FOOD WASTE PREVENTION & MANAGEMENT

A guideline for South Africa

environment, forestry & fisheries
Department:
Environment, Forestry and Fisheries
REPUBLIC OF SOUTH AFRICA

2030 NDP

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Food Waste Prevention & Management - A guideline for South Africa

DEPARTMENT OF ENVIRONMENT, FORESTRY AND FISHERIES & THE COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH

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South Africa

This guideline should be Cited as

DEFF & CSIR 2021, Food waste prevention & management: A guideline for South Africa. Edition 1, DEFF & CSIR, Pretoria

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CONTENTS

ACRONYMS AND DEFINITIONS

Acronyms	
CSIR	Council for Scientific and Industrial Research
DEA	Department of Environmental Affairs
GDP	Gross Domestic Product
FSC	Food Supply Chain
FIFO	First In First Out
SDG	Sustainable Development Goals
US	United States
Definitions	
Consumer food waste	edible food produced for human consumption, but ends up thrown away
Food loss	food loss refers to the decrease in food quantity or quality, which makes it unfit for human consumption
Food waste	food waste is any food, and inedible parts of food, removed from the food supply chain to be recovered or disposed (including composted, crops ploughed in/not harvested, anaerobic digestion, bio-energy production, co-generation, incineration, disposed to sewer, landfill or discarded to sea) and include food losses
Food surplus	Oversupply of edible food

WHAT IS IN THE GUIDELINE?

The guideline includes information on the drivers and possible actions that can be taken to prevent and manage food waste throughout the food supply. Information was extracted from various sources including journals, technical reports and guidelines. Only information containing definitions and statistics is referenced in the text. Sources of information that were used but not cited are included in the reference list.

The term 'food waste' is used in the broadest sense to include pre-consumer food losses and post-consumer food waste.

1. SETTING THE CONTEXT: FOOD WASTE FROM THE FARM TO THE CONSUMER

Globally, it is estimated that one third of edible food is lost or wasted each year (Gustavsson *et al.,* 2011). South Africa generates about 10.2 million tonnes of food waste throughout the supply chain annually (Nahman and De Lange, 2013). Food waste comes with food insecurity as well as economic and environmental impacts. Efforts to reduce food waste therefore provide an attractive opportunity to improve food security in South Africa as well as to reduce the economic and environmental impacts associated with it.

KEY MESSAGES:

- No person should waste food, but most people waste food although often unintentional.
- Food waste reduction has become a paramount consideration to achieve sustainability due to the growing burden of global food insecurity coupled with economic and environmental impacts.
- Food waste reduction is important for contributing towards achieving the sustainable development goals (SDGs). The South African government has signed up to SDG 12.3 to reduce food waste by 50% by 2030.
- Efforts to reduce food waste requires active involvement of all the stakeholders across the food supply chain.
- Industry led initiatives such as the proposed Voluntary agreement developed by the Consumer Goods Council of South Africa are very important to reduce food waste.

2. WHAT IS FOOD WASTE?

Food waste is "any food, and inedible parts of food, removed from the food supply chain to be recovered or disposed (including composted, crops ploughed in/not harvested, anaerobic digestion, bio-energy production, co-generation, incineration, disposed to sewer, landfill or discarded to sea)" (Ostergen *et al.,* 2014). Some food waste is avoidable, while others are unavoidable. The inedible parts (peels, bones, pips, etc) of food that ends up as waste cannot be avoided, but the edible parts that ends up as waste is avoidable and should therefore not be wasted.

Surplus food is food that is fit for human consumption but which is produced or prepared in excess. If surplus food is not eaten by humans while it is fit for consumption, it also adds to food waste.

3. WHY IS FOOD WASTE IMPORTANT?

It is estimated that global food production must increase by 70% by 2050 to meet the demand for food. Yet, globally, nearly one third of all food produced for human consumption is lost or wasted each year Gustavsson *et al.,* (2011). Food waste occurs at all stages of the food supply chain (FSC) from initial agricultural production on farm, through packaging, storage and processing, distribution and retail, up to the final consumer at household level.

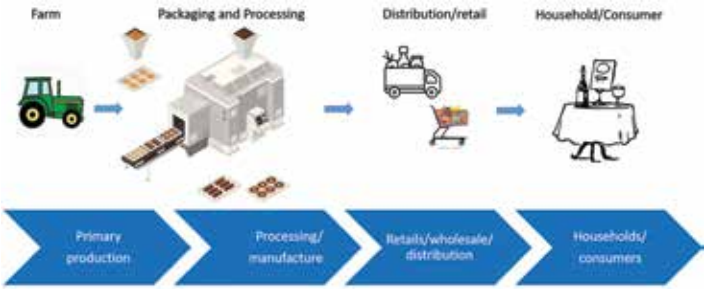

Figure 1: The food supply chain

Wasting food has a triple negative effect:

1. It negatively impacts **on the economy** as all water, electricity, seeds, fertiliser and other inputs used to produce the food is wasted if the food goes to waste. Food wastage therefore also impacts **on water security**.
2. It contributes to **food insecurity** by increasing the cost of food as the cost of the wastage gets factored into the prices of food, making food unaffordable for poor people.
3. It **contributes to climate change** by increasing greenhouse gas emissions into the atmosphere. The decomposition of wasted food disposed of at landfill generates methane, a greenhouse gas that is more effective at trapping heat in the atmosphere than carbon dioxide.

To support sustainable development, the United Nations have set a target to halve the per capita global food waste at the retail and consumer levels, and reduce food losses along production and supply chains, including post-harvest losses, by 2030.

Where in the supply chain the food is most wasted, depends on the country in question. It is generally accepted that developed countries like the US and Europe waste more food at the consumer stage of the supply chain while developing countries in Asia and Africa generate more food waste at the early stages of the supply chain, on farm and during packaging and processing. This behaviour is linked to the fact that consumers in industrialised countries are typically urbanised and buy food from supermarkets where abundance is portrayed. Consumers in developing countries are less urbanised, less reliant on supermarkets, and more likely to be involved in agriculture and primary food production. With the increasing urbanisation, income growth associated with economic prosperity, and resulting changes in dietary patterns, household food waste is likely to increase in South Africa and other developing countries alike if it is not addressed as a priority.

Food waste reduction is a priority for South Africa to address issues of food security and climate change while supporting the implementation of the waste management hierarchy (reduce, reuse, and recycle) and the Chemicals and Waste Phakisa.

4. WHAT IS THE PURPOSE OF THIS GUIDE?

This guide aims to assist South Africa to decouple economic development and food wastage at the consumer level of the supply chain. The purpose of this guide is therefore twofold:

1. To raise awareness of food wastage throughout the supply chain, but specifically at consumer level in order to address food wastage before it reaches the same levels as in the developed world; and

2. To help all the players in the food supply chain to identify pain points where food waste is likely to occur, and to provide some pointers as to what can be done to prevent avoidable food waste and minimise unavoidable food waste.

5. A SNAPSHOT OF FOOD WASTE

A comparison of global versus South African food waste is provided in Table 1.

Table 1: Comparing South African and Global food wastage

Indicator	Global	South Africa
		
Edible portion of food waste	**1.3 billion tonnes** per year	**10 million tonnes** per year
Consumer food waste 	Europe and North America = 95-115 kg per person per year Sub-Saharan Africa and South/Southeast Asia = 6-11 kg per person per year	On average households generate 6 kg per household per week On average people in Johannesburg dispose of 12kg of food waste per person per year into the municipal bin and in Ekurhuleni 8 kg per person per year
Cost 	**R37.57 trillion** (1USD =14.45 ZAR) (Jain *et al.*, 2018). About R14.45 trillion (1USD =14.45 ZAR) of this cost is incurred from environmental impacts including pesticide exposure, water use, greenhouse gas emissions, loss of biodiversity and soil erosion.	**R75 billion** (De Lange and Nahman, 2015) 2.2% of National GDP. R71.4 billion is opportunity cost and R3.6 billion of this cost is for disposal, and externalities (social and environmental costs)

Climate Change 	**4.4GT CO_2 Equivalents from food waste is equal to 13.6% of global emissions from fuel combustion.** 2.8-4.14 tonne of CO_2 emission equivalents per tonne of food wasted. Globally, food waste is the third largest greenhouse gas emitter after China and the US.	**About 0.04GT of CO_2 Equivalents** from food waste which is 7.6% of the total greenhouse gas emissions of South African in 2010.
Water 	The blue water footprint of global food waste was **250 km^3 in 2007**. This is higher than the national blue water footprint account of any country. This is equivalent to 100 million Olympic sized swimming pools	**1.7 km^3** of water is extracted from groundwater and surface water bodies to produce the food that was wasted in South Africa **in 2012** This is equivalent to 680 thousand Olympic sized swimming pools or nearly 1/3 of the capacity of the Gariep Dam.

6. HOW MUCH FOOD IS WASTED AT EACH STAGE OF THE SUPPLY CHAIN?

The food wastage occur throughout the supply chain and the wastage differ depending on the type of commodity as well as site specific circumstances. As a general rule of thumb, soft and leafy fruit and vegetables are more likely to be wasted than roots and tubers, which are sturdier and not so easily damaged during handling and transportation. The estimated waste percentage for each commodity group in each step of the food supply chain for sub-Saharan Africa is provided in Table 2 below. The wastage in the early stages of the supply chain is expected to decrease with increased levels of sophistication applied during harvesting, and post-harvest handling and storage. Wastage during distribution is influenced by external factors such a road conditions, accessibility and proximity to markets. Poor road conditions contribute to bruising while long distance travel subtracts from the shelf life of commodities. Export is one example where commodities can be on-route to the market for up to three weeks on a ship, before reaching the consumer. It is likely that the wastage in South Africa at pre-consumer level is lower than the rest of sub-Saharan Africa, but this still needs to be confirmed.

Table 2: Estimated waste percentage per commodity group at each stage of the supply chain for sub-Saharan Africa

Commodity group	Agricultural production	Post harvest handling and storage	Processing and packaging	Distribution	Consumer	Total
Cereals	6.0%	8.0%	3.5%	2.0%	1.0%	20.5%
Roots and Tubers	14.0%	18.0%	15.0%	5.0%	2.0%	54.0%
Oil seeds & Pulses	12.0%	8.0%	8.0%	2.0%	1.0%	31.0%
Fruits and Vegetables	10.0%	9.0%	25.0%	17.0%	5.0%	66.0%
Meat	15.0%	0.7%	5.0%	7.0%	2.0%	29.7%
Fish and Seafood	5.7%	6.0%	9.0%	15.0%	2.0%	37.7%
Milk	6.0%	11.0%	0.1%	10.0%	0.1%	27.2%

The estimated edible portion of food waste throughout the supply chain in South Africa is estimated to be 10.2 million tonnes per year broken down into 2.7 million tonnes during agricultural production, 2.4 million tonnes during post-harvest handling and storage, 2.6 million tonnes during processing and packaging, 2 million tonnes during distribution and 0.5 million tonnes at the consumption stage. This wastage include locally produced and imported food as illustrated in Figure 2.

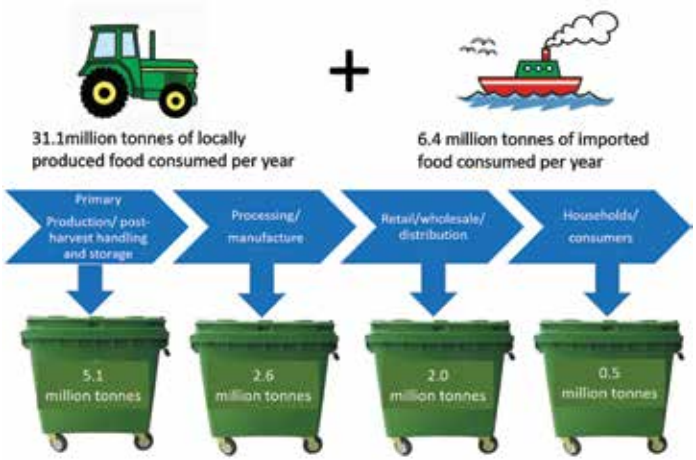

Figure 2: Estimated food waste throughout the supply chain in South Africa (from data from Nahman and De Lange, 2013)

Reported postharvest handling and storage losses in South Africa is provided in Table 3.

Table 3: Postharvest handling and storage losses in South Africa

Commodity type	% Loss	Source
Cereals	15-30	DAFF, 2015
Roots and Tubers	10-40	
Oilseeds and Pulses	15-30	
Fruit and Vegetables	15-44	
Meat	6-8	
Milk	8-16	

7. WHAT ARE THE DRIVERS FOR FOOD WASTAGE ON FARM?

The food losses and wastage on farm are the result of many different factors, some within the control of the farmer, and others not. South African farmers are categorised into commercial farmers and subsistence farmers. The commercial farmers typically supply fresh produce into the market, while subsistence farmers produce food for own consumption. The food losses and wastage on small scale farms without access to sophisticated harvesting, post-harvest handling, and storage facilities are generally higher than on the large commercial farms. The main drivers for food losses and wastage on farm are summarised in Table 4.

Case study: Loss of food due to lack of infrastructure at Tshakhuma fruit market in Limpopo (Mashau *et al*., 2012)

- 43.3% of the fruits is lost during post-harvest.
- Reasons for this wastage included:
  - lack of refrigeration (the market is exposed to temperatures of 35-40°C in summer and 25-34°C in winter), Knowledge gaps in the use of proper packaging materials, poor procurement planning and the lack of understanding of the link between transport and fruit rotting.
- Food was not lost during transportation due to short distance

Table 4: Drivers of on-farm food wastage

Driver	Cause	Result
Weather	• Drought • Floods • Hail • Wind • Heat waves • Cold spells	Damage to crops Stress to animals Reduced quality of the food Delayed harvesting if the fields are inaccessible
Harvest	• Mechanical damage • Spillage during harvest • Crops left behind due to poor harvesting techniques • Crops not harvested due to price drops	Damage to crops Reduced quality of food Crops ploughed back in
Disease and pests	• Animal deaths during breeding • Animal sickness • Disease of crops • Crops eaten or damaged by pests	Condemnation at slaughterhouse Milk discards Crops ploughed back in Reduced quality or discards
Demand forecasting	• Uncoordinated production i.e. all farmers produce tomatoes	Oversupply at markets
Grading	• Grading errors • Out-grades	Rejected at market
Storage	• Packaging failure • Interruption in cold chain	Spillage, reduce quality, or discards

Driver	Cause	Result
Transport	• Bruising • Package failures • Exposure to the elements • Cold chain failures • Road accidents	Reduced quality Shortened shelf life Discarded
By-catch	• Non-target species caught by fisheries	Discarded or processed as animal feed

8. WHAT CAN FARMERS DO TO REDUCE ON-FARM FOOD LOSSES AND WASTE?

It is in the best interest of the farmer to reduce food losses and wastage as it impacts on their income potential. It is therefore important that the workers on the farm are also aware of the impact of their actions on the quality of the food produced.

A few general tips for farmers to consider include:

- Engage with potential markets to establish market needs and quality specifications.
- Diversify markets to ensure market access for lower quality produce in case of rejections by high end markets.
- Optimise harvesting times and techniques to preserve product quality and shelf life.
- Optimise post-harvest handling and storage based on the commodity type being produced.
- Optimise transport between farm and distribution. It should be noted that poor road conditions, even short stretches on which produce is transported, contributes to losses due to bruising.
- Imperfect or sub-standard commodities creates opportunities for small business development in agro-processing.

Extend the shelf life of the commodities by applying best practice during production

9. WHAT ARE THE DRIVERS FOR FOOD WASTAGE DURING PROCESSING?

Food processors receive the commodities from the farm or the market for processing. Fruit are typically canned or processed into juice. Vegetables, fish and meat are processed into frozen, canned or bottled products, or converted into convenience foods such a pre-prepared meals requiring minimum further preparation by consumers. The main drivers for food losses and waste in the processing part of the supply chain are summarised in Table 5.

Table 5: Drivers of processing food wastage

Driver	Cause	Result
Rejected input	• Product rejected for not meeting quality specification	Discarded

Driver	Cause	Result
Losses in process	• Food safety concerns • Inefficient process flows • Accidental spillages • Washing, peeling, slicing, and boiling • Machine failures • Trimming • Process interruptions e.g. power outages • Maintenance runs	Condemnation Discarded
Quality Specification	• Over-demanding quality specifications	Discarded
Labelling errors	• Incorrect information on printed label • Skewed labelling	Discarded
"Off-spec" production	• Poor product formulation	Discarded

10. WHAT CAN FOOD PROCESSORS DO TO REDUCE FOOD LOSSES AND WASTE?

The majority of the food wastage in the processing stage of the supply chain occur during the preparation stages. A significant amount of the waste, including the pips and peels, is believed to be unavoidable waste. Avoidable waste streams should be minimised by optimising process flows, stock rotation, and general good housekeeping. Trimmings and off-cuts should be used in secondary products where possible.

Some steps that processors can take to reduce food wastage include:

- Measure food losses and identify the causes
- Train staff to prevent food losses
- Process optimisation through:
  - Identifying hotspots and introduction of quick-win solutions to prevent wastage;
  - Putting measures in place to allow for rapid retrieval, reworking of products, or reintroduction of primary materials;
  - Finding solutions for production interruptions;
  - Effective stock rotation and controls;
  - Coordinating production with clients and suppliers

11. WHAT ARE THE DRIVERS FOR FOOD WASTAGE DURING DISTRIBUTION?

The distribution stage in the supply chain includes wholesale markets, supermarkets, retailers, and fish markets. In the South African situation it also includes informal vendors and spaza shops. The main drivers for food losses and waste in the distribution part of the supply chain are summarised in Table 6.

How much food is wasted in this stage?	
Case study: Vegetable losses at retail level in Stellenbosch (Munhuweyi, 2012) • Revealed that 14.46% of tomatoes, 21.21% cabbage and 17.93% of carrots was lost in retails. • Reasons for losses included mechanical injury and decay	**Case study:** Self-reported losses of food by vendors (Mashau *et al.*, 2012) • Vendors selling guava, avocado and pawpaw self-reported 50% of food waste in a study that was conducted in Tshakhuma fruit market, Limpopo. • Losses occurred as a result of over-ripening due to a lack of measures to control the ripening processes of the fruits

Table 6: Drivers of distribution food wastage

Driver	Cause	Result
Distribution system	• Long travel distances • Sub-optimal logistics • Uneven road surfaces • Road accidents	Reduced shelf life Discard
Date labels	• Food not sold in time • Food items not used in time • Poor stock rotation in-store/depot	Donations Discarded
Ordering systems	• Over delivery • Ordered too much	Donations Discarded
Packaging	• Packaging failures	Discarded
Product recalls	• Food safety concerns • Compromised quality	Condemnation
Quality specifications	• Product rejected for being below quality	Donated Discarded
Cold chain failures	• Fridges and freezers not operated at optimum temperatures • Power outages • Consumers moving stock out of cold chain areas	Condemnation

Driver	Cause	Result
Retail over-stocking	• Company policies requiring full shelves at all times	Donations Discarded
Failure to distribute edible surplus	• Reputational concerns • Strict liability • Logistical challenges for redistribution	Condemnation Discarded

12. WHAT CAN FOOD DISTRIBUTERS DO TO REDUCE FOOD LOSSES AND WASTE?

Food losses and waste at the distribution part of the supply chain are the highest value food losses due to the input required to get it to this stage in the supply chain. Reducing losses at this stage of the supply chain is likely to have a significant economic impact. A few general tips for wholesalers and retailers to consider include:

- Support local producers to keep transport distances for distribution to a minimum;
- Avoid uneven road surfaces where possible to reduce bruising of fresh fruit and vegetables;
- Optimise ordering systems, cold chain management, and stock rotation;
- Do away with overstocking, it is okay if the shelf is not always filled to the brim;
- Reduced price offering on stock nearing its sell by date to entice consumers to buy the food;
- In-store processing of produce that is past 'sell-by' but within 'use by' date into readymade salads, bakery items, prepared meals etc.; and
- Donate surplus food to organisations such as Food Forward South Africa.

13. WHAT ARE THE DRIVERS FOR FOOD WASTAGE DURING CONSUMPTION?

The consumption stage of the supply chain includes consumption at household level, and in the hospitality sector where food is prepared and served out of home. The hospitality sector includes the commercial service sector (restaurants, fast food outlets, hotels and cafés in the formal sector) and the institutional service sector (universities, prisons, school and hospitals and work cafeterias).

13.1 What are the drivers of food wastage in households?

Household food waste is usually associated with multiple actions that consumers take when providing, handling, preparing and eating food. The actions increase or decrease the likelihood of food being wasted. Hence, food waste is often an unintended consequence of daily activities that are undertaken around food in a household. Drivers of food waste in the households are summarised in Table 7.

How much food is wasted at household level?

A Study based on municipal solid waste characterisation studies using bulk sampling with randomised grab sub-sampling conducted over a 6-week period during summer in 2014 (Johannesburg) and 2016 (Ekurhuleni) showed that households members dispose about 8 kg in Ekurhuleni and 12 kg in Johannesburg per person annually into the municipal bin (Oelofse *et al.*, 2018).

Household food wastage in the City of Tshwane was measured at an average of 6kg per household per week. The households separated the food waste for weekly collection and measurement by the project team (Ramukhwatho, 2016).

Table 7: Drivers of household food wastage

Driver	Cause	Result
Lack of planning	• Buying too much • Preparing too much • Serving too much • Impulse buying • Falling for special offers • Poor stock control at home • Food not in season	Expired food Leftovers Plate waste
Food preparation	• Food safety concerns • Accidental spillages • Washing, peeling, slicing, and boiling • Trimming • Cooking disasters (burnt, too much salt, wrong ingredients) • Inability to use leftovers	Discards
Fussy eating	• Allergies • Picky eaters	Discards
Labelling	• Misinterpretation of un-pack labels • Confusion – sell-by, use-by, best before, expiry	Discards
Packaging	• Pack sizes not suited for household size • Packaging does not empty easily • Packet does not reseal	Discards

Driver	Cause	Result
Storage	• Not knowing how to store fresh produce appropriately • Load shedding interrupting cold chain	Short shelf life
Lifestyle influences	• Unplanned change in diet • Cultural practices	

13.2 What can households do to reduce food waste?

Consumers are the end users of the food supply chain and therefore their preferences determine the demand, which in turn influence the supply of certain food types into the market. It can therefore be said that consumer demand is a huge driver of food wastage throughout the supply chain. In this regard, consumers are increasingly buying convenience foods, which require less input at home. This trend push preparation wastage to the earlier stages of the supply chain, while increasing the packaging waste at the consumer stage, but it also reduces the shelf life of the final product.

Households can reduce food waste by being vigilant during pre-shopping, shopping, storage, and preparation of food. A summary of household food waste prevention measures are provided in Table 8.

Table 8: Tips for households to consider

	Food waste prevention and management measures of households	
Prevent food waste	Planning	• Check your refrigerator / cupboard to identify what you already have • Make a shopping list (list should be done in conjunction with meal planning)
	Shopping	• Stick to the shopping plan • Avoid impulsive buying • Buy from small local shops or grow your own food • Buy seasonal food (Refer to Table 9) • Buy small amounts of food enough for meals that day each time • Avoid buying in bulk
	Storage	• Store dry food in a cool and dry place • All perishable food must be refrigerated except for potatoes, onion and banana. • Cheese must be stored in a cupboard and refrigerated once opened • Store food under correct temperature • recommended temperature for storing food is 0°C -4.4° C for refrigeration and -17.7°C for freezing • Practice stock rotation in both cupboard and refrigerator • Always keep your storage places organized
	Preparation	• Plan meals • Read recipes on how to prepare food • Avoid preparing excessive food
	Leftover	• Store in an air tight container and refrigerate or freeze • Do not keep food at room temperatures for more than two hours after you have prepared the food • Keep leftover food for 3-4 days • Find recipes to use your leftovers as ingredients of a new meal

	Once options for prevention are exhausted, manage food waste
Manage food waste	Feed people
	Feed animals
	Compost
	Anaerobic
	Landfill

13.2.1 Pre-Shopping

Planning before shopping focussing on needs, is one strategy that can be used to reduce food waste at consumption level. This involves checking the food that you already have in the cupboards or refrigerator and making a shopping list in order to avoid buying more than what you actually need. At the same time, checking inventories also helps in making sure that the products that you are going to buy will have space in the cupboards and refrigerators. Making a shopping list is important to reduce food waste, but only if you are going to stick to the list. Shopping lists should be made in conjunction with meal planning and communication between different household members to avoid more than one family member, buying the same products by on the same day.

13.2.2 Shopping

Factors contributing to food waste include: source of food, frequency of buying, not sticking to a list in the store and buying in bulk.

Sticking to the list is very important as it reduces overbuying and buying things that you already have. With regards to source of food, consumers that do shopping in large supermarkets are likely to generate a lot of food waste compared to consumers that shop in local small shops or those who grow their own food.

Buying locally produced and seasonal foods reduces the use of resources compared to imported and non-seasonal fruits and vegetables as they require transportation and energy. A guide that can be used pre-shopping to check seasonal fruits and vegetables is provided in Table 9.

Buying small amounts of food enough for meals that day each time reduces food waste at household level. Buying in bulk increases the likelihood of food being wasted as a result of not using it on time.

Table 9: A guide that can be used pre-shopping to check for seasonal fruit and vegetables

Deciduous fruit	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept
Apricots		X	X	X	X							
Peaches	X	X	X	X	X	X						
Nectarines	X	X	X	X	X	X						
Plums		X	X	X	X	X	X					
Table Grapes	X	X	X	X	X	X	X	X				
Pears				X	X	X	X	X	X	X	X	
Apples				X	X	X	X	X	X	X	X	
Kiwi									X	X	X	
Cherries			X	X								
Citrus Fruit	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sept**
Mandarins and naartjies	X					X	X	X	X	X	X	X
Lemons						X	X	X	X	X	X	
Oranges	X	X					X	X	X	X	X	X
Grapefruit							X	X	X	X	X	X
Sub-tropical fruit	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sept**
Avocado's					X	X	X	X	X	X	X	X
Litchi's		X	X	X	X	X	X					

Mangoes		x	x	x	x	x						
Pineapples	x	x	x	x	x	x	x	x	x	x	x	
Passion fruit					x	x	x	x	x	x	x	
Exotic fruit	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sept**
Raspberries		x	x	x	x	x						
Blueberries		x	x	x	x	x						
Melons		x	x	x	x	x						
Strawberries	x	x	x									
Figs			x	x	x	x	x	x				
Pomegranates					x	x	x	x	x			
Vegetables	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sept**
Brinjal			x	x	x	x	x					
Parsnips	x						x	x	x	x	x	x
Mielie	x	x	x	x	x	x	x					
Kale								x	x	x	x	
Baby marrow	x						x	x	x	x	x	x
Spinach	x	x	x	x	x	x	x	x	x			
celery	x				x	x	x	x	x	x	x	x
Mushroom	x	x	x	x				x	x	x	x	x

Rhubarb	x	x	x									x
Spring onions										x	x	x
Cauliflower	x	x					x	x	x	x	x	x
Broccoli	x						x	x	x	x	x	x
Green beans	x	x	x	x	x	x	x	x				x
Broad beans										x	x	x
Peas	x	x								x	x	x
Mangetout	x	x	x	x	x	x						
Leeks	x	x				x	x	x	x	x	x	x
Artichoke	x	x	x	x	x							x
Asparagus	x	x	x	x	x						x	x

13.2.3 Storage of Food Products

Food storage plays an important role in reducing the amount of food waste. Food storing includes dry storage and cold storage. Dry storage refers to storing of food in cupboards or a pantry while cold storage refers to storing food in the refrigerator or freezer. Improper storage or storing food for a long time are major contributors of food waste.

Refrigeration and freezing plays a critical role in reducing food waste as it prolongs the shelf life of a product. This food waste reduction technique is more important for food products that perish quickly such as fruits and vegetables. All fruits and vegetables except for bananas, onion and potatoes, should be refrigerated for prolonged shelf life. Depending on the type, vegetables can be kept for up to two weeks when refrigerated and up to 12 months when frozen. Critically important to refrigeration and freezing of food is the temperature as it affects microbial growth and the maturation, ripening and aroma development of fruits and vegetables. The recommended temperature for storing food is 0°C -4.4° C for refrigeration and -17.7°C for freezing. It is therefore important to ensure that food is stored under correct temperatures.

It is also important to note that refrigeration or freezing does not stop food spoilage but it simply retards the growth of microorganisms and slows down chemical changes that affect quality. Table 10 provides tips and recommendations on how long food can be stored in your cupboards, refrigerators and freezers.

Table 10: Tips and recommendations on how to store food

Product	Cupboard or pantry	Refrigerator	Freezer	Comments
Bakery goods: Bread	5-7 days	1-2 weeks	2-3 months	Bread should be refrigerated to extend the shelf life or frozen it if it is not going to be used quickly. The quality of frozen bread is much better than the quality of bread stored in the refrigerator.
Waffles		4-5 days	1 month	
Cake	1-2 days	1 week		
Vegetables: Sweet potatoes	2-3 weeks			Refrigeration and freezing is the best way to maintain quality and delay ripening for fresh vegetables. It is recommended to blanch (partially cook) or cook vegetables before freezing. Vegetables such as potatoes, sweet potatoes must be kept at room temperatures. Potatoes must not be washed before storing them as that can shorten their shelf life.
White potatoes	2-3 months			
Spinach		1-2 days	10-12 months	
Tomatoes	Until ripe	2-3 days	2months	
Mushrooms		2-3 days	10-12 months	
Carrots		3 Weeks	10-12 months	
Cauliflower		3-5 days	10-12 months	
Garlic	1 month	1-2 weeks	1 month	

Product	Cupboard or pantry	Refrigerator	Freezer	Comments
Fruits: Apples	1-2 days	3 weeks	(cooked) 8 months	Bananas will blacken when refrigerated but the inside colour will not change.
Bananas	Until ripe	2 days	1 months (whole, peeled)	
Strawberries		1-2 days	8 months	
Avocados	Until ripe	3-4 days		
Meat: Roasts, beef, veal, pork, lamb		3-5 days	4-12 months	
Sausage		1-2 days	1-2 months	
Fish and sea food: Smoked Fish		3-4 days	 2 months	
Oysters, clams, mussels		1-2 days		
Cereal: Pasta, dry	1-2 years			Cereals should be stored in air tight containers
Rice, white	2 years			
Flour	6-12 months			

In both refrigerators and cupboards, stock rotation is very important. Use the 'First-In First- Out' (FIFO) storage method where new products are kept behind so that the old products are used first. Avoiding chaotic storage areas is also important in order to prevent the risk of forgetting food.

13.2.4 Preparation of food

Lack of food preparation skills is a key cause of consumer food waste. Providing education, training and skills on how to prepare different food products is important to reduce food waste. The best way to learn how to prepare food is to assist and observe when someone who knows how to prepare food is in action.

13.2.5 Handling Leftovers

Leftovers occur as a result of preparing more food than needed. Reasons for preparing more food may include poor portioning and cooking for later use. Food commodities that are likely to end up as leftovers are small amounts of food such as rice, potatoes and pasta. Leftover food can also be reduced by proper portioning of food during preparation.

Proper handling of leftover food is important to ensure food safety when it is stored for later consumption. Food should not be kept at room temperature for more than two hours after preparation and should be kept in the refrigerator for no longer than 3-4 days.

13.2.6 Understanding best before and use by dates

Alleviating confusion on date labels is critical for food waste prevention. Food date labels are reportedly erroneously used by consumers as an indication of food safety and that results in loss of food that is still fit for consumption.

In South Africa, food date labelling is regulated by Foodstuff, Cosmetics and Disinfectants Act no. 54 of 1972 (as amended). According to the regulations food date labels should appear in a calendar format ("Day-Month-Year") with the minimum durability written as "best before" or BB and "use by" date written in full. There are various date labels that are used to mark different food products and these include:

- "**Best before"** date- indicating the date at which the product is at its optimum quality. According to the Foodstuff, Cosmetics and Disinfectants Act the products may be sold and consumed beyond this date.
- "**Use by date**- indicating the end of the estimated period for the product's best quality, after which the product may lose some of its quality attributes. The food product may not be sold after this date.
- **"Date of manufacture"-**indicating the day on which the food becomes a finished product.
- **"Sell by date"-** indicating the last day on which the product should appear on the retail store shelf and its aim is to inform the retailers about the date on which the product should be sold. Beyond this date, it is safe to consume the product.

It is important to note that date labels as contained in the Act is not an indication of food safety. Food safety is influenced by amongst other, the integrity of the packaging material as well as the effectiveness of the cold chain. Food that is within the "best before" date

can for instance be unfit for consumption if the packaging failed or the cold chain was interrupted. To verify food safety, consumers are encouraged to inspect the product before use. The food is likely to be safe for consumption if all the following are in place:

- the container is intact and the seal not broken;
- the food content looks and smell still good for consumption – no obvious signs of discoloration, texture change, mildew, bacteria etc.,
- the food taste as expected when taking a small bite.

13.3 What are the drivers of food wastage in the hospitality sector?

The hospitality industry generates a significant amounts of food waste, owing to the high prevalence of eating out among South Africans. This sector is made up of commercial food service sector and institutional service sector. The commercial food service sector includes hotels, all types of restaurants (restaurants, fast food restaurants and buffet type restaurants) and clubs while the institutional service sector includes transport services, health (public and private hospitals), educational institutions, and prisons. The main drivers for food losses and wastage in the hospitality sector are summarised in Table 11.

Table 11: Drivers of food wastage in the hospitality sector

Driver	Cause	Result
Planning	• Inaccurate demand forecasting • Use of margin of error • Over purchasing of stock • Having many dishes on your menu • Lack of menus for kids • New dishes on the menu • Time limits on how long the food should be stored after preparation	Over-preparation Donations Pre-consumer food waste Plate waste

Driver	Cause	Result
Food preparation	• Food safety concerns • Use of improper equipment (e.g. some peelers produce thick peels) • Accidental spillages • Washing, peeling, slicing, and boiling • Unnecessary trimmings • Cooking disasters (burnt, too much salt, wrong ingredients) • Inability to repurpose off-cuts • Preparation of more food than the demand • Large portion sizes • Inefficiency by the staff members	Discards
Labelling	• Confusion – sell-by, use-by, best before, expiry	Discards

Driver	Cause	Result
Serving	• Displaying large amount of food in a buffet • Accidental spillages • A patient discharged in a hospital • Large serving plates • Children dishing up for themselves in a buffet	Reduced shelf life Donations Discards
Storage	• Not knowing how to store fresh produce appropriately • Load shedding interrupting cold chain • Packaging failure • Poor stock rotation • Malfunction of the refrigerators	Short shelf life Discards

Driver	Cause	Result
Eating	• Dissatisfaction with the taste of food • Ordering an item that a consumers don't know • Loss of appetite on patients in hospitals • Picky eating especially children	Discards

13.4 What can the hospitality industry do to reduce food waste?

Food waste reduction is very important in the hospitality sector for economic benefits and also to avoid loss of valuable resources. Although the hospitality industry is diverse in terms of the types of facilities and how food is provided, actions towards food waste reduction can be applied across all the facilities. Some of the measures that can be used by the hospitality sector to reduce food waste include accurate customer demand forecasting, training of staff members, careful menu planning, acknowledging staff members that reduce food waste and donating food that is not sold. Consumers should also be involved in reducing food waste because they also contribute to generation of post consumption waste (plate waste) (Figure 3). A summary of hospitality food waste prevention measures are provided in Table 12.

In the hospitality industry left overs occur in the consumption stages (plate waste) of the service. The South African practice of offering a 'doggy bag' to consumers to take their left over food with for consumption at home should be encouraged. It should however be noted that salads and vegetables are seldom included in the 'doggy bag'.

Figure 3: A meal served in a restaurant (left) and the plate waste after the meal (right)

Table 12: Tips for the hospitality sector to consider

Food waste prevention and management measures in the hospitality sector		
Prevent food waste	Planning	• Check your refrigerator / cupboard to identify what you already have • Make a shopping list (list should be done in conjunction with meal planning) • Accurate forecast demand • Prepare food to meet the demand
	Shopping	• Stick to the shopping plan • Buy from local suppliers • Buy seasonal food (see guide) • Prepare food to meet the demand
	Receiving	• Ensure that all the food is in good condition upon arrival
Prevent food wast	Storage	• Store dry food in a cool and dry place • All perishable food must be refrigerated except for potatoes, onion and banana. • Cheese must be stored in a cupboard and refrigerated once opened • Store food under correct temperature (see link) • Recommended temperature for storing food is 0°C -4.4° C for refrigeration and -17.7°C for freezing • Practice stock rotation in both cupboard and refrigerator • Always keep your storage places organized
	Preparation	• Prepare food to meet the demand • Follow standard operation procedure • Portion food correctly • Provide training to the Kitchen operators to ensure proper handling of food • Acknowledge staff members that reduce food waste

Food waste prevention and management measures in the hospitality sector		
	Serving waste	• The buffet style used in hotels should be replaced with a la carte serving style • Buffet waste can be reduced through the use of small platters. A label to inform guests that they can return for more food must also be used • Use tasting plates with small portions to allow people to taste the food before dishing larger portions reduce • Educate university students about the impacts of their irresponsible food waste behaviours (forgetting to unbook meals) to avoid surplus food
	Plate waste	• Use of small plates to reduce buffet plate waste • Reduce portion sizes
	Once options for prevention are exhausted, manage food waste responsibly by separating the food waste at source and following the food waste hierarchy	
Manage food waste	Feed people	• Donate surplus food (food prepared but not served) to charities
	Feed animal	• Donate to a pig farm or feed pets • Meat must not be fed to pigs to avoid the risk of transmitting viruses to pigs, but it can be processed into commercial animal feed
	Compost	• Compost fruit and vegetable scraps and coffee grounds
	Anaerobic digestion	• Separate collection of waste for anaerobic digestion
	Landfill	• Throw in the bin only if no other option is available (last resort).

14. SURPLUS FOOD

According to Papargyropoulou *et al.,* (2014) surplus food refers to food produced beyond our nutritional needs. In the consumption stages of the FSC, the terms surplus food and leftover are often used interchangeably and thus making it difficult to distinguish between the two terms. For the purpose of this guideline leftover food refers to food left on the plate including both untouched and unfinished food. Surplus food on the other hand refers to food that has been prepared but not served to the people. Surplus food in the hospitality industry occurs in the serving stages of the service due to poor demand forecast and consequent preparation of excessive food and use of margin of error. In the households surplus food may arise as a result of stockpiling food and over-preparation of food. Papargyropoulou *et al.,* (2014) recommends supply of food that is needed to prevent surplus food and donation of food to the needy where it is not possible to prevent it.

In the hospitality industry it is very challenging to recover surplus food because of the short shelf life (i.e. 24h on average). The need to transport food from the food service to the receivers every day acts as a barrier towards recovering food and that results to extremely high logistics costs. Health regulations also negatively impact on the food service sector's ability to donate food due to the potential risks to human health.

Food Forward distributed 4 350 tonnes of surplus food to 600 registered beneficiary organisations in 2017 in South Africa. An estimated 14.5 million meals were served using surplus food from these donations. This surplus food was recovered from retailers, food manufacturers and farmers. Rivett-Carnac and Von Bornmann (2018) estimate that 40 000 tonnes of surplus food exist across all grocery retail stores in South Africa every year. Woolworths is one of the retail stores that distributes and donates surplus food to 1000 charities on an on-going basis annually. This includes food products that have gone past the "Sell By" date but before "Best Before" date (Woolworths, 2016). The surplus that is not recovered for redistribution is most often disposed of on landfills as food waste.

15. SUMMARY

Food waste is a huge challenge that threatens our food system as well as our economic and natural resources. This is particularly true for food wasted in the consumption stages of the food supply chain due to the cumulative amount of resources used to produce the final product. There is a great opportunity to prevent and manage food waste throughout the food supply chain but specifically in the consumption stages of the FSC through behaviour change and education and awareness.

Measures taken to prevent and manage food waste may include planning before shopping, sticking to the plan, understanding date labels and packaging, and growing one's own food. When options for prevention are exhausted, unavoidable food waste should be managed by feeding surplus food to people, and animals through processed animal feed. Other waste management options include nutrient upcycling, composting, anaerobic digestion and value extraction through alternative waste treatment solutions.

Industry led initiatives which are in line with the food waste guideline must be adopted and supported. The Voluntary agreements being developed by the Consumer Goods Council of South Africa is one such initiative.

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