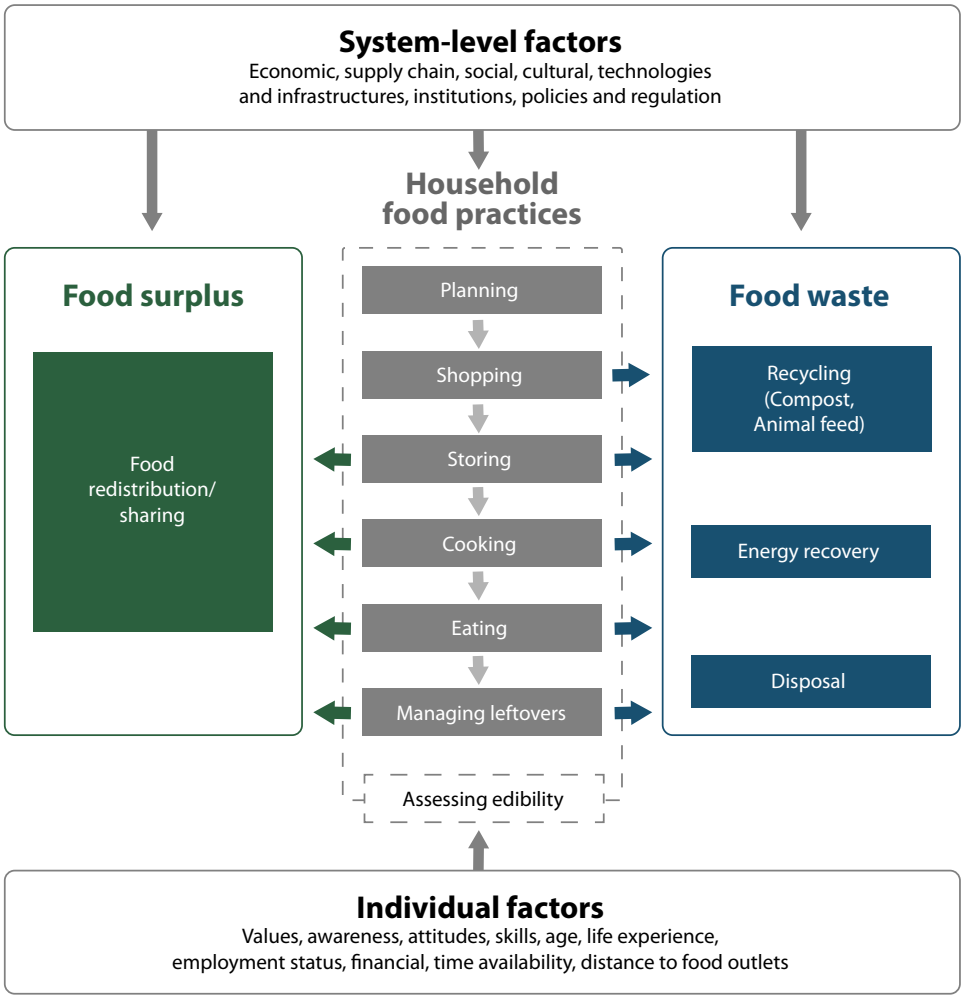
- None of the cities has an official data system to measure consumer food waste and track progress in achieving food waste-related SDG targets. Most of the data come from rough estimates based on municipal solid waste, biodegradable waste, or organic waste. There is an pressing need to fill in the gap in data collection and analysis.
- Although all five cities have policies on food waste at either the national or the municipal levels, there is a great deal of room for improving implementation and effectiveness. In order to establish accountability and transparency throughout the food supply chain, more enforceable policies are needed. Binding regulatory frameworks, mandatory standards and waste-management systems could provide clear guidelines and incentives to key actors. Efforts should also be made to remove perverse incentives that prevent actions to reduce food waste.
- While multinational companies and big retailers have become more active in introducing measures to reduce food waste, their initiatives are often based on self-reporting and voluntary commitments. This makes it difficult to benchmark their efforts and to measure their impacts. Furthermore, many of the activities undertaken by large companies and retailers focus more on reuse and recycling and less on preventing food waste.



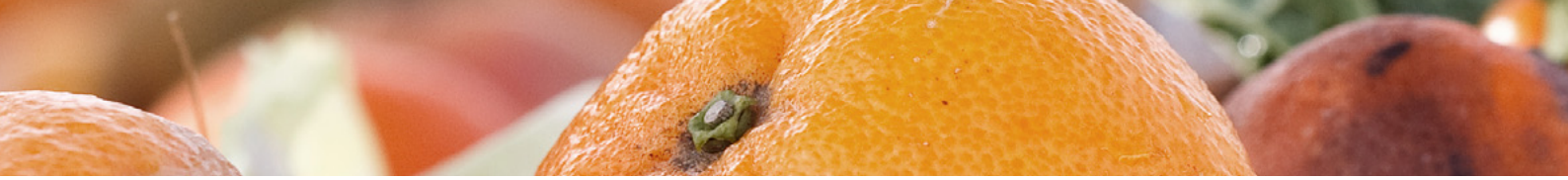
Key findings and messages of the report

UNDERSTANDING THE CAUSES OF FOOD WASTE IS IMPORTANT

- Consumer food waste is driven by factors at multiple levels (individual, household, food system, society), including attitudes, knowledge, skills, values, gender, income and living standards, markets, prices, and cultural practices, among others. These factors are embedded in the social practices, including household food practices, which make up peoples' everyday lives.
- Consumer food-waste interventions should thus take full consideration of everyday food practices and the factors that affect them and the generation of food surplus and food waste (see figure below).
- There is a large gap in data and in assessing consumer food waste, including current status, its economic, social and environmental costs, and future trends. Data for cities is even scarcer, making it difficult to diagnose the problem.



Household food practices and the links to food surpluses and food waste. Household food practices involve a range of activities, from planning and shopping via cooking to managing leftovers, each of which is influenced by system-level and individual factors.



GREEN AND DIGITAL TECHNOLOGIES AS ACCELERATORS IN FIGHTING FOOD WASTE

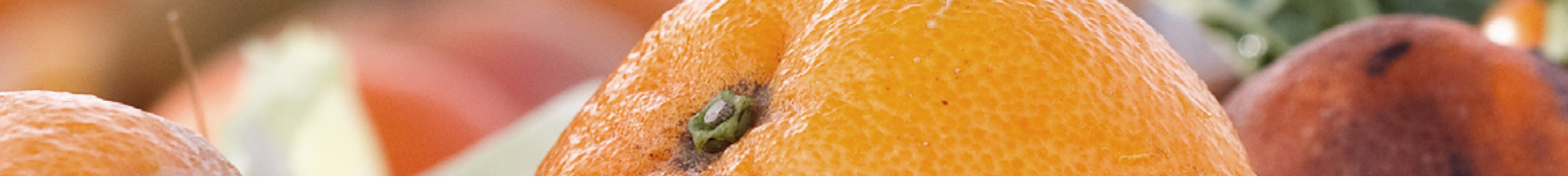
The report analyses green and digital technologies deployed in the fight against food waste, with a focus on technologies addressing the prevention and re-use of food surpluses (see below figure).

- Green and digital technologies are increasingly being used to prevent, reuse and recycle food waste, opening new opportunities for economy and society. Examples include technologies and innovations in thermal preservation, biological and bio-chemical preservation, solar-powered cold storage, active packaging, waste-to-energy and composting.
- Emerging digital technologies such as mobile applications and the Internet of Things provide innovative solutions for food-sharing, smart labelling, dynamic pricing, product traceability, intelligent redistribution, planning of shopping and meals, and smart storage.
- Technologies require an enabling environment to thrive and to fully unlock their potential in reducing consumer food waste. Most of the green tech solutions face challenges in upscaling and going beyond the 'niche market'.
- Technologies alone will not solve the food-waste problem. Instead, applied in the right way, they can work as a powerful enabler and accelerator to support initiatives and instruments led by different actors and partnerships.

PREVENTION		
Type	Function	Description
Green	Thermal preservation	*Refrigeration and cold chains*
	Biological and bio-chemical preservation	*Use of essential oils and natural extracts in active packaging*
Green + Digital	Smartphone apps: Food planning, shopping, storage & cooking	*Guide, track and inform consumers in food related choices to reduce food waste*
Green + Digital + IoT	Smart packaging	*Use of sensors and data carriers to monitor food quality*
	Smart labelling	*Use of data embedded barcodes (DEB) to improve information about food quality*
	Smart storage and disposal	*Wifi connected fridges and bins equiped with cameras and sensors to monitor food quality and food quantity*

RE-USE		
Type	Function	Description
Green + Digital	Smartphone apps: Food sharing and redistribution	*Different types of food sharing apps: Sharing for money, sharing for charity or sharing for the community*

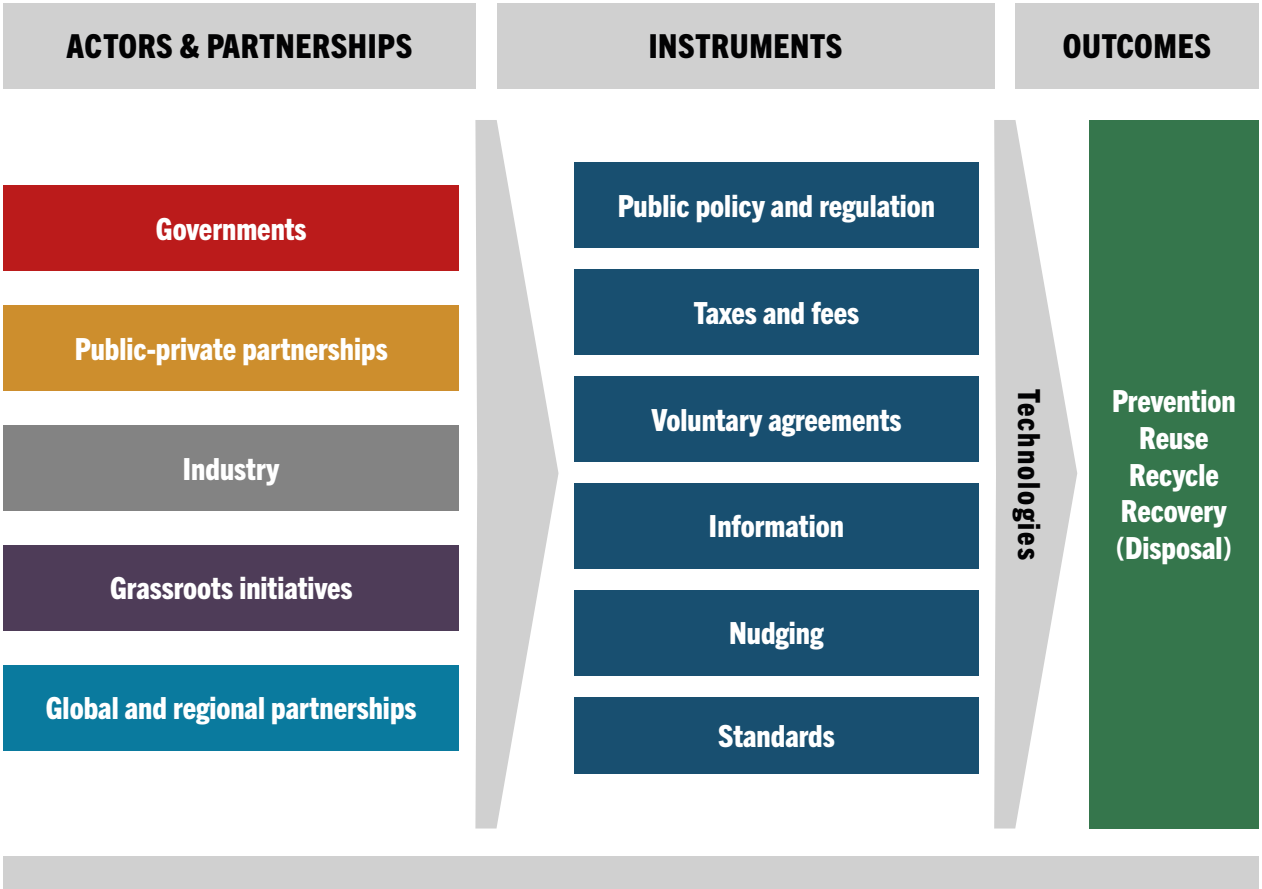
Overview of green and digital technologies addressing the prevention and re-use of food surpluses covered by the report.



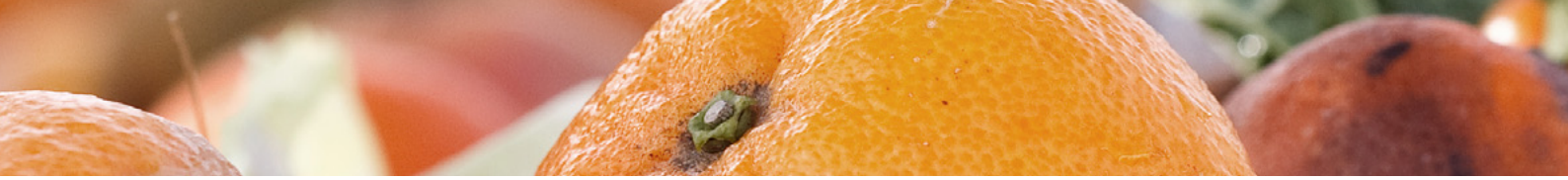
WHO DRIVES FOOD WASTE INTERVENTIONS AND HOW?

Governments are crucial in setting targets, ensuring accountability and providing incentives and support for businesses and consumers to take actions. This can be done through regulations, market-based instruments and providing waste-management infrastructure and capacity support.

- Food supply-chain actors as well as technology providers play a decisive role in influencing consumers' food-waste behaviour. Champions and pioneers are leading the way in entering into voluntary agreements between supply-chain operators, retailer-supplier contracts, traceability systems, closed-loop circular models and public-private partnerships.
- Grassroots initiatives led by communities and individuals have proved to be effective in changing people's perceptions and behaviour related to food waste.
- Consumer preferences and choices can influence business and government decisions on food waste, and consumers can contribute to wasteless, sustainable food systems if they are aware, motivated and empowered.



The main building blocks of food-waste interventions: actors and partnerships, the mix of instruments used, the role of technology in enabling and accelerating the interventions, and outcomes in relation to the food-waste hierarchy.

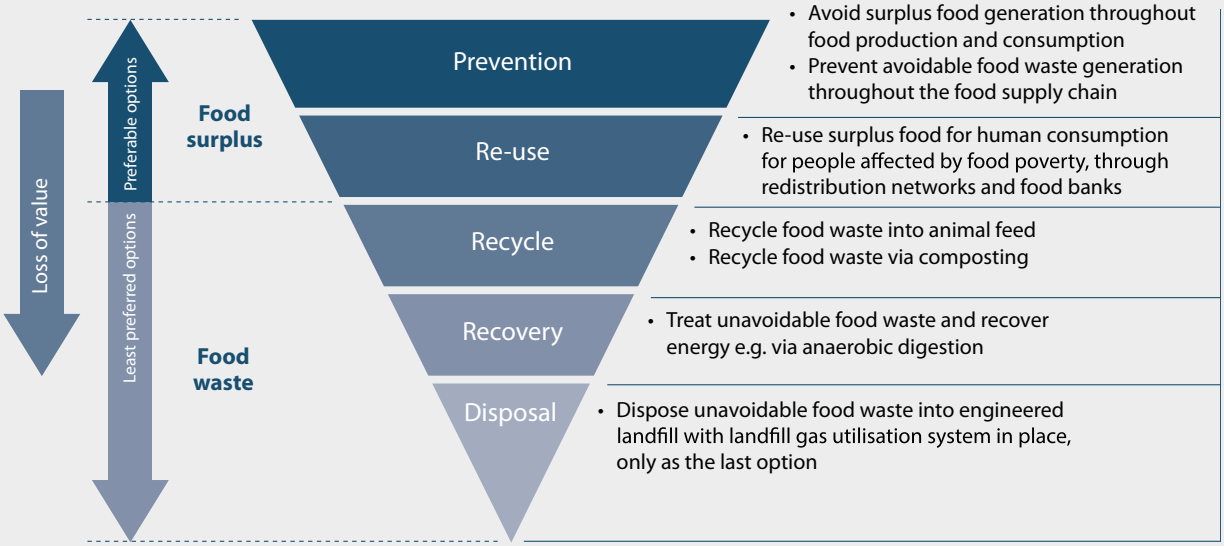


Recommendations

- Governments at all levels, businesses and civil society need to pay more attention to preventing the generation of a food surplus before making efforts of re-using surplus food, recycling food waste or recovering its energy and nutrient contents (see below box).
- Better data is urgently needed to improve our understanding of consumer food waste, to support the design and implementation of targeted interventions, and to track progress in achieving SDG targets.
- Design and implementation of food-waste interventions must be tailored to local circumstances and take fully into account everyday food practices as well as social and cultural factors such as values and norms, gender, food security, health and equality to ensure their success and impacts.
- More support is needed for small and medium-sized enterprises, local food vendors and community-based service providers in the informal sector, all of whom play an important role in waste collection and management in developing countries.
- A comprehensive and integrated approach is needed that links technology, policy, regulation, incentives, infrastructure, information and behavioural science in a way that makes them mutually supportive and complementary to each other.
- Governments at both the national and municipal levels can establish systems to measure and manage food waste, track progress in achieving SDG targets, and provide the right incentives and opportunities for changes in consumer behaviour and business practice.

The food waste hierarchy

The prevention and re-use of food surpluses have the highest priority, and include the reduction of overall food being wasted throughout the supply chain and the redistribution of surplus food that otherwise would have been wasted for human consumption. The next priority is to manage so-called unavoidable food waste in ways that ensure the recycling of the food's energy and minerals/nutrients for animal feed or through composting. An alternative option is recovery of the food's energy content through energy conversion such as anaerobic digestion and the use of the digestate for fertiliser. The least preferred option in the hierarchy is waste disposal in engineered landfills that safely manage gas and other pollutants.



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UNEP DTU Partnership and United Nations Environment Programme (2021). Reducing Consumer Food Waste Using Green and Digital Technologies. Copenhagen and Nairobi.

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