It's time

to end food waste

What needs to be done.
What could be done.
What is done.

4 Agricultural production
Imagine a 100% harvest

8 Post-harvest
Saving food after harvest: The buried treasure

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The amount of food we waste every year equals to 9 billion fish, 1 trillion bags of potatoes, 75 million cows, 574 billion eggs, 763 billion boxes of pasta, 3.7 trillion apples and enough olive oil to fill 11,000 Olympic size pools. The world needs to produce in the next 40 years the equivalent of all of the food produced in the last 10,000 years."

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IT'S TIME TO END FOOD WASTE
A special publication by AgroPress of Switzerland with support from TOMRA Sorting Solutions Food.

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The world's 'dumbest problem'

Agriculture is the world's most globalized industry. A large share of food travels thousands of kilometers, is handled by hand, by complex machinery, treated with extreme care, packed, cleaned, shipped, displayed - and then?
And then about 30% of this extremely complex product gets thrown away.

Almost a third of food produced worldwide is never eaten, leading to an estimated 1.3 billion tons of food waste each year. This includes around 45 percent of all fruit and vegetables and 20 percent of meat.

By calculations of the Natural Resources Defense Council, a family of four in the United States will throw away more than $2,000 worth of food a year. Every third apple, orange, walnut does not end up on our plate but in the garbage or in a landfill. Of this waste, over half (54 percent) is lost in upstream processes, including agricultural production and post-harvest handling. The other 46 percent is wasted in processing, distribution and consumption.

Why do we throw away food?

Food waste is a 'modern' problem: Only 70 years ago the notion of throwing away food was nearly unthinkable. Every part of meat would end up as nutrition – fresh, in a soup, in salads, canned, preserved, or processed. The final leftovers were used for other purposes such as packaging, clothing, and heating. Compost was the last resort. Some people even argue that food waste was intentionally 'created' by the supply chain to sell more produce, fertilizers, pesticides, seeds and machinery. Food waste does not add to our quality of life or well-being.

We need food, but we do not need food waste.

How and where do we waste food?

Food is wasted during production and harvesting:
Not applying the right seeds, irrigation, pruning, fertigation, crop protection leads to immense losses. A lot of agricultural products are not harvested, harvested too early or too late.

Food is wasted in the post-harvest process:
Food is lost because of improper treatment after harvesting, incorrect storage, sorting and packaging.

Food is wasted in during transport:
A lot of food gets dumped because of wrong labelling, transport failures, incorrect orders or simply by neglect.

Food is wasted on the retail level:
Retailers and caterers are throwing away raw materials and processed food in large scales.

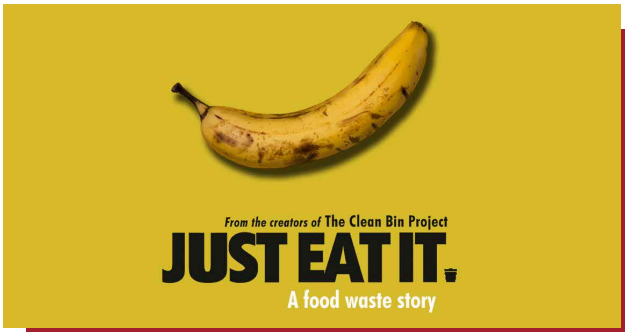
Food is wasted during consumption:
How much food do you discard from your fridge every week? The losses amount to millions of tons every year.

The good news:
The good news: People are finally taking notice. And there are lots of solutions on the horizon, from smart harvesting to auctioning leftovers in your fridge. Entrepreneurs are developing extremely creative ways in this 'war' against food waste.

Reducing food waste makes the food industry more sustainable.
Reducing food waste will be essential to feed a growing world population.
Reducing food waste can improve margins of growers, processors, shippers, traders and the retail community.

You will see some of the most exciting findings and solutions on food waste on the following pages.

Jens Breuer
Editor



Who'd have thought that a documentary about scavenging would serve up so much food porn? In their hugely entertaining "Just Eat It," Canadian filmmaking couple Grant Baldwin and Jenny Rustemeyer conduct an experiment to eat only discarded food for six months, highlighting an environmental crisis evidently fed by wasteful North American eating habits, but in a cheeky, accessible way.

Imagine a 100 % harvest

Food is wasted or lost long before a consumer gets to see it. But isn't it natural that losses occur during agricultural production? Preventing food waste on the farm level looks a bit different from what you expect.

It is probably the most difficult decision of any farmer to give up his crop – parts of it or entire orchards due to bad product quality or pests. Sometimes agricultural products simply are not harvested or dumped immediately because they do not match the requirements of their clients. It is the first place where food waste occurs in the food supply chain.

Usually farmers have already spent considerably on the 'lost' product: Seeds, water, fertilizer, pesticides and of course – manual labor. In consequence, avoiding food waste in agricultural production is directly connected with maximum efficiency.

There are two ways to solve the problem:

1. Reduce the amount of damage to the food product in the orchard

2. Use all the food that is being produced – regardless of damages or pests

How can the amount of damaged food be reduced?

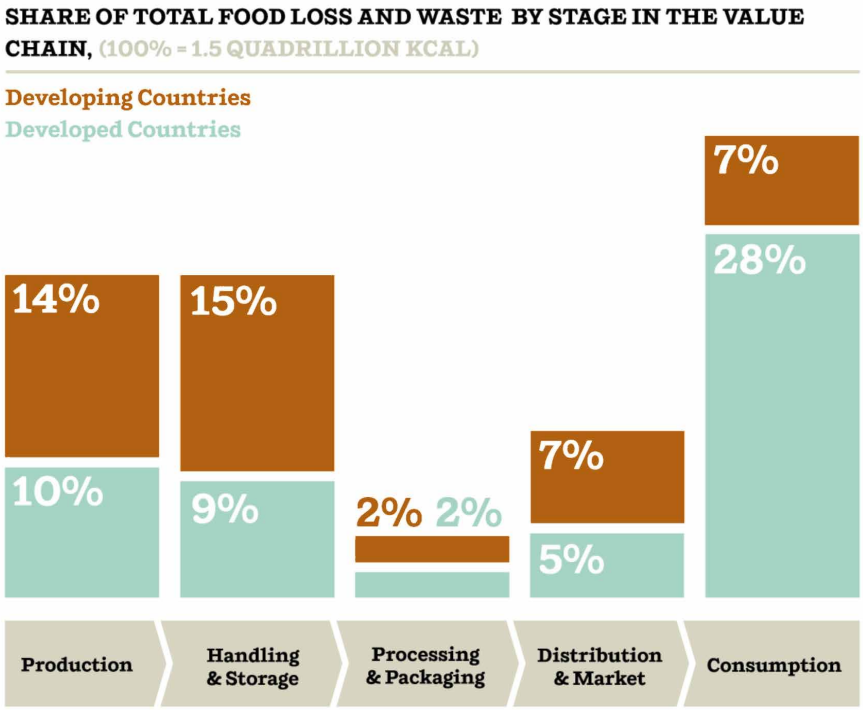
For thousands of years man has tried to raise the percentage of edible food per hectare – from pruning to development of efficient seeds and the application of fertilizers and pesticides. Crop protection is as old as crop production. Throwing away was an accepted part of the work. But now we live in the times of precision agriculture – and drones, satellites and agribotics: We can dream again of a 100% crop.

Preventing loss by precision treatment:
Satellites and drones can tell us exactly where water and inputs are needed. Algorithms combine satellite imagery, weather forecasts, soil sensors to exactly plan individual treatment – sometimes for every plant and every tree. All this allows higher yields and lower impact: "Autonomous tractors carrying herbicide sprayers coordinating with drones equipped with weed-detection systems have proven to save up to 75% of the herbicide.
Autonomous tractors equipped with on-board weed detection systems are able to kill 90% of weeds on a field," says Birgit Schulz from Deepfield Robotics

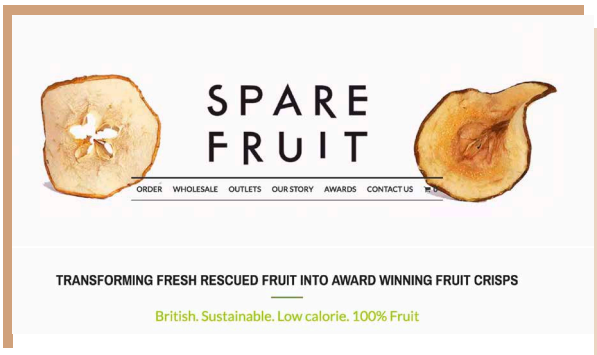
How can all the food be used?

For the time being many consumers will prefer spotless, uniform fruit, vegetables and meat. While many retailers and their sustainability departments have started so-called 'Ugly food' initiatives campaigning for food that is in perfect physiological state and plant health but does not meet aesthetic standards the initiatives are no perfect solution.

So what happens to carrots, apples and grapes that would be rejected by retailers and shoppers?



The ideal farm: Close to consumers, sustainable with embedded cooling solutions



Spare Fruit give farms a fair price for perfectly fresh and beautiful fruit that would otherwise go to waste, to help them become more sustainable both environmentally and financially. Sometimes the fruit is simply the wrong shape, size, color or even too plentiful - but it still goes to waste. What Spare Fruit does is take away the fruit and turn it into a healthy fruit crisp snack. The crisps are low calorie, 100% fruit and have no artificial additives. Launching in August last year, Spare Fruit has already managed to save over 15 t of fresh fruit from being wasted and has sold thousands of bags of fruit crisps in the process.

Inadequate processing and packaging

Capacity development, availability of raw materials and technologies, and access to modern energy and markets.

Lack of transportation and distribution systems

Capacity for transport, infrastructure and logistics.

Inadequate storage facilities and techniques

Capacity development, access to energy, inputs, investments and market information.

Sustainable food systems provide safe and nutritious food for human consumption and contribute to climate resilience

Food loss measurement and prevention at local, national, regional and global level

Production and harvest losses

Sustainable technical, social, economic and environmental practices and training. Coherent investments for short, medium and long term returns.

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Food and Agriculture Organization of the United Nations

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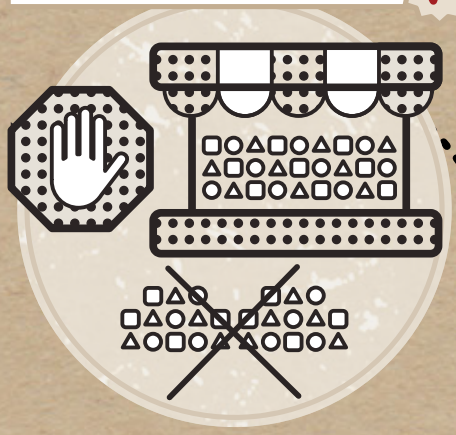
Production and harvest waste

Effective planning, contractual agreements and networks for recovery of safe and nutritious food.

Wholesale and retail systems inefficiencies

Adequate planning, management, labelling, and marketing.

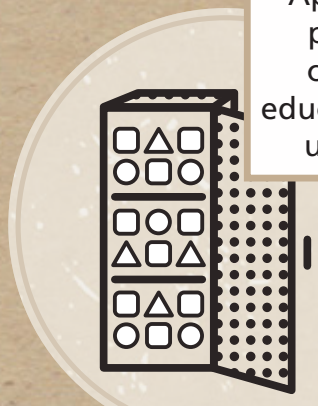


Safe and nutritious food available for human consumption prevented from becoming waste and discard

Informed behaviour, sustainable consumption/production, partnerships

Hotels, restaurants, catering and households waste

Appropriate planning, consumer education, food utilisation.



Food waste and discards along supply chains

Prevent and reduce safe and nutritious food removal from supply chains. Reduced impact on climate change.

#foodwaste #foodloss

fao.org/platform-food-loss-waste

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Saving food after harvest:

The buried treasure

Harvesting a mango or avocado in a place far away from shopping malls and supermarkets and presenting it weeks later perfectly ripe for consumption is an effort that involves an incredible amount of energy, work and inputs. The system only works when all available systems and skills are working properly. Here is where we stand and what is possible.

How does food waste occur after harvesting?

Harvest losses have several causes, including bad timing and poor conditions during the harvest as well as inadequate treatment and equipment. Similarly, lack of good infrastructure for transportation, storage, cooling and marketing cause food to spoil, especially in hot climates. There are very different reasons for losses in the supply chain in different parts of the world: In developing countries food gets lost because of lack of knowledge and availability of technology. In the developed world food gets wasted mainly because food needs to be 'perfect' - and oversupply.

How can we eliminate food waste in the post-harvest process?

Better storage:
In Tanzania, for instance, nearly 40% of all grains are lost due to poor storage, costing the East Africa nation USD 332 million in revenues every year. In South Africa, despite increased production of food, 13 million people go to bed hungry partly because of inadequate storage facilities. Improved rice-storage bags in the Philippines have helped cut losses of that staple grain by 15 percent. In West Africa, use of solar dryers to extend the shelf life of fruit and tubers is showing promise in reducing post-harvest losses.

Better cooling:
India suffers losses of up to 5.7bn USD in fruit and vegetables each year due to the absence of effective technologies to keep produce cool. Despite being the world's largest banana producer, it holds just 0.3% of the global banana market. Better cold storage, education about food handling and improved infrastructure could help grow the trade of banana containers from 3,000 to 190,000 annually, and benefitting more than 34,000 smallholder farmers across India. Better cooling alone could make India the biggest player in the global banana market. A recent study predicts a 10-fold reduction in greenhouse gas emissions from food waste if developing countries had the same level of cold chain implementation as the developed world.

Better sorting:
The sorting process could be regarded as an originator of food waste: According to the requirements of retailers and processors harvests are divided in acceptable and not acceptable streams. But modern food sorting can help create a variety of selections that

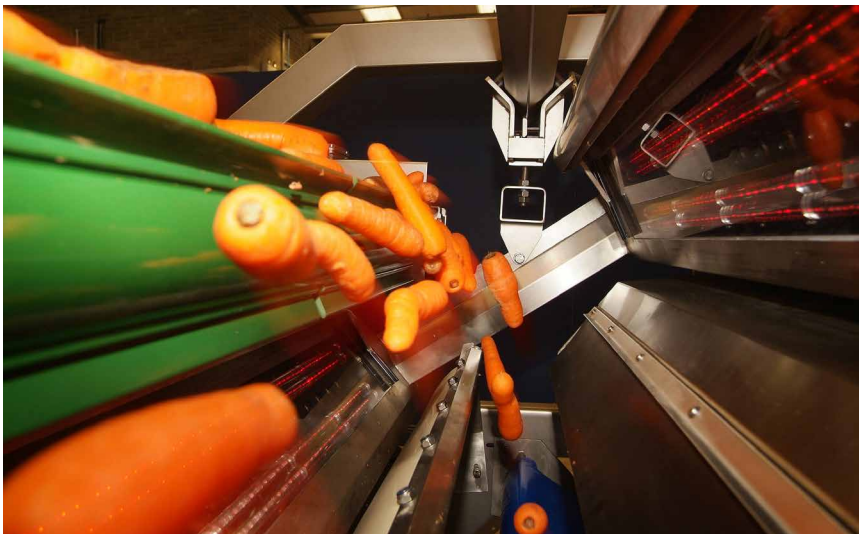
John Mbindyo was buying groceries at his local store in Nairobi, when the 28-year-old IT graduate wondered how long the shelf life was for fruits without electricity. When the store manager responded only two to three days, the idea for FreshBox was born. FreshBox is a solar-powered, walk-in cold room that provides retailers with storage facilities to preserve perishable products. Operating for five months, the project offers vendors and farmers refrigeration services for 70 Kenyan shillings ($0.68) a crate per day.

enables food to be used for different purposes. This way all food would be used in the most efficient way.

Lack of precise sorting can lead to unnecessary food losses:
An average French fry plant produces 140,000 tons of French fries per year. By increasing yields by as little as 0.5% through modern sorting technologies, processors could take an estimated 90 truckloads off the roads. It would increase the availability of raw material and boost profitability. For example, the ability to efficiently sort vegetables, potatoes and nuts,which represent over 19% of the total amount of food wasted in the United States alone could have enormous effects:

By increasing yields by just 1% with better sorting technology, it is possible to increase the final amount of this type of produce in the United States by 11 million tons.

The improvement in yield enhancing technology is not simply about ensuring that food can be used for its initial purpose, but it also identifies what produce can find its way into the food chain with an alternative use. These improvements will result in produce that would once have been identified as waste being recovered.



A food type that does not make the grade for sale in its original form can be recouped for the creation of potato flakes, tomato sauces or other alternatives. It can also be sold as a grade B product, ensuring that waste is reduced at every stage of the process. Developments in technologies, such as a 360-degree surround view of the produce for optimal inspection, combined with innovative detection and rejection technology, result in more valid decisions about the quality of the product.

This technological progress not only improves the quantity of available food, but it alsomaintains the high levels of quality expected by consumers who are increasingly interested in what they are purchasing.
If a food processor was to notice depressions in yield in a particular area of the process, the results taken from the sorting machine could create a solution to easily identify and form actions earlier in the food growing process. Armed with this data, food processors can formulate plans to overcome present issues. Regulations and standards on aesthetic requirements for fruit and vegetables could stand to be revised. Some supermarkets have already begun relaxing their standards on fruit appearance, selling "misshaped" items for a reduced price and helping raise consumers' awareness that odd-shaped does not mean bad.
TOMRA Sorting Food's Eamonn Cullen, says: "The amount of food being left on the production line can add up significantly as it's viewed as waste and not something that can be repurposed. Therefore there is increased motivation for processors to reduce waste and, by doing so, reduce inefficiencies, lower overheads and increase profits.
Other ways to cut levels of waste involve the sorting machines themselves. Today, the real focus should be on how much 'good'

Fruits and vegetables growing on the field are constantly exposed to high temperatures. The Wakati keeps the cell structure of recently harvested fruits and vegetables intact by preventing dehydration through the creation of a saturated humidity inside the tent. Wakati uses hydration to preserve food instead of a cooling system, creating a low-cost, lowenergy alternative to conventional refrigeration. With the Wakati, ethylene production is eliminated which is the ripening hormone of fruits and vegetables. At high temperatures, harvested crops produce high levels of ethylene, especially when they are bruised, which accelerates the rotting process of the produce. Using just one liter of water per week and solar energy, the Wakati system functions to keep fresh produce hydrated, enabling farmers in warm climates to more effectively store their harvests on-farm and in transit, increasing their ability to bring crops to market.

product is unnecessarily being removed from the processing line and how the food sorter can be optimized. The further into the production line you go, the higher the value of the product becomes as you reach the blanching, freezing and storing stages.
Sensor-based sorting machines can determine that a product is 70 percent good quality and, rather than consigning this to waste, the majority of the product can then be reworked until it is ready to be used. For example, when storing potatoes or blueberries, you must ensure healthy product doesn't suffer from mold or rot to help lengthen the lifetime of the product."

Since 2006, artist Uli Westphal has been collecting, documenting, and eating **Berlin's Mutatoes**—the non-standard fruits, roots, and vegetables that can be found at the city's farmers' markets. His photographs form an archive of "these last survivors of agricultural diversity," revealing an incredible variety of colors, curves, and contours. The complete absence of botanical anomalies in our supermarkets has caused us to regard the consistency of produce presented there as natural. Produce has become a highly designed, monotonous product. We have forgotten, and in many cases never experienced, the way fruits, roots, and vegetables can actually look (and taste).
www.uliwestphal.de/mutatoes

Better peeling:

Steam peeling is a process which can help to tackle food waste within the potato industry. With steam peeling 1,000 potatoes can be peeled in 4 - 5 seconds. The speed of steam peeling potatoes ensures the minimum amount flesh is lost, while at the same time making considerable savings in steam usage. TOMRA Sorting Food's peeling expert Eamonn Cullen explains: "Steam peeling is achieved by heating the moisture beneath the potato skin, using high pressure steam. When the steam exhaust occurs, the moisture expands rapidly - in less than one second - and separates the skin from the flesh. This results in the user keeping the shape of the potato and achieving the minimum amount of waste."

With a possible yield improvement of up to one percent, and an average person consuming 25 kg of potatoes per year, that one percent saving could provide potatoes to more than eight million people without the need for extra resources or additional land being farmed. In conclusion, Eamonn explains that TOMRA Sorting Food is continuing to develop sustainable solutions with its customers and many other companies. "The discrepancy between demand and supply - a major cause of food wastage - ranges from farmers not finding a market for their products and leaving them to rot in the field, to supermarkets reducing product orders last minute, leaving producers with unsalable products," he says. Currently across the world, TOMRA's steam peeling machines are processing around 20million tons of potatoes every year.

What if a blueberry could be left on the plant long enough to fully develop its flavor — and still be sweet and juicy when it arrived at a grocery store in New York days later? That is precisely the promise of a start-up in Southern California, Apeel Sciences, that aims to make obsolete the gas, wax and other tricks growers use to keep fruits and vegetables fresh over time. The company takes uneaten plant material like banana leaves and peels—whatever is left behind on the farm—blends them up, and extracts certain lipid molecules. It ships the resulting product in powder form, which is reconstituted into a liquid before it's sprayed onto produce, or produce is dipped into the solution. The resulting barrier acts as a physical impediment to water evaporating, keeping the moisture inside. "We're very simply augmenting what nature has already designed," he says.

Better packaging:

Wireless sensors developed by VTT Technical Research Center detect ethanol in the headspace of food packaging, allowing live data on the food's quality and freshness to be transmitted to retailers and customer via radio frequency identification (RFID) tag technologies. The smart packaging products can help to improve the shelf-life of packaged food products and can help better control and monitor food quality throughout the distribution chain, reducing the amount of food wasted during transportation and in retail.
The Super Bag uses hermetic storage to increase the shelf life of stored grains and seeds. When sealed, the bag reduces oxygen levels from 21 to 5 percent and, as a result, can significantly reduce the number of live insects without using insecticides. The bag also increases the germination life of stored seeds from 6 to 12 months and maintains consistent grain moisture within the bag, allowing for potentially greater head rice recovery during the milling process.

Packaging's Role in Addressing Food Waste

Production: Food loss occurs due to environmental factors, inadequate storage, as well as compliance regulations.

Harvest Processing: In the first stage of processing post harvest, technical limitations prevent efficient processing and result in food loss.

Industrial Processing: Packaging, marketing and transportation complications can cause food waste.

- Leak resistant packaging
- Tough, tear resistant packaging

Distribution and Sales: Food waste occurs when demand is over-forecasted or ordered inappropriately.

- Freshness preservation
- Shelf-life extension
- Package integrity during transportation

Table: At home or in restaurants, overgenerous portions or poor food preservation methods drive food waste.

- Portion control
- Ready-to-eat
- Resealable
- Vacuum or modified atmosphere
- Shelf life extension

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The Formula 1 of Composting

A US-based startup is turning food waste into liquid fertilizer and animal feed in 3 hours

The average supermarket in the US throws away 500 to 1,000 pounds of food every day. 90% of that amount currently goes to landfills where the food waste creates greenhouse gases. At the same time soil health is a major problem for a growing world population. A United Nations report predicts that fertilizer resources might be depleted in less than 50 years. An American group of investors named **KDG AG** is moving to offer a solution for both problems – and become a billion-dollar business at the same time.

KDC Ag is a family development team founded by two sons and their father joined by **Howard W. Buffett** (grandson of Warren), **Alex Uruqhart** former CEO of GE Energy Financial ($22b), **Ann Veneman**, former U.S. Secretary of Agriculture, **Matt Jansen** former President of ADM and many.

I talked to Co-Founder (and one of the sons) **Justin Kamine** about their solution – the Ferrari of composting.

What led you to invest in a food waste solution?
We as a society currently throw away a tremendous amount of food. The current solutions for composting waste to energy represents an inefficient usage of the nutrients in this food waste – and most of them are slow or cannot be scaled. So, we came up with a simple proposition: we wanted to process food waste the very same day that it is thrown away. We are trying to utilize food and capture all the nutrients to maximum benefit. If this food cannot benefit humans anymore we want to give it back immediately to the system and thus create a much more sustainable agricultural cycle.

How does it work?
Six years ago, our group invested in a technology that is imitating the human digestion process. We pick up the food that would usually be dumped in a landfill, put it into a grinder very similar to your teeth, use digestive enzymes very similar to those in the human digestive system - and within three hours we can create a pathogen-free consistent and sustainable liquid fertilizer. This is 720 times faster than conventional composting!

How much food can you process?
We will be digesting about 100 tons of food every three hours. Each facility will be able to process 60,000 to 90,000 tons of fresh food what is it per year. Our big goal is to limit any food waste within five years because we can deploy this technology to any big city. The most important result is that we get a highly energetic fertilizer that is being fed to soils or animals the very next day with human grade food quality nutrients. We currently have around 10 bigger clients for our fertilizer, among them producers of avocado, almonds, strawberries, blueberries, carrots, leafy greens. We are currently working on agreements with bigger clients for their pig feed and chicken feed.

Are you up and running with the system already?
We have commercialized the system already in California. We are currently preparing his system on the East Coast in the Tristate area and we are currently planning the next 6 to 10 facilities across the US. Our goal is to install 50 of these systems all over the US in the next five years which would eliminate food waste entirely. And then we want to move abroad.

How can this solution be a viable business?
As a company, we believe that to have the biggest ecological impact you have to have the best economics. We are definitely saving a tremendous amount of moneyfor the supermarkets. We charge a very low, below the market amount to the supermarkets. They currently pay much more for dumping in landfills and the logistics. We pick up the food waste every day or every other day and we provide the bins for the different kinds of food waste increasing the hygiene in the supermarket itself. Our technology emits no odors and we utilize 100% of the food that we receive. Our fertilizer is price competitive against all major conventional and organic products. Our advantage is that we take in such a balanced diet - meat, fruit, vegetables and baked foods we can create a fertilizer that has a tremendous amount of vitamins and other nutrients that a lot of other products don't have. With this mix of ingredients, we noticed a great improvement of soils using our fertilizer - and improvements in yields and productivity. Apart from the fertilizer we also produce an animal feed for pigs and chicken.

For us it like bringing agriculture and human consumption back to the times of the 18th and 19th century and before: Every component in the food system was utilized for maximum benefit. There was no waste. And we are doing it with innovative technology on an industrial level."

Thank you very much.

Read more about KDG's solution at http://kdcag.com/

Justin and Matthew Kamine, founders of KDG AG in front of the first liquid fertilizer production plant

The psychology of food waste

by Jessica Aschemann-Witzel

Consumers clearly do not like to waste food – consumer studies repeatedly show how consumers feel uneasy and guilty about food waste, and regard the waste of food as unethical in the light of hunger and malnutrition in other parts of the world[1]. In particular, consumers appear to dislike that wasting food shows they have been using their money and the products they have bought unwisely and un-economically[2]. Yet, studies estimate that around 10-to 30 % of a household´s food purchases end up in the bin in one form or other[3]. Which are the reasons for this, and what can business in the food sector do to contribute to solutions tackling consumerrelated food waste?

Factors causing consumer-related food waste

Consumer-related food waste is caused by the complex interaction of factors which play a role in today´s food and eating choices in households. Food plays a number of roles – more than nutrition and health, it is part of a social interaction and used to express identity, status, preferences, and lifestyle. Food has to be chosen, purchased, stored, prepared, eaten and discarded. Through literature research and expert interviews, six factors have been identified as the most crucial ones, for both the consumer as such and his or her surrounding[4]:

Firstly, consumers need to be motivated in some way or other to avoid wasting food. Most consumers are, but might not be aware of the extent of the negative consequences that food waste has, or how much they actually waste themselves. Secondly, consumers very often lack capabilities and skills of managing food – not knowing how best to store fruit and vegetables, how to assess whether food past the date label is edible, and which would be a creative idea to cook a delicious new meal from leftovers. Thirdly, there are a lot of conflicts between the different goals consumers have in relation to food: they might buy an abundancy of fruits to ensure they eat their 'five a day' even though part is wasted, prioritize spontaneously going out for dinner instead of following the meal plan, or rather discard leftovers if they know the rest of the family will be more thankful when served something new and exciting. Without an extra portion of food management skills, these conflicts likely lead to placing food in the bin. Fourthly, in the consumers surrounding, there are situational factors which ultimately can cause food waste in the household – as for example the lack of small packaging units for single households, or the existence of 2-for-the-price-of-1 offers. Fifth, there is also a social context which can cause food wastage, as for example the unwritten norm that there should be an abundancy of food offered when inviting guests, or that it appears rather 'cheap' or 'stingy' to ask for a 'doggy bag' to take home the plate remains in a restaurant. Sixth and last, the macro-environmental context entails factors that have been related to food wastage – as for example strict food safety laws, or the low price level of foods overall.

Over the last two years, acclaimed Italian chef **Massimo Bottura** has been busy opening a handful of quasisoup kitchens called "refettorios" around the world, all of which serve dishes made from food waste. The original soup kitchen, which was established at the Milan Expo in 2015, is the subject of a new feature-length documentary called Theater of Life. To get the ball rolling, Bottura invited some of his famous buddies, including René Redzepi, Alain Ducasse, Daniel Humm, and Ferran Adrià, to cook at the Milan kitchen for the local community. See the trailer on Youtube.

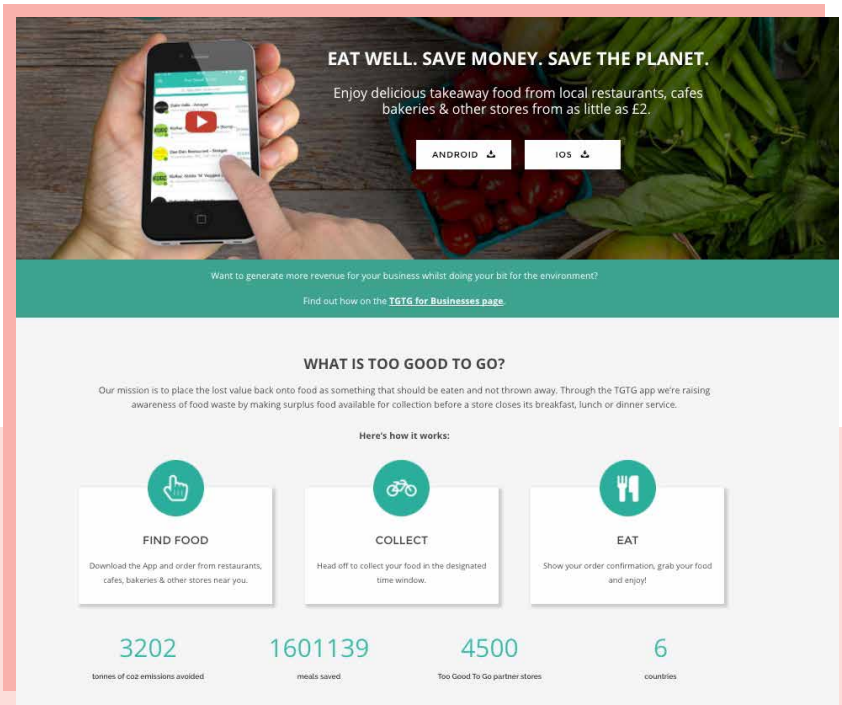
[1] Evans, D. (2014). Food Waste: Home Consumption, Material Culture and Everyday Life. London and New York: Bloomsbury Academic. Graham-Rowe, Ella, Donna C. Jessop and Paul Sparks (2014), Identifying motivations and barriers to minimising household food waste, Resources, Conservation and Recycling, 84 (0), 15–23. Parizeau, Kate, Mike v. Massow and Ralph Martin (2015), Household-level dynamics of food waste production and related beliefs, attitudes, and behaviours in Guelph, Ontario, Waste management, 35, 207–17. Watson, Matt and Angela Meah (2013), Food, waste and safety: negotiating conflicting social anxieties into the practices of domestic provisioning, The Sociological Review, 60 (2), 102–20. // [2] Aschemann-Witzel, J., Jensen, J. H., Jensen, M. H., & Kulikovskaja, V. (2017). Consumer behaviour towards price-reduced suboptimal foods in the supermarket and the relation to food waste in households. Appetite, 116, 246–258. https://doi.org/10.1016/j.appet.2017.05.013 // [3] Universität Stuttgart (2012), Ermittlung der weggeworfenen Lebensmittelmengen und Vorschläge zur Verminderung der Wegwerfrate bei Lebensmitteln in Deutschland. ISWA, Stuttgart. WRAP (2012), Household Food and Drink Waste in the United Kingdom 2012: Final Report. // [4] Aschemann-Witzel, J., Hooge, I. de, Amani, P., Bech-Larsen, T., & Oostindjer, M. (2015). Consumer-related food waste: Causes and potential for action. Sustainability, 7(6), 6457–6477. // [5] Aschemann-Witzel, J., Hooge, I. de, Amani, P., Bech-Larsen, T., & Oostindjer, M. (2015). Consumer-related food waste: Causes and potential for action. Sustainability, 7(6), 6457–6477. // [6] Aschemann-Witzel, J., Hooge, I. E. de, Rohm, H., Normann, A., Bossle, M. B., Grønhøj, A., & Oostindjer, M. (2017). Key characteristics and success factors of supply chain initiatives tackling consumer-related food waste – A multiple case study. Journal of Cleaner Production, 155, 33–45. https://doi.org/10.1016/j.jclepro.2016.11.173. // [7] Aschemann-Witzel, J. (2018). Consumer perception and preference for suboptimal food under the emerging practice of expiration date based pricing in supermarkets. Food Quality and Preference, 63, 119–128. https://doi.org/10.1016/j.foodqual.2017.08.007. Kulikovskaja, V., & Aschemann-Witzel, J. (2017). Food Waste Avoidance Actions in Food Retailing: The Case of Denmark. Journal of International Food & Agribusiness Marketing, 7(1), 1–18. https://doi.org/10.1080/08974438.2017.1350244. // [8] Aschemann-Witzel, J., Hooge, I. E. de, Rohm, H., Normann, A., Bossle, M. B., Grønhøj, A., & Oostindjer, M. (2017). Key characteristics and success factors of supply chain initiatives tackling consumer-related food waste – A multiple case study. Journal of Cleaner Production, 155, 33–45. https://doi.org/10.1016/j.jclepro.2016.11.173. // [9] Aschemann-Witzel, J., Hooge, I. de, & Normann, A. (2016). Consumer-Related Food Waste: Role of Food Marketing and Retailers and Potential for Action. Journal of International Food & Agribusiness Marketing, 28(3), 271–285. https://doi.org/10.1080/08974438.2015.1110549.

Potential solutions to consumer-related food waste

Food sector business can and are already engaging in a number of initiatives which can contribute to tackling food waste at the consumer level. Potential directions which have been derived from literature research and expert interviews are the issues of date-labelling understanding by consumers, consumer expectations of exaggerated 'optimality' of foods, or improving consumers food management capabilities. Retailers and producers can work on the price strategies that they employ, innovate packaging solutions and collaborate with the supply chain[5]. Cases of such actions can be found across the whole of Europe[6]. Some examples are given below:

A range of Danish retailers have begun to systematically use price reduction on any food approaching the date of the date label or being 'suboptimal' in any other way, while also communicating the food waste avoidance entailed in buying the food item. It appears that 9 out of 10 items are sold on the same day, customers become familiar to the approach, and built-in checking for such offers into their food purchase routines[7].
In addition, initiatives have been founded which deal with redistribution of foods which cannot be sold or have become suboptimal – as commercial alternative retailers such as the German Milchwerk, as not-for-profit foodbanks such as the Italian Last Minute Marketing, or as bottom-up student activities such as the Swedish Food Rescue project[8] which organizes events and parties 'fuelled' by the leftover foods from the supply chain. Alternative ways of tackling the issue of food waste is to create new foods through new additions to the business or start-up companies. For example, the Swedish retailer ICA started an own in-store kitchen preparing meals and snacks from suboptimal food, offering the result as lunch on a day-to-day basis via facebook[9]. Berlin start-up company Doerrwerk produces edible 'fruit paper' from fruit surplus in the supply chain, and the Dutch Kromkommers amongst others produced soups for the supermarket shelf which contain vegetable of suboptimal shape. These examples show that along all the steps of the supply chain, food sector business can create opportunities for reducing consumer-related food waste. It can be done in ways that acknowledge consumer´s goal conflicts with regard to food or the lack of food management capabilities. And in addition to that, the actions can also increase consumer awareness of the negative consequences of food waste, or provide easy tips on how to skillfully handle food in the household. More ideas are in the pipeline or have been tested, as for example smaller packaging, packaging indicating freshness independent of the date label, or easy-to-empty packaging solutions. And given consumers increasingly favour locality or diversity, appealing to their preference for local, seasonal fresh fruits and vegetables or portraying the diverse shapes and colours in a positive way might show that consumers can become much more open to non-standard fresh produce in their shopping basket.

Jessica Aschemann-Witzel



Founded in Denmark at the end of 2015 by a group of friends, **Too Good To Go** was soon able to grow internationally thanks to the diversity of its team. Those who had started the concept up in Scandinavia were quickly ready to take it home and in January 2016 work began on **Too Good To Go UK**. The team launched the app in Brighton and Leeds in June 2016 and have since gone onto to divert over one million meals from landfill across Europe. See more about **Too Good To Go** on Youtube.

ORGANISATIONS, NGOS AND INITIATIVES

FAO SAVE FOOD
http://www.fao.org/save-food/resources/keyfindings/en/

REFRESH
http://eu-refresh.org/about-refresh

Food Waste Reduction Alliance (FWRA)
http://www.foodwastealliance.org/

Foodtank
https://foodtank.com/

The Food Law and Policy Clinic (FLPC)
http://hls.harvard.edu/dept/clinical/clinics/food-law-and-policy-clinic-of-the-center-for-health-law-and-policy-innovation/

Forgotten Harvest
https://www.forgottenharvest.org/

STARTUPS

KDC AG
http://kdcag.com/

Wakati
http://www.wakati.co/

Fresh Box Kenya
https://www.freshbox.co.ke/

Apeel Sciences
http://apeelsciences.com/

Culinary Misfits
http://www.culinarymisfits.de/en/misfits/

The Real Junk Food Project
http://therealjunkfoodproject.org/

VIDEOS

Just it eat – Trailer
https://www.youtube.com/watch?v=zkASAZGluu0

Selina Juul – TED
https://www.youtube.com/watch?v=B6mi-ZFCprs

Tristram Stuart
https://www.ted.com/talks/tristram_stuart_the_global_food_waste_scandal

ARTISTS

Klaus Pichler
https://kpic.at/

Uli Westphal
http://www.uliwestphal.de/mutatoes/index.html