# POSSIBLE BREAKTHROUGHS
# REDUCING FOOD WASTE

Overall, about one-third of global food production is lost or wasted.[1] Food is lost and wasted throughout the food supply chain, on both the production and consumption sides. In developed countries, food is wasted to a significant extent at retailer and consumer ends, while in developing countries food is lost mostly during the production, storage and transportation stages of the supply chain.[2] Food loss and waste not only mean wasting valuable nutrition, but also wasting valuable land, water and energy. About 30% of global energy consumption is used for the production, processing, and distribution of food, while the food sector contributes more than 20% to total greenhouse gas (GHG) emissions.[3] A significant reduction in food losses and waste will have significant influence on availability of valuable energy and water resources. However, energy inputs are difficult to quantify, as different food products require different amounts. The same holds for water losses, because different food products need different amounts of water for production, processing and transportation.

[1]Gustavsson et al. 2011, [2]Ibid, [3]FAO 2011

ANNEX N

# Geography

## High-income countries

Food losses in industrialized countries are as high as in developing countries, but in developing countries more than 40% of the food losses occur post-harvest and during processing, while in industrialized countries, more than 40% of the food losses occur at retail and consumer levels. This has much to do with supermarket philosophy, cosmetic criteria leading to trimming and discarding perfectly edible food, and poor understanding by consumers of the meaning of the "use-by" date. Solutions to these unnecessary wastes include having supermarkets substitute "use-by" with "best before" dates, adjust aesthetic criteria for food selection, and avoid promotional offers that encourage over-purchase. At the same time, at the consumer level, awareness campaigns should be pursued to inform on the health benefits of balanced consumption and more balanced diets.

Techniques for monitoring the quality of perishables from right after they are harvested until they reach the store are in the making (see box 1).

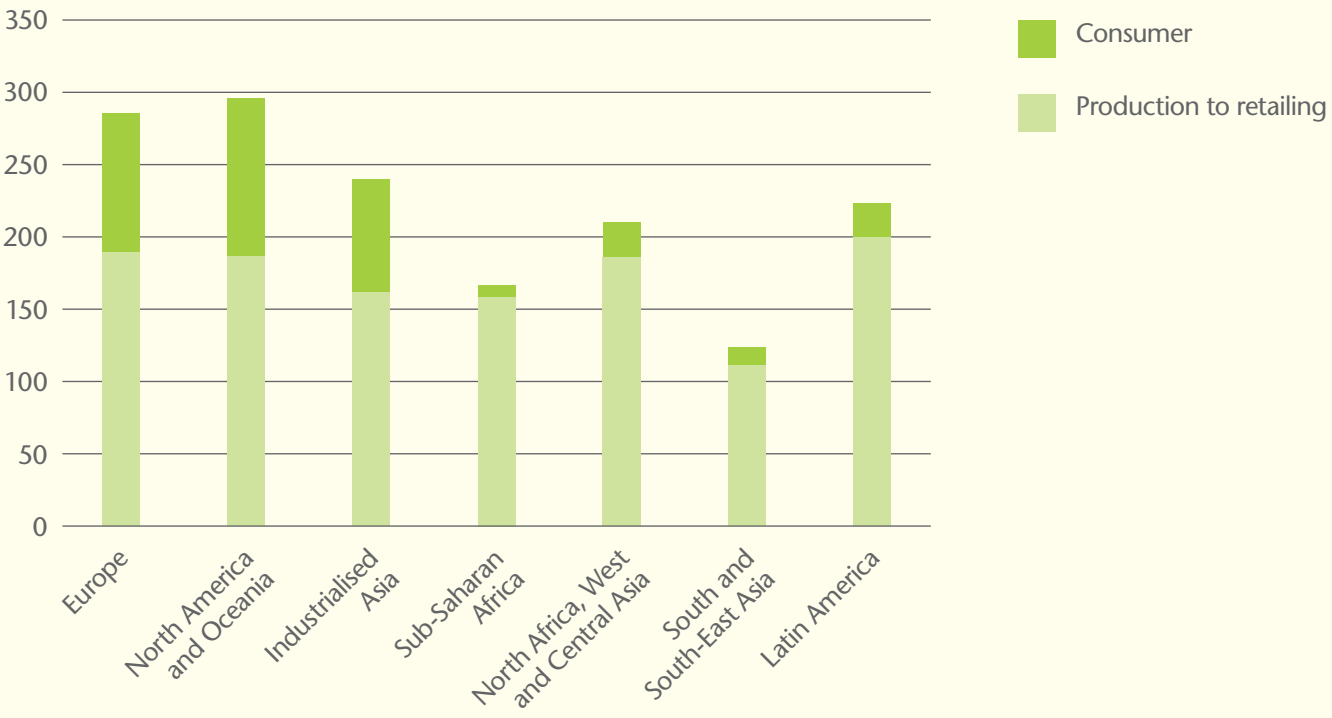
## Low-income countries

Food losses in developing countries are often related to deficient infrastructure and facilities for harvest, storage, processing and transport. Already in the field, as much as 50% of the production can get lost because of harvest failures due to lack of labor or machinery and/or inadequate protection against adverse weather conditions and pests (e.g. rodents, birds). Measures to reduce field wastage therefore include: increased protection against pests and climate vagaries; the availability of mechanized harvesting systems or sufficient labor; the use of appropriate boxes or baskets so as to reduce handling of crops while facilitating transport through to consumers.

Secondly, properly designed or maintained storage and processing facilities will lead to less food losses. Moreover, more equal agreements between producers and buyers, such as supply contracts, would create incentives for producers to invest in the crop and reduce over-production as a form of insurance. Available markets and infrastructure to get harvested crops to markets are also crucial factors that have to be considered. Figure 1 gives an overview of the per capita food losses and waste, at consumption and pre-consumption stages, in different regions.[4]

[4]Gustavsson et al. 2011

Figure 1
**Per capita food losses and waste, at consumption and pre-consumption stages, in different regions**




Source: Gustavsson et al. 2011

Box 1

# A chip to reduce waste

Monitoring the quality of perishables from right after they are harvested until they reach the store can reduce food waste. By placing a chip on a batch of fruits, vegetables, meat or flowers that constantly measures the environmental conditions during product transport and storage, product quality and ripening behavior can be determined more accurately and the "use by" dates can be predicted better. Also, thanks to the real-time data, the ripening process can be adjusted remotely to ensure that the product has the desired quality when it arrives in store. Wageningen UR Food & Biobased Research participated in the development of the chip. The Pasteur Project, coordinated by chipmaker NXP, has led to the production of the first prototypes. This chip has sensors that measure various environmental conditions, such as temperature, humidity, acidity, oxygen content and ethylene content. All this

information, combined with information on the product that is being transported or stored, provides details about the state the fresh produce is in. Tracking the history of the conditions under which the product was kept makes it possible to predict the future quality of the product more accurately. This information helps to find the right buyer for the product.

Fruit that has the best quality at the time of trading does not necessarily have a better shelf life than fruit that looks a little less good at that moment. To properly judge what the fruit will look like in the period to come, Wageningen UR Food & Biobased Research develops models that can predict the quality in the future based on the history of the fruit. This information can help to reduce food waste because it prevents lesser products (which might look better at the time of trading) from ending up in specialized stores with high standards. These stores might throw fruit away that a market salesman would still find acceptable to sell to his customers.

The sensors developed in the Pasteur Project are small, portable and wireless. They send information about the environment (like temperature and humidity) to a central computer. Within a few years it should be profitable to place a chip on every pallet of fresh food or flowers in order to trace the history of the products before they reach the trading grounds.

## Energy

- Per capita food waste by consumers in Europe and North America is 95-115 kg/year, while this figure in sub-Saharan Africa and South/South-East Asia is only 6-11 kg/year.[5]
- In India, it is estimated that 35-40% of fresh produce is lost because neither wholesale nor retail outlets have cold storage.[6]
- Food waste has high energy content and could thus be used for energy generation, such as through biogas digestion or hydrogen recovery. This could enhance the economic feasibility of waste treatment.[7]

## Water

- One-quarter of total water withdrawals is lost in food that never reaches consumers.[8]

## Costs and benefits

- A campaign in the UK to persuade consumers to waste less food had cost £4 million and saved British consumers £300 million.[9]
- Roughly one-third of the edible parts of food produced for human consumption gets lost or wasted globally, which is about 1.3 billion tonnes per year, corresponding to approximately US$ 1 quadrillion.[10]

[5]Gustavsson et al. 2011, [6]Nelleman et al. 2009, [7]Han and Shin 2004, [8]Hall et al. 2009, [9]Stuart 2009, [10]Gustavsson et al. 2011

## Productivity

- Production losses in developing countries are hard to estimate, but some authorities describe losses of sweet potatoes, plantains, tomatoes, bananas and citrus fruit as sometimes as high as 50%, or half of what is grown.[11]
- Food waste at the consumer level in industrialized countries (222 million tonnes) is almost as high as total net food production in sub-Saharan Africa (230 million tonnes).[12]
- Reducing waste would decrease food demand by about 10%.[13]
- The total amount of cereals transformed into biofuels in 2008-2009 was less than half the quantity wasted worldwide.[14]
- Smil[15] found that the food saved by curtailing waste by 20% just at retailer and consumer levels corresponds to at least 100 million tonnes of grain, which could feed the world's malnourished nearly four times over.
- Hall et al.[16] found per capita food waste in the US has progressively increased by 50% since 1974, reaching more than 1,400 kcal per person per day, or 150 trillion kcal per year.

## Climate change

- In addition to the wasteful consumption of fossil fuels for food production and the direct impact of fossil fuels on climate change, food waste rotting in landfills produces substantial quantities of methane – a gas with 25 times more global warming potential than $CO_2$.[17]

[11]Kader 2005, [12]Gustavsson et al. 2011, [13]Connor and Minguez 2012, [14]Stuart 2009, [15]Smil 2004 [16]Hall et al. 2009, [17]Hall et al. 2009

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