FOOD HANDLERS' KNOWLEDGE OF FOOD WASTE AND WASTE PREVENTION PRACTICES IN SUPERMARKET KITCHENS IN SOWETO, SOUTH AFRICA

Dissertation submitted for the degree Magister Technologiae:
Food and Beverage Management
in the Department of Tourism and Integrated Communication
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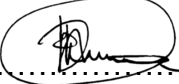
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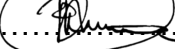**DTech Food Service Management**

Date: September 2022

DECLARATION

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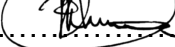
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STATEMENT 1

This dissertation is being submitted in fulfilment of the requirements for the degree of Magister Technologiae Food and Beverage Management.

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STATEMENT 2

This dissertation is the result of my own independent work/investigation, except where otherwise stated. Other sources are acknowledged by giving explicit references. A bibliography is appended.

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ACKNOWLEDGEMENTS

DEDICATION

This dissertation is dedicated to Mr Dumisani P. Buthelezi.

ABSTRACT

Background: Food waste in the foodservice units, which include supermarket kitchens, occur due to factors related to the menu such as the lack of careful menu planning, improper procurement of the menu items, lack of menu execution and improper practices during the distribution of meals. Also, improper refrigeration and storage facilities at optimal temperatures to maintain product's shelf life contribute to food waste in foodservice units. Food waste management is a significant challenge globally and locally.

Purpose of the study: To determine the knowledge on food waste and waste prevention practices of food handlers in supermarket kitchens in Soweto.

Methods: A quantitative, descriptive research design was chosen to determine the knowledge and food waste prevention practices of food handlers. The population was 11 branches of supermarkets represented by one of the five largest franchise stores in South Africa with approximately 20 to 35 food handlers employed by each supermarket (± 220 total) as indicated by management. Only three supermarkets gave permission for the study. From the population, the survey system calculator was used to calculate the sample size (n=107). Purposive sampling was used to select the supermarkets and participants were conveniently sampled. A questionnaire based on reviewed literature was developed by the researcher to determine food handlers' knowledge on food waste. An existing observation checklist was also amended for this study. Before the observations began, the researcher was alert about the reactivity problems. Data were collected during different times of the month, and the observations were conducted at different times of the day in each supermarket to measure the behaviour that was demonstrated by food handlers in the morning and in the afternoon. Collective instances of food waste practices were observed. For this study, descriptive statistics were used (SPSS version 27) to analyse the food waste knowledge of food handlers in supermarket kitchens. Presentation of the results was in the form of graphs, tables and charts. A frequency table was used.

Results: The demographic profile of the participants indicated that many participants were women (60.7%) and 39.3% were men. The results suggest that to a larger extent, the food handlers have limited or insufficient knowledge on the customer's profiles. The general food waste knowledge results was good. However only 47.7% of the respondents agreed that food waste can led to environmental damage. The majority of the responds

(61.7%) strongly agreed that careful menu planning contributes towards preventing food waste. Food handles knowledge on food storage was good. Food preparation results reflected a good level of knowledge regarding the appropriate methods of food preparation to minimise food waste. Food handlers' knowledge results revealed that participants had a moderate (45.4%) level of knowledge of green practices. There was a high level of knowledge on waste separation (82.3%). None of the supermarkets participated in any of the compositing activities to manage food waste. The observation results revealed poor waste prevention practices as influenced by the lack of menu planning. Lastly, menu planning results indicated that staff members recognise the importance of careful menu planning (61.7 percent strongly agreed) contributing towards preventing food waste. Factors and actions that were observed on food handler's practices were mostly correct (56.7%) and 43.3 percent of the practices were lacking during food production in the kitchen. The results of the current waste prevention practices of food handlers in supermarkets revealed the necessity to develop food handlers' guidelines.

Conclusion and recommendations: It is evident that the supermarket food handlers may not be aware of the importance of a menu as a communication tool, which has a major influence on all the aspects of the foodservice unit including food waste prevention and management. Food handlers' level of knowledge findings on food waste did not align with practices that were observed during meals production in supermarket kitchens. The level of food handlers' knowledge and waste prevention practices has been determined and the guidelines on food waste prevention practices for this target group has been developed as the basis for further studies.

Key words: Food waste knowledge, food waste practices, food Handlers, supermarkets kitchens

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GLOSSARY OF TERMS

The following concepts applicable in this study are defined as follows:

Food handler

A food handler is any person who comes into contact and directly engages with cooked or uncooked food and uses all equipment used to prepare and serve food (FAO 2019:5). For the purpose of this study, food handlers are referred to as the cooks, chefs and food servers (deli food servers) in food production kitchens.

Food waste

Food waste refers to food, which is fit for consumption and of good quality, being discarded or not used for its intended use (Consumer Goods Council of South Africa [CGCSA] 2019:1).

Food waste practices

Practices of food waste are the way food waste is managed in terms of reducing, reusing, recycling. It involves the systematic approach starting with the use of natural resources, manufacturing, sales, and consumption and ending with decision on final disposal (Environmental Protection Agency [EPA] 2019).

Green practices

Green practice is to become environmentally friendly by taking steps to reduce pollution, conserve resources, conserve energy, reduce production of waste and protect the environment (Elsaied 2018:660).

Soweto

A group of townships in northern eastern South Africa southwest of and administered by Johannesburg (Dictionary 2020).

Supermarket

A supermarket is a self-service store with a wide range of food and household products that are arranged into departments (Matamalas & Ramos 2009:5).

LIST OF SYMBOLS AND ACRONYMS

AD	Anaerobic digestion
ANOVA	Analysis of variance
AWARE	Association of Whistler Area Residents for the Environment
BTech	Baccalaureus Technologiae
^{o}C	Degrees Celsius
CAST	Council for Agricultural Science and Technology
CF	Carbon footprint
CGCSA	Consumer Goods Council of South Africa
CoGTA	Co-operative Governance & Traditional Affairs
CSIR	Council of Scientific and Industrial Report
DoH	Department of Health
DTIC	Department of Trade, Industry and Competition
EPA	Environmental Protection Agency
FAO	Food and Agriculture Organization
FDA	Food and Drug Administration
FIFO	First in first out
FLW	Food waste and loss
FSC	Food supply chain
FW	Food waste
GHG	Greenhouse gas
GRMI	Grocery retail market inquiry
HACCP	Hazard Analysis Critical Control Point
HLPE	High-Level Panel of Expert
IDP	Integrated Development Plan
IFAD	International Fund for Agricultural Development
KAP	Knowledge, attitude and practice
Kg	Kilogram
KZN	KwaZulu Natal
LFHW	Love Food Hate Waste
NGOs	Non-governmental organisations
NPOs	Non-profit organisations

NWMS	National Waste Management Strategy
OHS	Occupational Health and Safety
OSP	Standard Operating Procedures
PATH	Protecting Americans from Tax Hikes
PPE	Personal protective equipment
RASA	Restaurant Association of South Africa
SA	South Africa
SARS	South African Revenue Services
SAWIC	South Africa Waste Information Centre
SAWIC	South African Waste Information Centre
SD	Standard deviation
SDGs	Sustainable Development Goals
SOWETO	South Western Townships
SPSS	Statistical Package for Social Science
SRPC	Supermarket Recycling Program Certification
SSA	Statistics South Africa
UK	United Kingdom
US	United States
UNEP	United Nations Environment Programme
UNGA	United Nations General Assembly
UNPD	United Nations Development Programme
VUCA	Vitality uncertainty complexity ambiguity
VUT	Vaal University of Technology
W&RSETA	Wholesale & retail sector education and training
W2F	Waste to Food
WFP	World Food Programme
WHO	World Health Organization
WRAP	Waste and Resources Action Programme
WWF	World Wild Fund
ZWIA	Zero Waste International Alliance

1

SETTING OF THE PROBLEM AND JUSTIFICATION

1.1 INTRODUCTION

Globally, an excessive amount of food produced for human consumption goes to waste (World Wild Fund [WWF] 2017:4). Food waste is an environmental, social and economic problem. Yearly, about 1.3 billion tons of food are wasted or lost globally (Rois, Meier, Gossling & Cornuz 2018:9), of which approximately 30 percent of food waste is from farm to fork (Hardersen 2018:1).

In sub-Saharan Africa, 46 percent of the total waste comprises of organic waste that includes food waste (Gebremedhin 2018:26). South Africa spends about R61.5 billion a year on food waste removal, which has a negative impact on the economy, environment and society (Council of Scientific and Industrial Report [CSIR] 2019:7). Most of the food waste is not reused or recycled due to reckless disposal of waste into the environment (Kubanza 2010:1) despite space limitations and greenhouse gas (GHG) emissions at landfills. The quantity of food waste produced is a significant indicator of inefficient resource use (Turcker & Farrelly 2015:683). Therefore, food waste management is still a significant challenge globally and locally.

1.2 BACKGROUND TO THE PROBLEM

The largest amount of food waste and loss in South Africa is produced by agricultural/ post stage (50%) followed by processing and packaging (25%), distribution and retail at 20 percent with consumer level at 5% (WWF 2017:5). Research on food waste indicates that retailers have a significant influence on consumer level food waste (Young, Russell, Robinson & Chintakayala 2018:2), distribution and retail food waste (20%) calls for more in-depth research. The evidence indicates that household food waste is not only because

of consumer reckless behaviour, but also due to the marketing tools adopted by supermarkets (Koivupuro, Hartikainen, Silvennoinen, Katajajuuri, Heikintalo, Reinikainen & Jalkanen 2012:183). For example, the multi-buy supermarket food deals are seen as key facilitators of food waste generation in households (Calvo-Porral, Medin & Losada-Lopez 2016:57).

The population growth experienced in South Africa (South Africa Waste Information Centre [SAWIC] 2018:6) and the driver of food waste generation within different stages of the food supply chain (Godfrey 2018:6), owing to a high demand for food, has led to the high number of retailers (Nair 2018:320), which contribute to food waste. The South African food retail industry is diverse; it includes large formalised supermarket chains, wholesale markets, spaza shops and informal traders on the street (Grocery Retail Market Inquiry 2019:6). According to Matamalas and Ramos (2009:5), a supermarket is a self-service store with a wide range of food and household products that are arranged into different departments. A supermarket is larger and has a wider selection of products than a traditional grocery store. Supermarkets includes but are not limited to, ready-to-eat foods, such as full meals, baked goods, fruit and vegetables, butchery, dairy sections and other types of food items. Supermarkets have food handlers working in the food service outlets which have been highlighted as the main contributors to food waste. For this study, the focus was on food waste in the supermarket kitchens.

Food waste in the foodservice units, which include supermarket kitchens, occur due to factors related to the menu such as the lack of careful menu planning, improper procurement of the menu items, lack of menu execution and improper practices during the distribution of meals (Derqui & Fernandez 2017:439; Marais, Smit, Koen & Lotze 2017:21). Also, improper refrigeration and storage facilities at optimal temperatures to maintain product's shelf life contribute to food waste in foodservice units (Eriksson, Strid & Hansson 2016:80).

The literature on inventory control in foodservice operations stipulates that food items held in storage represent a significant investment of the organisation's assets. However, if the monetary value of food in storage is clear to management only, employees may not always grasp this concept (Egan 2015:34)., It is likely that food handlers may lack awareness, skills regarding food waste, the capacity to identify food waste and the monetary value attached to food waste. Thus, the focus of this study was to determine food handlers' knowledge on food waste and waste prevention practices in supermarket kitchens.

1.3 PROBLEM STATEMENT

In Africa, South Africa has the largest proportion of food waste, yet 24.5 percent of people go to bed hungry each day (Oelofse, Muswema & Ramukhwatho 2018:1). Gauteng has the largest share of the South African population with about 15.5 million people (26.0%) (Statistics South Africa [STATS SA] 2020). The city of Johannesburg Metropolitan Municipality under Gauteng province is divided into seven regions and the most populated region (24%) is Region D, Soweto, which covers Doornkop, Diepkloof and Meadowlands with the highest rate (43%) of unemployment (National Department of Health [DoH] 2018:13). The main drivers for food waste include population growth and urbanisation, which require more retail value chains in South Africa actively participating in food waste management practices (National Waste Management Strategy [NWMS] 2020:14). The population growth has led to the increased number of supermarkets located within Soweto township that sell convenience and grocery items, which are beneficial to the customers.

According to Makhitha (2016:1752), the supermarkets comprise approximately 55.5% of food products. Therefore, the increase in supermarkets contributes to the increased usage of natural resources and food waste. The reasons for food waste generation in supermarket kitchens are multiple. This can be due to overstocking of food inventory, poor production methods and storage, poor cold chain management, as well as unsold

food, which leads to food disposal due to passing of the best before or use by date (Martin-Rios, Demen-Mereier, Gossling & Cornuz 2018:201). In addition, Filimonau and Gherbin (2017:1186) indicate that irresponsible staff attitudes and their disinterest in minimising food wastage are a challenge for food waste management. Employees' engagement in the delivery of environmental management initiatives is crucial as it saves money, improves customer loyalty and builds productivity. However, food waste holds the largest mitigation potential from the managerial perspective, as it rests within the concerns of primary managerial responsibility.

To enlighten the problem, the growth of supermarkets in South Africa, due to the increasing population, contributes to the South African crisis about the waste impact on the environment, economy and society. All sectors that contribute to the usage of natural resources and food waste are entitled to take initiatives at all levels, including the supermarkets as part of the food supply chain. Managing food waste leads to reduced costs for the organisation and for the environment (Mabaso & Hewson 2018:2).

1.4 MOTIVATION AND JUSTIFICATION OF THE STUDY

Supermarket managerial attitudes often represent a significant barrier to the adoption of more effective food waste management practices in many retail ventures (Filimonau & Gherbin 2017:1185). There are limited studies about food handlers' knowledge and practices on food waste in supermarkets as indicated in Table 1.1, which indicates studies that have been conducted in supermarkets globally. Therefore, this justifies the need to target food handlers, including managers, to determine knowledge on food waste and waste prevention practices of food handlers in supermarket kitchens.

Notably, not much has been done in South Africa (refer to Table 1.2) to study food waste knowledge and waste prevention practices by food handlers in supermarket kitchens, despite the identified challenges on the economy, society and the environment (WWF 2017:7). Table 1.2 indicates studies that have been conducted in supermarkets in South

Africa; as indicated, there are limited studies about food handlers' knowledge and waste prevention practices on food waste in supermarkets. From the commencement and up to the submission for examination of this study (2019-2021) the studied literature revealed that, there is no sound policy that has been formulated with procedures in South Africa, which enforces food services to comply with eco-friendly practices on food waste (Mbasera, Du Plessis, Saayman & Kruger 2016:1). According to Carino, Collins, Malekpour and Porter (2021:156), there is no correlation of correct green practices with the knowledge in some food services. Therefore, this indicates a gap and the need to compile green practice procedures to be followed by food handlers. The lack of studies on food waste in supermarket kitchens is an obstacle and needs to be addressed.

In addition, the fact that policies are not successfully adopted and implemented could be contributing to a lack of visibility of food waste volumes and causes, across supermarkets, which in turn contributes to the high level of food waste (WWF 2017:19). In order to reduce food waste in supermarket kitchens, it is necessary to have an in-depth understanding of the factors shaping food handlers' practices and the level of their knowledge on food waste. Therefore, the researcher will observe the current practices applied by the food handlers in the supermarket kitchens targeted in this study. The contribution of this study is to provide a picture of the factors causing food waste in kitchens in supermarkets, identifying potential action points for further reduction and highlighting future research directions with regards to food waste knowledge and practices by food handlers in the supermarkets. The study further contributes to knowledge on environmental sustainability by unpacking the insights and current patterns on food waste practices by food handlers.

Table 1.1: List of global food waste studies in supermarkets conducted between 2015-2020

Reference	Study setting and participants	Study design and intervention	Main significant results
Scholz, K., Eriksson, M. & Strid, I. 2015. Carbon Footprint (CF) of supermarket food waste.	-Swedish supermarkets -n=6 investigated stores - analysed data on products in the meat, deli, cheese, dairy and fruits & vegetable departments	-Aim was to analyse wasted retail food in terms of GHG emissions, in order to obtain knowledge about the climate impact pattern of food waste. - To quantify and illustrate the discrepancies between mass and CF profile of the waste. -used life cycle assessment	-Over a three-year period, 1570 of fresh food were wasted in the six supermarkets - total wastage CF was 2500 t CO_2e. -Halving the waste of the top three products in each department could save more than 25 t CO_2e per store and year.
Eriksson M., Strid, I. & withHansson, P. 2016. Food waste reduction in supermarkets-Net costs and benefits of reduced temperature.	-Swedish supermarkets -n=6 supermarkets	-A case study using three years of data on cheese, dairy, deli and meat product. -Used life cycle assessment	-Food waste was found to be reduced lower storage temperature for all product tested.
Cicatiello, C., Franco, S., Pancino, B. & Blasi, E. 2016. The value of food waste: An Exploratory study on retailing.	-Central Italy supermarket -Waste audit on fruits, bakery products, vegetables, wheat, coffee and sugar, pasta and rice, dairy products and eggs, baby food, biscuits and snacks, meat product and beverages.	-An exploratory case study -Quantitative investigation. -Composition analysis -data collection: January to December 2012	-The results show that the extent of food wast in retailing is certainly considerable, both in terms of quantity and economic value.

Table 1.1 (cont.)   List of global food waste studies in supermarkets conducted between 2015-2020

Reference	Study setting and participants	Study design and intervention	Main significant results
Brancoli, P., Rousta, K. & Bolton, K. 2017. Life cycle assessment of supermarket food waste.	-Supermarket in Sweden	-Analysed the food waste at supermarket in Sweden in terms of product type, mass, environment impacts and economic costs. -used database from 2014 - 2015 -quantification of food waste over a one-year period.	-The annual wastage of bread and beef products have the largest contribution to the environmental footprint.
Hermsdorf, D., Rombach, M. & Bitsch, V. 2017. Food waste reduction practices In German food retailers.	-Food retailers in Germany -n=12 food retailers and food banks managers.	-Study focus is on selling and redistributing agricultural produce with visual impairments and surplus food. -Qualitative content analyses - Exploratory study -Snowball sampling. -Interviews.	-Retailers were reluctant to include agricultural produce with visual impairments in their products assortments, due to fears of negative consumer reactions. -logistics and regulatory framework were the main barrios to food redistribution.
Filimonau, V. & Gherbin, A. 2017. An exploratory study of food waste management practices in the UK grocery retail sector.	-UK grocery retailers -South East Dorset region -managerial interviews -n=twelve interviews	-Investigating how managers of major UK retailers address the problem of food waste in their day-to-day operations. -Exploratory study -Qualitative method -Cross sectional analysis -Interviews and focus groups.	-The majority do not assign the due significance to food waste because of the recycling and food waste disposal practices adopted in house. -alternative approaches are on an ad-hoc basis.

Table 1.1 (cont.)   List of global food waste studies in supermarkets conducted between 2015-2020

Reference	Study setting and participants	Study design and intervention	Main significant results
Bilska, B., Piecek, M. & Krajewska, D. 2018. A multifaceted evaluation of food waste in Polish supermarket-case study.	-One supermarket in Polish -Focus on 14 food groups	-A case study - objective was to evaluate food wasted in terms of mass, financial value and wasted calories value. -Duration: two weeks -Used questionnaires and database	-The evaluation shows that in one supermarket, approximately 3.3 tons of food was wasted in over two weeks. -The group of products with the highest waste were fruits and vegetables, followed by meat, cold meat and fish.
Teller,C., Holweg,C., Reiner. C & Kotzab, H. 2018. Retail store operations and food waste.	-Western European retailers -n=28 case studies -n=12 interviews	-Focuses on the issue of food waste from a retail and store operations perspective. -Exploratory research - Case study studies - Semi-structured interviews -Qualitative method	-Findings show that the root causes of food waste are related to undesirable customer behaviour and erratic demand, inefficient store operations and replenishment policies.
Smith, F., Mirosa, M. & Skeaff, S. 2020. A mixed-methods study of retail food waste in New Zealand.	-New Zealand -n=16 retailers	-Aimed to quantify retail food waste and identify key drivers for food waste reduction. -Mixed method -interviews and observations.	-The barriers to food waste reduction were: training and educating staff, food safety concerns, quality standards and lack of available resources.

Table 1.2   List of studies conducted in supermarkets regarding food waste in South Africa from 2015-2020

Reference	Study setting and participants	Study design and intervention	Main significant results
-Le Roux, C. 2017 The extent and drivers of perishable food waste in the retail supply chain industry in South Africa.	-South Africa -Retail industry -five main retail groups (population) -n=406 individual retailers' data	-To determine the extent of waste at the retail level on perishables, promotions and price, shelf life and seasonal demand and supply. -Quantitative	-Found that the extent of food waste in S.A. is lower than expected. However, the extent of food waste is still significant considering the amount of food waste in the food supply chain.
-Du Toit, K. 2018 A model for consumer forces of food waste in the retail industry.	-South Africa -677 retailers' population -n=6 major retailers	-To contextualise consumer forces that influence the level of food waste at the retailer sector pertaining sales. -Mixed method -Structured interviews -Telephonic questionnaires	- the living standard measurement of customers influenced the percentage sales in the presence of studied consumer forces.
-Parker, J., Sikobi, T. & Jones, P. 2019. Wastage: its effect on green retail and its role in Socio-economic improvement and food security.	-South Africa -W&RSETA retailers' database -n=254 - population: 15854	-An assessment of wastage with S.A retail sector -questionnaires -Fourteen interviews were conducted - Qualitative - Online interviews and surveys	-There are not many alternatives available for retailers to implement green initiatives, there is insufficient support from government or incentives to implement green initiatives. Retailers cannot afford to invest in green initiatives

1.5 RESEARCH QUESTION

The research questions that guided this study were: What is the level of food handlers' knowledge on food waste in supermarket kitchens in Soweto? What are food waste prevention practices by food handlers in supermarket kitchens in Soweto township?

1.6 OBJECTIVES OF THE STUDY

The following section presents the main and sub objectives of the study.

1.6.1 Main objective

The main objective of this study was to determine the food handlers' knowledge of food waste and waste prevention practices in supermarket kitchens in Soweto.

1.6.2 Sub objectives

To achieve the main objective, the following sub objectives were measured:

Sub Objective 1

To determine the level of food handlers' knowledge on food waste using a food handler's questionnaire.

Sub Objective 2

To determine practices of food handlers on food waste prevention by using an observation checklist.

1.7 DELIMITATIONS OF THE STUDY

1.7.1 Inclusion criteria

- Supermarkets that gave the researcher permission to conduct the study.

- Kitchen and deli food handlers only.
- Food handlers that were present at work during data collection.
- Food handlers that gave consent to participate in the study.
- Supermarkets located within Soweto township, region D only.

1.7.2 Exclusion criteria

- Supermarket employees from other departments.
- Food handlers that were not present at work during data collection.
- Food handlers that were not willing to participate in the study.
- Food handlers from the suppliers and delivery people that are not employees of the supermarket.

1.8 IMPORTANCE OF THE STUDY

The proposed study sought to provide an in-depth understanding of the factors shaping food handlers' practices and the level of their knowledge on food waste especially in supermarket kitchens. The findings might contribute to food waste knowledge, environmentally friendly prevention practices and solutions. Alternative solutions to waste management are vital in South Africa. Therefore, the study will contribute to the literature on food waste in supermarkets, through actual knowledge and suggested practices on food waste. This study used a non-experimental quantitative research design and a descriptive design, which will be discussed in Chapter 3.

1.9 LAYOUT OF THE DISSERTATION

The study is presented in five chapters. Chapter 1 presents the background to the problem, motivation and justification, problem statement and objectives of the study. Chapter 2 covers the literature review on knowledge of food waste and practices by food handlers in supermarket kitchens. Chapter 3 discusses the methodology of the study on the research design, study population, sample size, ethical considerations, measuring

instrument to collect data and the data analysis methods. Furthermore, Chapter 4 covers results analysis and interpretation and discussion of the findings of the study. The last chapter (Chapter 5) discusses an overview of the study, limitations, recommendations and conclusion of the study. The layout of the dissertation is presented in Figure 1.1.

Chapter 1	→	SETTING OF THE PROBLEM AND JUSTIFICATION	→	1. Background to the problem 2. Problem statement 3. Research question and objectives
Chapter 2	→	LITERATURE REVIEW	→	1. Food waste knowledge and practices by food handlers in supermarket kitchens.
Chapter 3	→	METHODOLOGY	→	1. Ethical consideration. 2. Study population and sample. 3. Measuring instruments
Chapter 4	→	RESULTS AND DISCUSSIONS	→	Interpretation and discussion of the finding of the study.
Chapter 5	→	CONCLUSION	→	Conclusion and recommendations for future research.

Figure 1.1: Layout of the study

2.1 INTRODUCTION

The main purpose of this study was to determine the knowledge of food waste and waste prevention practices of food handlers in the supermarket kitchens in Soweto, South Africa. Notably, not much has been done in South Africa (refer to Table 1.2 in Chapter 1) to study food waste knowledge and practices by food handlers in supermarket kitchens. Owing to the limited literature on food waste knowledge and practices by food handlers in supermarket kitchens as part of food service units in South Africa, a gap was identified to survey the literature in this regard.

Journal papers, accredited scholars and researchers, books and government reports were reviewed in this literature review. The majority of the literature was found in sources such as Google scholar and the Vaal University of Technology (VUT) library (electronic database). Search terms that were used as key words included food waste, kitchen food waste, food services, supermarkets, meal production, food waste causes, green practices, food handlers and food waste knowledge.

In this chapter, the theoretical framework model that was followed by the current study is discussed. Furthermore, global food waste problems, the impact of food waste in South Africa, specifically the role of supermarkets in the food supply chain (FSC) with emphasis on factors that contribute towards food waste in food service units, such as supermarket kitchens, is presented in relation to knowledge and practices of food handlers. Additionally, factors that contribute towards preventing food waste, management guidelines, green practice campaign awareness and non-governmental organisations' role on food waste were discussed. An overview of the South African supermarkets' food waste programmes and food waste management challenges was provided. A brief discussion on the methodology applied in the study is also presented. The literature

review provides the context of this study. The theoretical framework that guides the study is presented in the next section.

2.2 THEORETICAL FRAMEWORK

The knowledge, attitude and practice (KAP) model was used as the theoretical foundation for this study. KAP theory model was introduced by Schwartz (1976:28) to determine interrelationship of knowledge, attitude and practice as indicated in Figure 2.1. Knowledge is the information and skills acquired through experience or education; the theoretical or practical understanding of a subject (Oxford Learner's Dictionaries 2021). Babu (2014:148) defines attitude as a person's behaviour towards a specific object or subject to the conditions prevailing in the environment.

In the context of this study, Asmawi, Norehan, Salikini, Rosdi, Munir, Basri, Selemat and Nor (2017:351) findings confirmed that knowledge is the most important factor to influence the outcome of attitudes and practices among the food handlers. Food handlers with good expertise will have good attitudes and behaviours. However, Da Cunha (2021:131) argues that knowledge gained from training generates changes in practice. Numerous studies (Da Cunha 2021; Mihalache, Dumitrascu, Nicolau & Borda 2021; Asmawi *et al.* 2018; Zanin, Da Cunha, Rosso, Capriles & Stedefeldt 2017) have used the KAP model in different types of food service industries, however, the majority focused on the food safety perspective. Therefore, in this study, the KAP model was applied to determine the association of food handlers' knowledge and practices on food waste, which ultimately, determined the factors behind food handlers' attitudes towards food waste.
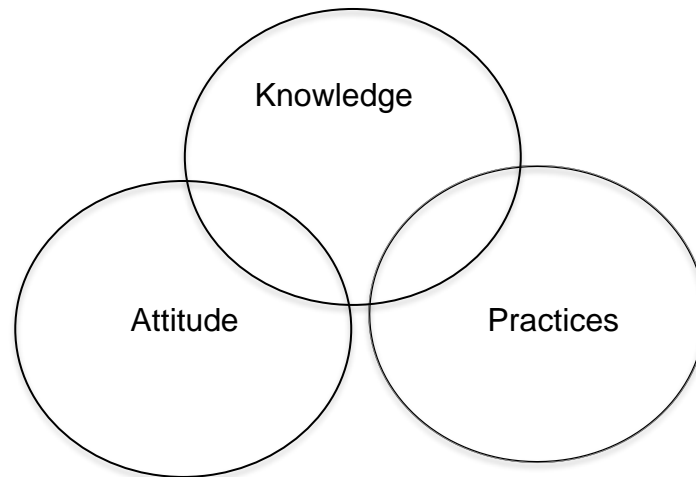
Figure 2.1: Knowledge, attitude, practices (KAP) model (Adapted from Schwartz 1976)

The difference between food waste and food loss within the food supply chain is discussed in the next section.

2.3 FOOD WASTE AND FOOD LOSS

2.3.1 Food waste

Food waste is defined as food fit for human consumption that is discarded, whether it has been kept past its expiration date or has been left to spoil due to behavioural issues. Food loss, on the other hand, refers to a reduction in the mass (dry matter) or nutritional value (quality) of food that was intended for human consumption. (Consumer Goods Council of South Africa [CGCSA] 2019:6). According to Okazaki, Turn and Flachsbart (2008:2483), food waste is any food not consumed by humans and can occur at any stage of the food chain from farms, processing plants, manufacturers, commercial establishments and households. Furthermore, Richter and Bokelmann (2016:425) define food waste at each stage along the chain as a specific proportion of food originally intended for consumption but which does not reach the intended consumer. However, the High-Level Panel of Experts (HLPE 2014:22) describe food waste as food appropriate for human consumption

being discarded or left to spoil at consumer level, regardless of the cause. In addition, the food waste literature further categorises food waste as unavoidable or inedible and avoidable or edible food waste. Banks (2018:3) defines unavoidable food waste typically as waste consisting of food preparation residues from items such as inedible peels or seeds and avoidable food waste consists either of unused food, which is mostly discarded due to over-purchase and/or the passing of a best before date or of part-consumed items such as left-overs from meals.

2.3.2 Food loss

The FAO (2019) states that food losses occur along the FSC specifically during production/ farming prior to the retail stage and food waste exists at the level of distribution/ retail and consumption. Indeed, the Environment and Resources Annual Review (2019:120) agrees that food losses occur earlier in the FSC (production, transport, storage, processing and some distribution), while food waste occurs further below the FSC level, for example, retail and consumer level. Retailers are, therefore, dominated by large supermarkets, which contribute to a significant amount of food waste from storage procedures, preparation and sales (Eriksson 2015:18). There are several factors in the supermarkets, such as sales promotions, which play indirect roles by influencing consumers' behaviour (Chalak, Abou-Daher & Abiad 2018:1280). These factors, therefore, indicate that consumer-level food waste is influenced by decisions taken at the distribution stage, such as product packaging and food marketing strategy (Aschemann-WitzelIlona, Hooge, Normann, Blossle, Gronhoj & Oostindjer 2017:34). The occurrence of food waste both globally and in South Africa is discussed below.

2.4 FOOD WASTE GLOBALLY

Approximately 30 percent of the food produced for human consumption worldwide is lost or wasted along the food supply chain (Rezaei 2017:26). Meanwhile, the world's population is estimated to reach 9.1 billion by 2050 and this will require a 70 percent

increase in food availability (World Wide Fund [WWF] 2017). Therefore, lost and wasted food represents a missed opportunity to feed the growing world population (FAO 2013). The studies have long neglected the retail stage, even though sustainability is becoming an essential part of business processes as it can influence the entire food supply chain and its economic, environmental and social outcomes (Calmfors & Omar 2019:12). Waste levels are up to 35 percent and between zero and 15 percent of fruits and vegetables are wasted at retail level in all regions except sub-Saharan Africa (FAO 2019).

In September 2015, the United Nations [UN] (2015:1) adopted a set of 17 Sustainable Development Goals (SDGs), which include target 12.3 that calls for halving global food waste and loss per capita at retail and consumer level along production and supply chains by year 2030. The SDGs, also known as the Global Goals, are a universal call to end poverty, protect the environment and ensure that all people live in peace and prosperity (United National Development Programme [UNDP] 2020). As a result, SDG 12.3 is one of the goals that has an impact on other SDGs, such as the goal of achieving zero hunger (SDG 2), which calls for an end to hunger, the achievement of food security and improved nutrition and the promotion of sustainable agriculture, sustainable water management (SDG 6), climate change (SDG 13), land terrestrial ecosystems, forestry, biodiversity (SDG 15) and other SDGs (FAO 2019). This raises a question as to what extent the world has made progress in achieving this target. It is, therefore, vital to address food losses and wastes in order to reach some of the SDGs (De Steur, Wesana, Dora, Pearce & Gellynck 2016:360) worldwide.

In sub-Saharan Africa, South and South-east Asia, as developing parts of the world, food waste generated within the FSC at the production to retailing stage is significant, as shown in Figure 2.2, compared to consumer stage; however, supermarkets and other retailers are strongly influenced by the consumer's purchasing behaviour (du Toit 2018:23). In developing countries, 40 percent of the food losses and waste are lost during post-harvest and processing operations, while in industrialised countries, more than 40 percent of food waste is generated by retailers and consumers (FAO 2011).

Per capita food losses and waste (kg/year)
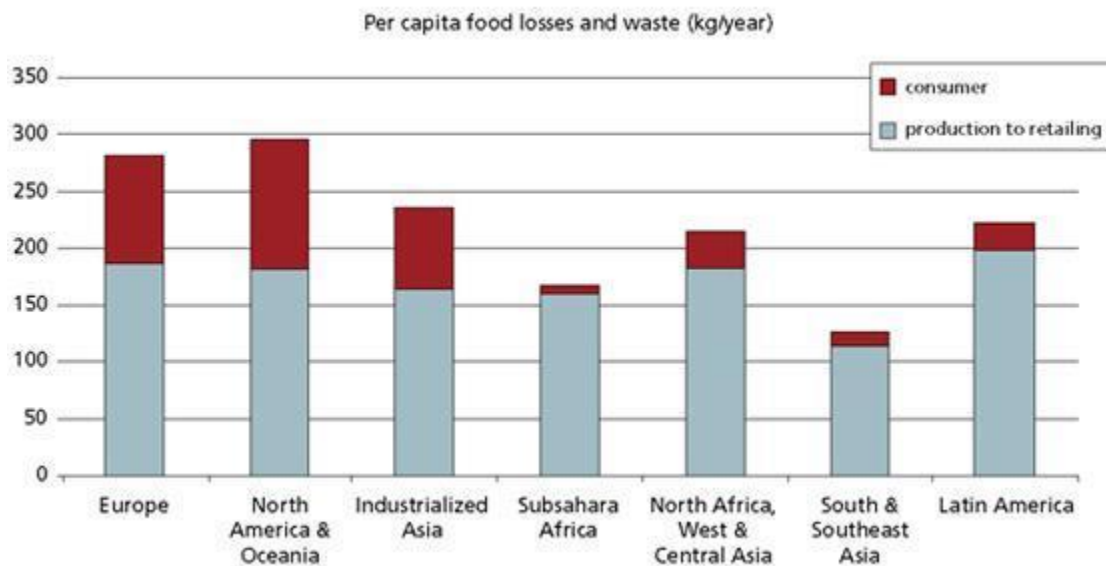
Figure 2.2: Global food waste per capita (FAO 2011)

2.5 FOOD WASTE IN SOUTH AFRICA

The South African Waste Information Centre [SAWIC] (2018:18) revealed that only 12 percent of organic waste, which comprises food waste, is being recycled and the rest is being disposed of in South Africa, despite the fact that South Africa faces severe constraints on the supply of methane-generating landfill sites (National Waste Management Strategy [NWMS] 2019:19). Food production in water-scarce countries such as South Africa is gradually becoming more challenging due to the growing population and intensifying water shortages (Morris & Ncube 2018). Thus, the cost of water and energy, along with the cost of waste disposal, means that food wastage is costly for the South African economy and the environment (WWF 2017). However, Filimonau and Gherbin (2017:1184) state that despite the fact that food waste negatively affects our society in a number of ways, insufficient research has been carried out on food waste in supermarkets as one of the dominant food supply chains.

Food waste leads to a severe food insecurity issue in South Africa (Misselhorn & Hendriks 2017:1), therefore, food waste can be linked to a waste of money and natural resources

(FAO 2013). When food is discarded, the land, water and energy used to produce, process, distribute and prepare food is also discarded (Council for Agricultural Science and Technology [CAST] 2016:23). The estimated food waste source footprints in South Africa are indicated in Figure 2.3.
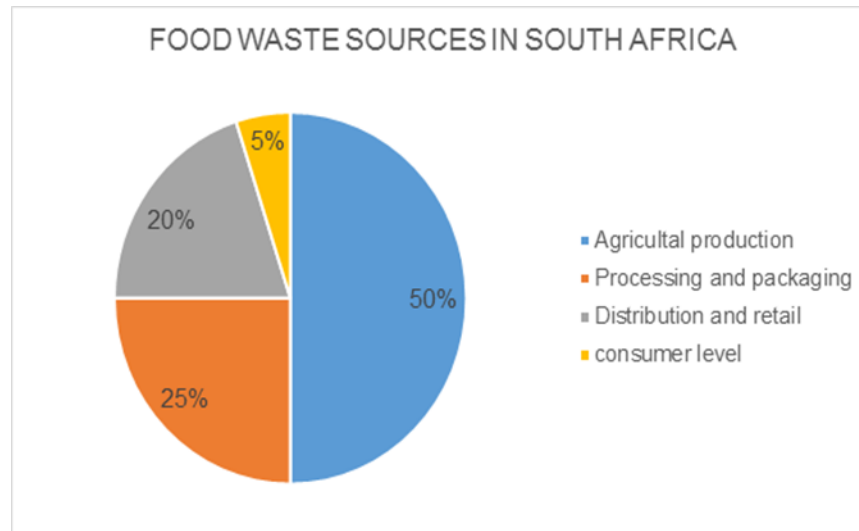
Figure 2.3: Food waste in South Africa. (adapted from WWF 2017)

Although the percentage of food waste in distribution and retail levels indicates 20 percent, 12 million people in South Africa (24.5% of the national population) go to bed hungry every day (Oelofse, Muswema & Ramukhwatho. 2018:1), indicating that the basic needs of human beings, namely physiological needs, as identified in Maslow's hierarchy of needs, are not met (Maslow 2019). South Africa is estimated as one of the countries with the largest proportion of food waste in Africa (Oelofse *et al.* 2018:1). This has a significant contribution on food waste generated throughout the FSC and has an impact on consumer stage of the supply chain downstream (Brancoli, Rousta & Bolton 2016:39). The low level of food waste in retailing in comparison to other areas of the FSC is one of the reasons why the food waste in retailing up to now has not been researched in depth, unlike other stages of the FSC (Cicatiello, Franco, Pancino & Blasi 2016:96). Research on food waste shows that the bulk of food waste is produced in the pre-consumer phase

of the supply chain in South Africa (Council of Scientific and Industrial Report [CSIR] 2014). The pre-consumer phase includes retailers that are more dominated by supermarkets (CSIR 2019). The following section further discusses food waste within the food supply chain, which includes all sources of the food supply.

2.6 FOOD WASTE IN THE FOOD SUPPLY CHAIN

The FSC consists of several stages in which food passes from producers to final consumers. Farmers harvest the initial production, processors produce and package the final products, distributors deliver the final products to retailers and finally, supermarkets and other retailers are the ultimate places for consumers to purchase the products (Nosratabadi, Mosavi & Lakner 2020:2). Waste is a problem for retailers, but it is not a retail problem in and of itself; rather, it is a system problem. Each link in the chain from "farm to fork" has an impact, whether positive or negative. Retailers can take the lead on food waste reduction by minimising food waste practices and educating other role players such as consumers (Wyman 2014:4).

In spite of the growing public recognition of negative socio-economic and environmental impact, the issue of food waste in supermarkets has been under-researched (Filimonau & Gherbin 2017:1184). South Africa is listed as one of the developing countries with an estimated 44 percent of the total food waste and loss (FLW) and a further 55 percent in developed countries (Ishangulyyev, Kim, Sang & Lee 2019:6). The loss of 44 percent of fruit and vegetable, followed by 26 percent of cereal, 15 percent of meat and dairy and 13 percent of roots, tubers and oilseed within the FSC is estimated in South Africa (WWF 2017). The supermarkets' role within the FSC as the focus of this study is discussed in the next section.

2.7 SUPERMARKETS ROLE IN THE FOOD SUPPLY CHAIN

Food reaches consumers through retail food distribution channels, including supermarkets (Environment and Resources Annual Review 2019:126). The retail food channel consists of convenience stores, discounters, deli shops, supermarkets and hypermarkets. The difference is the size, scale and range of the offered products (Krasteva, Kotzab, & Lienbacher 2019:5). However, wholesalers and retailers are still grouped together as many countries have found it difficult to distinguish between them (Stenmarck, Jensen, Quested & Moates 2016:22).

According to Bonanno and Busch (2015:10), supermarkets can be described as gatekeepers of the food system. Supermarkets are located close to the end of the supply chain and often store vast quantities of food in a limited number of physical locations (Eriksson 2015:11). Supermarkets stores do not affect all players in the food chain but serve as a conduit between consumers and producers.

2.7.1 Food waste in supermarket kitchens

The food waste study conducted by Bilska, Tomaszewska & Krajewska (2018:6) shows that in the supermarkets, the amount of waste in selected food groups as follows: vegetables (24%), fruits (14.9%), meat, including cold meat (12.5%), bread and beverages (10.3%) and milk and dairy products (7.5%). About 80 percent of food waste comes from perishable foods, including freshly prepared deli items, meats, fruits and vegetables, seafood, milk and dairy products and certain grain products, such as bread and bakery items. The problem of food waste in food service units, including supermarket kitchens, is also related to the handling of food items and failing to meet the customer demands (Krasteva *et al.* 2019:81). Non-perishable foods such as pasta, canned goods and highly processed, shelf-stable products are usually wasted less because they do not spoil as quickly (Rethink Food Waste Through Economics and Data [REFED] 2016:14).

2.7.2 Factors and sources contributing to food waste in supermarket kitchens

Food waste occurs during the following processes: planning and purchasing, storage, food handling, food preparation, serving and consumption (Okumus 2020:295; Food wise Hong Kong Campaign 2013:3). These are the factors that contribute to food waste generation in food service units due to a lack of proper menu planning (Marais, *et.al.* 2017:20). According to FAO (2019), factors that contribute to food waste are short shelf life, quality requirements in terms of colour, shape, size and demand variability. Consumer food waste is also caused by improper product purchases and preparation of meals, unnecessary buying (influenced by excessive portioning and package sizes), labelling confusion (best before and use by) and inadequate storage.

The sources of food waste indicate that other drivers of food waste occur in food service units, including supermarket kitchens, due to the impact of early-stage practices within the FSC, for example in transportation and supply of food products as indicated in Table 2.1.

Table 2.1: Waste sources in supermarkets (Lewis, Downes, Verghese & Young. 2017:21).

	Sector at which waste:					
	Occurs		Caused			
Source of waste	R	W	R	W	L	U
Product/packaging damaged during transport	✓	✓			✓	✓
Rejected for safety e.g. incorrect temperature management	✓	✓			✓	
Rejected for quality, e.g. aesthetic standards	✓	✓	✓			
Returned due to incorrect packaging/labelling, product recalls	✓	✓				✓
Surplus to demand, e.g. poor forecasting/inventory, mispicks, promotions	✓	✓	✓	✓		
Product/packaging damaged by handling e.g. packing, stacking, shelving	✓	✓	✓	✓		
Spoiled early e.g. due to lack of climate control during transport	✓	✓			✓	
Expired: low demand, poor rotation, misunderstanding dates	✓		✓	✓		
Spurned by customer, e.g. for appearance, shelf life, new product fails	✓		✓			

R = Retail store, W = Wholesale/retail distribution, L = Logistics/transport, U = Upstream (i.e. producer, processor or manufacturer).

Food products delivered in a bad condition would have a significant effect on the final product to the customer. Annual Review of Environment and Resources (2019:127) further noted that the market, regulatory and sociocultural requirements for food quality, aesthetic, safety and availability are all main drivers of retail and wholesale FLW, as well as forecasting uncertainty, logistical inefficiencies and technical malfunctions such as damaged items.

Teller, Holweg, Reiner and Kotzab (2018:981) used root cause analysis to identify the key cause of food waste, which include consumer behaviour, fluctuating demand, ineffective store management, in-store operations and replenishment policies. Mena, Terry, Williams and Ellram (2014:150) also state that the main causes of food waste include forecasting accuracy, promotions, stock management policies, quality control (discoloration) and temperature regulation during storage and supply. Additionally, losses in service units are even higher in situations where measures such as protective packaging, temperature and humidity control and proper display to minimise food handling by buyers are not in place (HLPE 2014:46).

2.8 FACTORS CONTRIBUTING TOWARDS PREVENTING FOOD WASTE

A comprehensive and thorough approach to waste management and food service procedures is crucial, identifying issues contributing to food wastage should remain a priority (Marais *et al.* 2017:22). Thus, this section discusses the factors that contribute to food waste prevention in food service kitchens, such as careful menu planning, menu execution, proper practices during meal distribution, good management practices during food storage and inventory control, application of good food handling practices, proper working conditions that prevent errors and accidents, human management resource management and availability of food waste management plans.

2.8.1 Food menu

Regardless of the menu pattern used, food menu design is an essential first step in food production. The first decision to be made is whether a no-choice, limited-choice, or choice menu will be used. A menu reflects what is available daily, weekly, or over a period of several weeks. (Brown 2014:125). A foodservice operation's menu is also known as its driver. This descriptive term emphasises how the menu affects every aspect of a foodservice operation and how the menu is a managerial tool for controlling many aspects of a foodservice operation (Egan 2015:59), including food waste. The menu design process should be well-planned, flexible enough to be reviewed on a regular basis and designed with customer preferences in mind (Food wise Hong Kong campaign 2013:5).

There are different types of menus (see Figure 2.4), which are often associated with particular foodservice operations (Egan 2015:60) and because of their nature can lead to more food waste. Another important consideration when creating a food menu is to include a meal plan pattern with balanced nutritional content and appropriate portion sizes based on dietary guidelines (Brown 2014:124).

BASIC TYPES AND CATEGORIES OF MENU

Table d 'hote menu	**À la carte menu**	**Static menus**	**Cycle menus**	**Daily (or single-use) menus**
• Fixed number of courses. • Selling price is fixed • Food is available at a set time • Limited choice within each course	• The choice is more extensive. • Each dish is priced separately. • Dishes are cooked or finished to order.	• Stay the same every day. • Mostly used in quick service and restaurants. • Include appetizers, salads, entrees, sides, desserts and beverages. • May be offered on a menu board or in a printed format.	• Mostly used in non-commercial foodservice units. • Serve the same group of customers daily. • Examples are business and industries, hospitals, and schools. • May be seasonally. • May be quarterly, half-yearly or annually.	• Change on a daily basis • Can be used for a special event with a single use. • Often used in fine dining • For catered events like parties, banquets or daily specials.

Figure 2.4: Basic types and categories of menus (Egan 2015:60; Cousins, Lillicrap & Weeks 2014:92).

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2.8.1.1 Careful menu planning

According to Derqui and Fernandez (2017:439), poor menu planning in foodservices contributes to food waste. Payne-Palacio and Theis (2016:133) further state that regardless of the type of foodservice, careful menu planning, implementation and evaluation are critical in meeting customers' needs and preferences within available resources. A well-planned menu serves as a catalyst for all operational functions, including purchasing, production and service. A menu is also a management control tool that influences resource acquisition and utilisation. Food, labour, equipment, time, money and facilities are examples of these resources. Customers' profiles, on the other hand, play an important role in the menu planning process (Egan 2015:63). Therefore, successful menu planning and knowing the customer's profiles go hand-in-hand.

The first step in menu planning is to understand customer preferences in the context of purchasing a product, which includes understanding what customers buy in terms of features or attributes they want in the product; who buys it – what types of consumers buy the product; why they buy it – what benefit they seek; when they buy it; where they buy it; and how they buy it (Ngugi, Osullivan & Osman 2020:2). Understanding a customer's profile is beneficial for a variety of reasons. Organisations survive by attracting and retaining customers. As a result, by understanding customer behaviour, the organisation will most likely be able to attract and retain customers more effectively. The knowledge of a customer's profile is important for the company's profit. It is useful for any job where the mission includes meeting human needs and desires (Ngugi *at el.* 2020:4).

Another aspect to consider in menu planning is knowing the customer's profiles. The demographic status of customers such as nationality, age, gender, household composition, education, and income are the factors that helps to understand customers' food preferences, that ultimately reduce food waste (de Hooge, Oostindjer, Aschemann-Witzel, Normann, Loose & Almli 2017:81). Thus, understanding such factors may provide some new and important insights into customer preferences for product purchase and

consumption, which may aid in the reduction of food waste (de Hooge *et al*. 2017:81). Bagdare and Jain (2013:791) define customer experiences as the sum of cognitive, emotional, sensorial and behavioural responses generated during the entire purchasing process, which include an integrated series of interactions with people, objects, processes and the environment. To control the customer experience is difficult for food service units, including supermarkets, because it is influenced by elements that are difficult to control and may be beyond control (Terblanche 2018:48). This calls for food service units' management to know the profile of customers before starting the process of menu planning in order to reduce food waste in food service units, including supermarket kitchens.

2.8.1.2 The importance of menus in a food service unit

All actions, such as purchasing, selecting equipment to use, scheduling labour and serving, are dictated by the menu (Brown 2014:124). Food menus are also used as a marketing tool for customers, as food menus that do not appeal to consumers are one of the causes of food waste (Marais *et,al*. 2017:20).

Heikkila, Reinikainen, Katajajuuri, Silvennoinen and Hartikainen (2016:449) reveal that a proper menu plan in foodservice unit kitchens has a significant impact on how kitchen activities are controlled and regulated and how various practicalities such as maintaining and correcting recipes and deciding on the amounts of food to be prepared influence the amount of kitchen waste. The findings show that errors in recipes and preparing excessive amounts of food increase kitchen waste. In other words, incorrectly sized or too large food portions increase waste.

2.8.1.3 Standardised recipes

A standardised recipe is a list of the ingredients and procedures needed to prepare a specific food item. When a recipe has been tested and adapted to the needs of a specific

foodservice operation, it is considered standardised. Customer expectations and efficient, effective use of available resources, such as personnel, equipment and money, are the important factors to consider when preparing a standardised recipe (Payne-Palacio & Theis 2016:219). It is easier for an untrained employee to make mistakes in the kitchen, which may result in food waste. Mistakes can occur as a result of incorrectly or carelessly interpreting or reading a recipe. Thus, attention to detail, meticulousness and the ability to follow instructions are essential components of professional skills required in the foodservice kitchen (Heikkila *et al.* 2016:450).

Goonan, Mirosa and Spence (2014:68) state that the overproduction of food leads to food waste, thus the use of standardised recipes is vital as it decreases the amount of food wasted during food preparation and production because it minimises production errors. Effective management and control of kitchen operations, such as procedures for maintaining and correcting recipes, agreeing on the amount of food to be prepared, menu planning and inventory management, play a role in the prevention of food waste (Heikkila *et al.* 2016:449). The use of portioning guidelines improves accuracy in portion control and thus avoids food waste (Goonan *et al.* 2014:68). Additionally, the cooks should be responsible for following recipes correctly and using items efficiently (Okumus 2020:302).

2.8.1.4 Importance of food attributes

Food menu principles include balance, nutritional quality, aesthetics and variety, including colour, texture, flavours, shapes and sizes of food (Egan 2015:62). Food presentation is based on the sensory and aesthetic appeal of food; when designing food menus, one should try to visualise how the food will look on the food display. The flavour combination, as well as the texture, shape and consistency contrast, should be considered (Payne-Palacio & Theis 2016:156).

LEANPATH (2016) states that creative food presentation displays should be achieved by creating food dishes in a variety of colours and elegant dishes, as well as reducing the

use of dishes that are rarely consumed. According to the Environmental Protection Agency [EPA] (2019:8), even small garnishes and incorrect serving sizes quickly add up to a significant amount of food ending up in landfills. Foodservice managers can reduce food waste by avoiding the use of inedible or rarely eaten garnishes and controlling serving size to reduce wasted food while still satisfying the appetite of the customer (REFED 2018).

2.8.1.5 Cooking methods and techniques

Knowledge of cooking methods and techniques, as well as food component arrangement, is essential for reducing kitchen waste (Hennchen 2019:679). Food handlers should be familiar with the different types of cooking methods, such as dry heat and moist heat. Dry heat methods include roasting, baking, broiling, grilling, griddling and frying. As shown in Table 2.2, moist heat methods include boiling or simmering, stewing, blanching, poaching, braising and steaming. The method used is determined by the type and quality of food as well as the availability of equipment. Different cooking methods are appropriate for various types of food (Payne-Palacio & Theis 2016:497). If an appropriate cooking method is used, food waste is reduced.

Table 2.2 Main cooking methods (Cousins *et al.* 2014:101)

Cooking method	Procedure
Baking	Cooking in either a conventional or a fan oven. Dry cooking is a term that is frequently used.
Boiling	Cooking food in a simmering liquid.
Braising	Slow cooking in minimum liquid in a casserole dish with a lid.
Deep frying	Cooking by placing into deep fat held at a temperature of about 175–190°C.
Grilling	Quick and dry method of cooking food by radiant heat, either over heated charcoal or under electric or gas salamanders.
Microwave	Cooking or re-heating food using high frequency power in a microwave oven Powered by electricity.
Poaching	Cooking in a minimum amount of liquid held at simmering point.
Roasting	Cooking with dry heat in the oven.
Shallow frying	Cooking in the minimum amount of heated fat or oil.
Steaming	Cooking heat is transferred from the water vapour (steam) to the food being cooked.
Stewing	Very slow cooking of food items in their own juices and using the minimum amount of liquid, such as stock, in the process.
Water bath:	The technique of vacuum packing ingredients and cooking them at low temperatures in a water bath. This is a slow and gentle process where moisture is not expelled and flavour is retained.

2.8.2 Careful menu execution

The execution of the menu is in the hands of the kitchen staff, regardless of the type of foodservice unit or the type of food served. Menus are only as good as the ability of the staff to produce the menu items as described (Taylor & Francis 2016:26). This section discusses factors related to menu execution during food production by food handlers,

such as ingredient issuing, ingredient preparation, menu and recipe compliance, food ingredient quality, re-use of menu items and food holding temperatures.

2.8.2.1   Issuing of ingredients

According to Ahmed (2018:57), there are food production kitchens with no designated person responsible for food storage and storage areas, no designated person to control issuing of ingredients and as a result, all kitchen staff are responsible and have access to food storages. However, to control inventory and determine daily menu costs, a requisition procedure must be established in which anything transferred from storage to the kitchen is done by a written request to the storage clerk. Personnel are resistant to using requisition forms because it is much easier and faster to simply enter the storage room and collect what is required. To reduce the likelihood of this happening, the storage areas should be secured by limiting the number of people who have access to the rooms, storage, freezers, or storage refrigerators (British Colombia [BC] cook articulation committee 2015a:36).

Additionally, effective controls on shrinkage, theft and pilferage, as well as unnecessary food handling, can help keep foodservice costs down (Egan 2015:220). Thus, it is critical to follow the food quantity specified by the kitchen staff. Portion control is one of the most important aspects of managing a foodservice organisation's food budget. Portions can be measured in three ways: weight or volume, number and size. Careless measuring eventually reflects in the final yield of food and the establishment's cost (Brown 2014:132). As a result, inappropriate storage and inventory management behaviours not only cost the company money, but also result in food waste when food handlers do not adhere to the correct quantities of food ingredients collected from storage; therefore, guidelines are important in this regard.

2.8.2.2 Preparation of ingredients

Food that is prepared inaccurately increases the chances that it will eventually have to be discarded due to spoilage or in the form of serving waste (Hennchen 2019:679). Okumus (2020:303) states that food preparation is one of the most crucial stages of food waste. The preparation steps refer to work routines that allow food to be served without major delays. Due to a typically limited time window during opening hours, ingredients are cut, food is precooked and products are organised in a fixed order (*mise en place*) (Hennchen 2019:679). One of the identified food waste drivers is a lack of food handlers' food preparation skills, such as poor cutting skills (Kasavan, Mohamed & Halim 2019:78). Therefore, improving preparation methods for the frequently wasted food items is one of the approaches that has the potential to minimise food wastage (Papargyropoulou, Wright, Lozano, Steinberger, Padfield & Ujang 2016:330).

Figure 2.5 indicates different recommended food handling tips, which also include food preparation tips to reduce waste (EPA 2019). Food waste can also be reduced during the preparation and production process by practices such as avoiding over-trimming of ingredients and whole vegetables (Leanpath 2016). Food handlers should be trained in cutting techniques, observed and rewarded for the best 'cutters' each month and food waste prevention champions should be assigned in the kitchen (Papargyropoulou, Wright, Lozano, Steinberger, Padfield & Ujang 2019:16). That can be accomplished by following standardised recipes with cutting specifications; however, kitchen staff prepare food based on their experience, not on a standard recipe (Ahmed 2018:57).

Additionally, a study conducted by Kiio and Njuguna (2020:95) revealed that approximately 70 percent of foodservice unit kitchens have colour-coded chopping boards for various tasks during food preparation, but they are still used haphazardly depending on which one is accessible or convenient to use. However, it is critical to avoid cross contamination during food preparation, which occurs when harmful bacteria are transferred from one food item to another via a non-food surface, such as utensils,

equipment, or human hands. Cross contamination can also occur between foods, such as when thawed meat drips on ready-to-eat vegetables. Proper hand washing procedures, clean and sanitised utensils and cutting boards, properly washed fresh fruits and vegetables and preparing the required batches of food are, therefore, essential (Garden-Robinson 2017:5). Contaminating food during food preparation not only results in food waste but also in food poisoning and food spoilage microorganisms, which can allow disease-causing microorganisms to be transferred directly to the consumer (Lorenzo, Munekata, Dominguez, Pateiro, Saraiva & France 2018:54).

Prep and Storage Tips

☐ **Use leftovers from the day before.** Steak one day can be used for beef stew the next day.

☐ **Train staff on knife skills to make more efficient knife cuts** to use more of the food being prepared.

☐ **Use as much of the food as possible.** Cook up carrot greens and don't peel cucumbers or potatoes.

☐ **Reconstitute stalky vegetables that have wilted** by immersing them in warm water (100˚F) for 15 minutes.

☐ **Marinate meats** to extend their shelf life for a few more days.

☐ **Different foods like different storage conditions.** Refresh staff on storage techniques for different foods (e.g., don't store tomatoes and lettuce in the same container or near each other).

☐ **Use see-through storage containers.** Easily see what is available and keep an eye on freshness.

☐ **Cook, freeze, juice, or otherwise process foods** that are approaching the end of their peak freshness to prolong their useful life.

Store Set Up and Display Tips

☐ **Set up a discount shelf for ripe, near-to-expire, discontinued, or slightly damaged food.** Provide clear communication about this reduced price section.

☐ **Redesign product displays with less excess.** For example, instead of a pile of produce, have a back support that makes it look like a pile to keep produce fresher.

☐ **Allow prepared foods to run out near store closing.** Track these items and only make as much as you can sell.

Engaging with Customers Tips

☐ **Provide taste samples.** Train staff to remind customers that they can try a sample to see if they like a product before they buy it.

☐ **Have best storage practices information available** in appropriate departments for certain foods, including how long food should last when stored properly.

☐ **Offer various options to your customers on produce** (e.g., whole, sliced, and mixed fruit). This will assist them in eliminating food loss in their own homes.

Figure 2.5: Food waste preparation tips (EPA 2021).

2.8.2.3 Compliance with menu and recipes

The complexities of food presentation, the ingredients used in cooking and the need to know the exact temperatures at which foods come together best are all factors that kitchen staff must be intimately familiar with in order to prepare food at its best. Many foods and ingredients are highly susceptible to overcooking and poor preparation techniques; for example, fresh fish will become rubbery and unappealing if cooked for even a few minutes too long. As a result, it is critical that the menu be created with an understanding of how skilled the kitchen staff will need to be in order to properly prepare the foods (Mahfud, Parddjono & Lastariwati 2019:59).

Following a standardised recipe step-by-step is the first step in adhering to the menu and recipe. A standardised recipe lists all the ingredients and quantities, as well as the instructions, in numerical order. The set of instructions describing how to prepare a specific dish, including the preparation method, cooking method and amounts, ensures consistent food quality and quantity, portion control and cost control (Brown 2014:134).

2.8.2.4 Quality and reuse of the food ingredients

Food quality standards are a set of characteristics that determine the acceptability of a product in terms of food purity, flavour, texture, colour, appearance and workmanship. Another quality criterion is the perceived worth of the product (Giovannuci & Satin 2007:7). Food quality standards were identified as another barrier to food waste reduction. Teller, Holweg, Reiner and Kotzab (2018:288) indicate that the customers' inability to tolerate the appearance of lower-quality food results in food waste. Some customers are even willing to pay more for an item if they believe it is of higher quality (Popovic, Bossink & van der Sijde 2019:22). Customers have high expectations of what 'fresh' looks like (Smith, Mirosa & Skeaff 2020:7).

It is critical to recognise that consumers have the right to demand high-quality food products that are appropriate for their taste as well as their aesthetic appearance (Filimonau & Gherbin 2017:1191). However, in the case of some food items, such as fresh produce, there is a tendency to sell only homogeneous and perfect produce (in terms of colour, shape and size) and food that does not meet these high standards is discarded (FAO 2019:37). This is due to consumers who are unmotivated to purchase sub-standard foods in supermarkets (De Hooge *et al*. 2017:81). Foodservice establishments are concerned that customers will be dissatisfied if defective food remains on the shelves and that this will discourage them from purchasing products from the store altogether (Smith *et al.* 2020:7). In this regard, consumer education is critical in helping consumers understand that imperfect-looking "ugly" fruits and vegetables are nutritionally perfect and provide the same nutritional value as perfect-looking produce (Yuan, Yi, Williams & Park 2019:2676).

Menu design flexibility to accommodate the use of leftovers and trimmings from previous meals is critical to success by creatively repurposing leftovers and trimmings to efficiently use excess food for other meals. Reusing leftover food can save money and reduce waste as long as proper food safety and handling practices are followed (Wyman 2014:7). Unsold breakfast meat, for example, can be used as an ingredient in lunch or dinner dishes. The strategy for safely repurposing ingredients can enable the kitchen to generate revenue from this potential waste (Clowes, Hanson & Swannel 2019:9). The best practices for reducing food waste include redesigning a food menu to improve opportunities for secondary use of food (for example, chicken sandwiches, chicken casserole and chicken soup) and paying close attention to quantities not sold to improve forecasting of future consumption (Okumus 2020:302).

Wyman (2014:7) further states that in-store production, where the operating model allows perishables nearing the end of their life to be transformed into a ready-to-eat product in store, for example through a salad bar or as part of a store-produced convenience range, can be an option for managing waste. Food waste can also be reduced by creating menus

with waste reduction in mind, reducing the number of ingredients and repurposing food preparation trim and overproduction (REFED 2018:10; Okumus 2020:304). Supermarkets can support and team up with chefs to demonstrate how to use leftover ingredients and food (Kor, Prabu, & Esposito 2017:6).

2.8.2.5 Food holding temperatures

Numerous research findings on food handlers' knowledge and practices on time and food holding temperature in various types of foodservice units were found to be insufficient in ensuring food safety and preventing food spoilage, which ultimately leads to food waste (Kunadu, Ofosu, Aboagye & Tano-Debrah 2016:329; Osaili, Obeidat, Hajeer & Al-Nabulsi 2017:286; Amhed 2018:57). As shown in Figure 2.6, one of the factors influencing safe food preparation and handling that reduces the risk of food spoilage is when the food temperature changes from heating to cooling, which places foods in the danger zone 4 – 60 °C (Marriott, Schilling & Gravani 2018:393). As a result, it is critical to avoid temperature/ time abuse during the food holding stages. Food temperatures should be monitored using thermometers (Garden-Robinson 2017:5).

Food temperature and time control during the preparation, thawing, cooking, cooling, reheating and serving stages should be followed as specified by the Food and Drug Administration [FDA] (2017) food code to protect public health and ensure food is unadulterated and accurately presented when offered to the consumer. Every foodservice unit establishment, including supermarket kitchens, should have a written plan regarding temperature and time for food preparation that states what will be monitored, when and by whom (Brown 2015:89). Some of the time and holding temperature control stages in food safety handling are as follows:

- Hot and cold holding: Hot food should be kept at a temperature of 54°C or higher, while cold food should be kept at a temperature of 5 °C or lower (FDA 2017:96).

- Cooling: Food must be cooled within 2 hours from 57°C – 21°C or less and within 6 hours from 57°C – 5°C or less. Time/ temperature control for safe food shall be cooled within 4 hours to 5°C or less if prepared from ingredients at ambient temperature, such as reconstituted foods and canned tuna (FDA 2017:94).
- Reheating: Controlling time and temperature for food that has been cooked, cooled and reheated for hot holding must be reheated to reach a temperature of at least 74°C for 15 seconds. The food at a temperature between 5°C and 60°C must be consumed within 2 hours (FDA 2017:91).
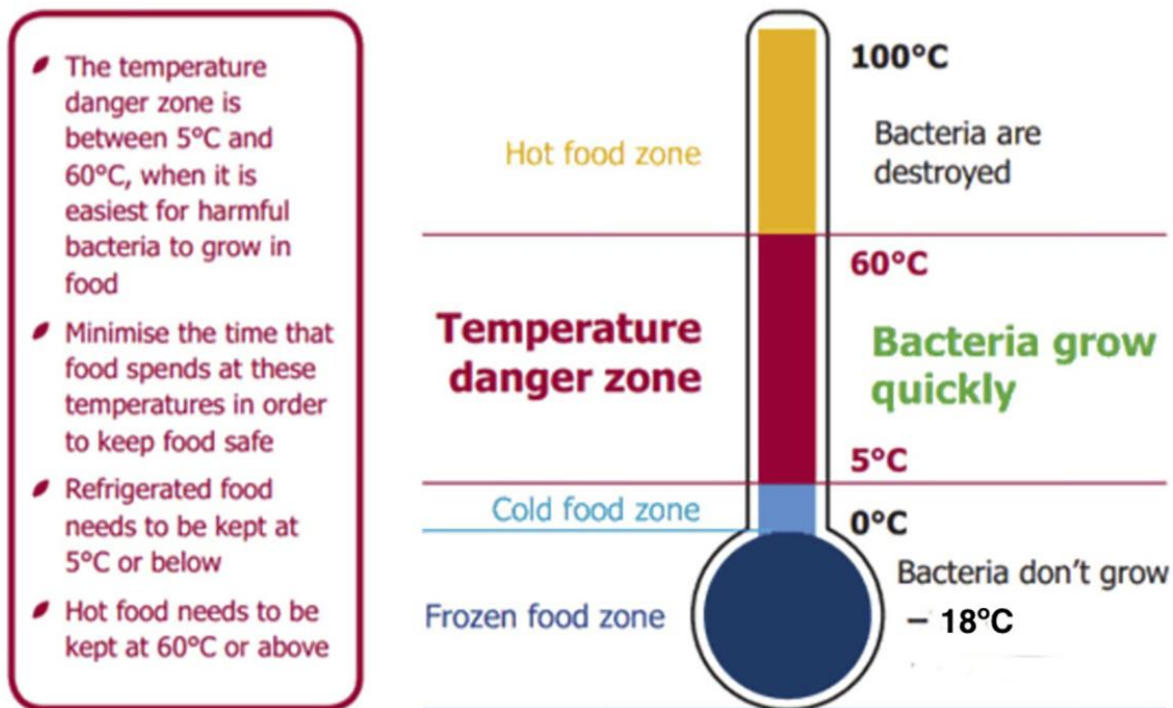
Figure 2.6: Proper food cooking temperatures (Food safety information council 2022).

2.8.3 Proper practices during the distribution of meals

One of the most significant causes of food deterioration in delicatessen cabinet displays is improper temperature control, which affects food quality, the drying rate of food and

displayed in foodservice units during food distribution and serving (Hadawey *et al.* 2018:324).

Furthermore, if the proper temperature is not maintained in a hot or cold display, or if food is handled incorrectly, the chances of contamination increase. To avoid food display contamination, raw and cooked or ready-to-eat food should be displayed in separate units, separate serving utensils should be used for each food and most importantly, food displays and utensils must be cleaned and sanitised before use (Catering Wholesalers 2019). Garden-Robinson (2017:6) emphasises the importance of keeping hot foods hot and cold foods cold at the appropriate temperatures. Ready-to-eat foods such as lettuce, ham and cheese should not be handled with bare hands and should instead be handled with spatulas, tongs and clean plastic gloves. Food that has been previously stored must not be placed on top of freshly prepared food. Spoons or tongs should be provided in self-service/ buffet situations so that human hands do not come into contact with the food. In the case of the current COVID-19 situation, the process of self service is not allowed. Additionally, menu and food variety, diversity, food presentation and overall food display appearance all have a significant impact on customer satisfaction and staff service efficiency (Anu & Manorselvi 2021:1117).

2.8.4 Good management practices during storage and in the inventory control of foods

Food waste is the result of amongst other not adhering to the FSC requirements for proper temperature and handling of food items. Food waste is caused by food poor storage practices and temperatures. It is critical to keep food fresh for as long as possible (Mercier, Villeneuve, Mondor, & Uysal 2017:659). Improper food storage reduces food shelf life and exposes it to early and rapid spoilage (Chalak *et.al.* 2018:1280). The proper storage of food immediately after receiving and inspecting it is an important factor in the prevention and control of loss or waste (Payne-Palacio & Theis. 2016:206). Additionally,

by keeping an eye on inventory, potential issues such as pilferage and waste can be identified (Egan 2015:178).

Osaili, Alnabulsi and Krasneh (2018:176) findings revealed a gap in food handlers' knowledge of temperature control during food storage. However, the findings of Alqurash, Priyadarshini and Jaiswal (2019:7) reveal that food handlers had a better understanding of how food items should be stored. Whereas, Taha, Osaili, Saddal, Al-nabulsi, Ayyash and Obaid (2020:3) found that there was a very low percentage of food handlers who indicated a lack of knowledge regarding the cross contamination aspect of storing meat, cooked food, salads and vegetables in the fridge in the correct order. Therefore, such inconsistent and insufficient findings on food safety concerning the drivers of food spoilage during food storage, which ultimately leads to food waste, indicate a gap in food handler's knowledge and practices in foodservice units' kitchens, including supermarkets.

The following section discusses food storage types, storage access control, food storage rules, labelling and dating of food items in storage areas, as well as sanitising and cleaning schedules of storage areas as factors that contribute to food waste.

2.8.4.1   Types of food storage areas

2.8.4.1.1 Dry storage

Non-perishables are foods that are shelf stable at room temperature and are stored in dry storage, such as grains, pulses and dehydrated foods with low moisture content (Shukla 2018:55). The storage area should be dry and the temperature should be between 10°C and 21°C. Certain organisms, such as moulds, thrive in a dark, moist environment. One of the most important aspects of dry storage is ventilation (Payne-Palacio & Theis 2016:206). Dry food should be stored at least 15cm above the deck, away from bulkheads and away from direct sunlight. Foods must be stored in their original packaging and, once opened, in tightly sealed containers. This will keep insects, rodents and microorganisms

out of the food (Fernandes 2018:63). Storage facilities should provide adequate space as well as appropriate dust, insect, rodent and other extraneous matter control and protection (Marriott *et al.* 2018:4). Bulk food products, such as sugar and flour, should be properly labelled before being emptied into storage containers (Atia & Abdelgawad 2018:21).

2.8.4.1.2 Refrigerated and freezer storage

Non-perishable and semi-perishable foods are stored in refrigerators and freezers. Refrigerated food items are perishables that must be kept at a constant low temperature and at chilled/ frozen temperatures, such as meat, dairy products, fruits and vegetables. Perishables can be kept under normal refrigeration for five to eight days, but deep freezing is required for longer storage. Semi-perishables, such as cheeses and eggs, can be kept at room temperature for a short period of time. Under refrigeration, the shelf life can be extended to about 30–90 days (Shukla 2018:55).

2.8.4.2 Food storage rules

All foods prepared ahead of time must be promptly stored in a refrigerator at or below 50°C. Cooked or ready-to-eat foods, as well as raw poultry, meat, or seafood, should be stored in separate sections of the refrigerator or freezer in the proper order. All food should be tightly wrapped or covered (Fernandes 2018:63). To avoid cross contamination, raw meat should be stored below cooked food and dripping liquids of raw uncooked foods in cooked or ready-to-eat foods should be avoided (Atia & Abdelgawad 2018:22; Fernandes 2018:59).

2.8.4.3 Storage access control

Storeroom control not only prevents theft and pilferage, but also food spoilage, which can result in food waste of merchandise if not handled properly. As a result, storeroom rules

that specify who is permitted to enter stores are required. After obtaining requisitions signed by authorised individuals, the item should be issued in accordance with the prescribed procedure (Shukla 2018:54).

2.8.4.4 Labelling and dating of food items in storage areas

Proper storage techniques include making sure that food products are well organised so that employees can easily use older products first, find products when they are needed and monitor inventory levels, as well as making sure that food does not spoil before use (EPA 2014:8). The first-in-first-out (FIFO) approach for stock rotation is commonly used to ensure that food is consumed before it expires (Betz, Buchli, Gobel & Müller 2015:225). Food products with the most recent expiration dates should be used first. Furthermore, not only should the temperature and quality of food products be checked during the receiving stage, but the expiry date or shelf-life should be checked as well to avoid storing food with a closer expiry date, which leads to food spoilage before use (Shukla 2018:55).

Food, whether raw or cooked, must be stored in a clean, covered labelled container after being removed from the container or package in which it arrived (Fernandes 2018:62). Labelling food items before storing them informs a food handler of when the food must be consumed. Use by dates should be included on highly perishable packaged foods such as cooked meat, fish and dairy products. All ready-to-eat foods must bear a label that includes the food's name as well as a use by or expiration date. Items that are less perishable, such as dried fruits, flour, chips and canned food, should have a best before date (Always food safe 2018). By labelling, storing and managing stock in the correct way, food spoilage in storage areas can be limited to a certain extent.

2.8.4.5 Sanitising and cleaning of food storage areas

Sanitation refers to practices that aim to keep a clean and healthy environment for food production, processing, preparation and storage. Sanitation is more than just cleanliness

and when done correctly, it can improve the aesthetic qualities and conditions of food preparation areas. Organised storage layouts with proper stock rotation can frequently reduce contamination, make cleaning easier and contribute to a cleaner operation. Storage area floors should be swept or scrubbed and shelves and/or racks should be cleaned and sanitised using appropriate cleaning compounds (Marriott *et al.* 2018:90).

Cleaning with soap and other detergents is only the first step in the cleaning process; sanitation is also required. Cleaning removes dirt and grease but does not necessarily kill bacteria or other pathogens. Only a sanitiser will kill bacteria and make the area safe for food preparation. In any foodservice preparation area, a sanitation plan is essential. A cleaning schedule that specifies how each item should be cleaned, who is responsible for it and how frequently it occurs (BC cook articulation committee 2015b:43) is a necessity in all foodservice units.

2.8.5 Application of good food handling practices

There are numerous obstacles to reducing food waste in foodservice establishments, some of which are related to food safety (Okumus 2020:303). Improper food preparation, time and temperature abuse in food handling and improper food storage are not only sources of cross contamination; they are also considered causes of food spoilage through humans (Baluka, Miller & Kaneene 2015:39). Food waste is largely the result of spoilage and poor food safety practices. A strong food safety culture at all levels of the organisation that ensures alignment between best practices and day-to-day operations is one way to combat this (Johnson 2020:1). Therefore, this highlights the importance of prioritising the improvement of food handlers' food safety knowledge and attitudes through measures such as the provision of basic and advanced food safety training programmes, in order to increase the use of safe food handling practices (Ncube, Kanda, Chijokwe, Mabaya & Nyamugure 2019:1686).

Table 2.3 indicates measures to be followed to ensure the provision of food safety and to manage food waste.

Table 2.3 Guidelines for ensuring food safety (Adapted from World Health Organisation [WHO] 2020).

Step	Danger	Measure
Storage	Contamination	Keep foods in wrapped or closed containers. Perform pest control.
	Reproduction of bacteria .	Monitor the time and temperature of storage. Follow the FIFO principle.
Preparation	Contamination resulting from personal hygiene	Wash hands before touching the food. Prevent cross contamination by surfaces and containers. Separate cooked foods from raw foods. Use boiling water, especially if the food will not undergo additionally cooking.
	Reproduction of bacteria	Pay close attention to the amount of time foods remain at room temperature.
Cooking	Survival of the pathogen	Make sure that the food is cooked well (the food in its entirety should have a temperature of 70°C).
Cooling and keeping at cool temperatures	Reproduction of the bacteria and spores which did not die in high temperature; toxin production	Make sure that the temperature of the food drops below 5°C as soon as possible when cooling it. Do not let foods remain at room temperature longer than two hours. Avoid storing too much food in the refrigerator or in the cool spaces in it. Beware of the thermal agitations in long-term cold storage.
	Contamination by various Sources	Wrap the foods appropriately and prevent their direct or indirect contact with raw foods. Make sure that the food containers are clean when storing the cooked foods.
Waiting in high temperature	Reproduction of the bacteria and spores which did not die in high temperature; toxin production	Keep temperature of the food above 60°C.
Re-heating	Survival of the bacteria	Re-heat the food properly.
Service	Reproduction of bacteria, production of spores and toxins	Re-heat the food properly.
	Contamination	Do not touch the food with hands. Serve the food hot. Prevent contact between uncooked foods and unclean containers.
HACCP: Hazard Analysis Critical Control Point		Follow all steps of HACCP accordingly.

Food workers may be exposed to microorganisms that cause illness and food spoilage. Hygiene is a term used to describe sanitary principles for health preservation. The cleanliness of a person's body is referred to as personal hygiene. Skin, hands, hair, eyes, mouth and nose are examples of body parts that contribute to food contamination

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(Marriott *et al.* 2018:94). To avoid cross contamination, never touch raw foods and then touch ready-to-eat foods without first washing hands. Proper hand washing, general cleanliness, preventing sick employees from working with food and enforcing strict rules on eating, drinking and smoking policies while handling food are some of the key features of good personal hygiene (Fernandes 2018:55).

2.8.6 Proper working conditions towards minimising food waste

The primary responsibility of the employer is to provide safe working conditions, which in turn provides employees with comfort and confidence in their work (Ramesh & Manimegalai 2018:145). Thus, in this section, the workplace safe environment and kitchen hazards are discussed as factors that prevent errors and accidents, as well as contribute to reducing food waste in foodservice kitchens, including supermarkets.

2.8.6.1 Workplace safe environment

Oktem and Oztoprak's (2020:27) findings indicate that employee perceptions of the workplace are influenced positively or negatively by the workplace's safe environment. The relationship between employee workplace security and job performance and satisfaction is quite significant. A safe work environment can affect the productivity of kitchen workers in labour-intensive foodservice kitchens and it can also lead to a variety of problems in the workplace (Oktem & Oztoprak 2020:15). The employer is responsible for providing a safe working environment (Ramesh & Manimegalai 2018:148), but injury prevention requires a collaborative effort between managers and workers (Ercan & Kiziltan 2014:417).

2.8.6.2 Kitchen hazards

Electrical kitchen machines and equipment contribute to efficient food production by producing large quantities of food at lower costs and in less time, which ultimately reduces

wastage of resources such as electricity, water and energy (WWF 2017), but they may pose health risks such as injuries to food handlers if used incorrectly (Restaurant Association of South Africa [RASA] 2019).

In South Africa, the Occupational Health and Safety (OHS) Act 85 of 1993 governs workplace safety and health. The act provides protection from hazards arising from the activities of people at work in connection with the use of machinery. The Act's main goal is to provide for and prevent work-related injuries and illnesses (Labour Guide 2021). Occupational accidents in foodservice units' kitchens are caused by a lack of precautions in the production area and unsafe behaviours by unqualified employees; accidents not only reduce productivity and quality, but they can also result in worker disability or death (Ercan & Kiziltan 2014:417). The OHS Act emphasises employee safety when using any machinery only after they have received proper training in accordance with the manufacturer's or supplier's guidelines (Labour Guide 2021). As a result, it is critical in foodservice kitchens that food handlers receive training on any kitchen equipment that may pose electrical hazards or cause appliance failure due to improper use (RASA 2019).

Cuts from sharp objects such as knives and slicers, burns from fire and cookware, falls and strains and improper use of electrical kitchen equipment and appliances are common causes of kitchen accidents (RASA 2019). Safety training and prevention strategies can be used to teach safe behaviours, provide practice time and motivate employees to work safely (Ercan & Kiziltan 2014:417). Effective orientation and training include workplace hazards, emergency procedures such as kitchen fire prevention rules, fire safety procedures and regulations and first aid procedures, as well as warning symbols used to identify hazardous materials, which all workers should be familiar with (British Colombia [BC] Cook Articulation Committee 2015c).

Kabir's (2019:4) study identified that commercial kitchens were the occupational group with the highest risk of injuries in the kitchen, such as handling hot oil and dangerous cooking vessels. Therefore, being aware of such hazards in the kitchen necessitates the

use of appropriate protective clothing and equipment. Accidents can be avoided by wearing personal protective equipment (PPE). All employees are responsible for ensuring that uniforms are properly fitted, clean and in good condition, with no fraying or excessive wear. Chef jacket sleeves must be buttoned at the wrist, overall and trouser cuffs must be removed and trouser legs must be long enough to hang outside boots. Personal safety equipment such as safety shoes, chef jackets, gloves and aprons, as well as a chef hat, should be worn at all times in the kitchen (BC Cook Articulation Committee 2015c:40). It is clear that proper and clean PPE not only mitigates the risks to food safety during food handling, which would result in food spoilage and waste, but it is also essential for the safety and health of food handlers from kitchen hazards.

It is critical to assess and identify all potential hazards to ensure they are kept to a minimum, which allows the employees to stay safe and work at full efficiency. Hazards can result in errors and accidents, such as food spillage that may be due to obstructions in the kitchen and kitchen fires from flammable liquids (Hunter & Tinton 2011:44). Such incidents do not only put employees at risk but also contribute to food waste in foodservice kitchens as food will be wasted when such incidents occur.

2.8.7 Proper human management resources contribute towards preventing food waste

Aspects such as food handlers' knowledge, which includes technical expertise to perform specific tasks, practical and theoretical training and written job descriptions will be discussed in this section to highlight how proper human resource management contributes to good practices and the prevention of food waste.

2.8.7.1 Food handlers' knowledge

People are the key factors responsible for errors in every company (Bilska, Tomaszewska & Krajewska 2018:14), so food handlers must have adequate knowledge of proper food waste handling, as knowledge is fundamental for proper practices (Da Cunha, Stedefeldt & de Rosso 2014:173). Improper food handling, poor food preparation, improper equipment and storing food at incorrect temperatures are all kitchen-related causes of food waste, as are employee behaviour, a lack of or insufficient training, menu planning and poor recycling and reuse of leftovers (Okumusa, Taherib, Giritliogluc & Gannon 2020:6; Ozbuk & Coskun 2020:12). Therefore, only by incorporating elements of knowledge, attitude and practices among food handlers throughout food production can a proper waste management system be successfully implemented (Abdullah, Yusof, Gani, Mohammad & Ishak 2018:10).

2.8.7.2 Theoretical and practical food handlers training

Employees are usually regarded as an underutilised resource in the development and implementation of a company's sustainability programmes and strategies (Larsen 2015:1). However, the true costs of failing to provide food handlers with training include the waste of company resources, time and money as a result of a lack of knowledge and unavoidable food waste (Gonzalez 2020:1). According to Teller *et al.* (2018:288), one of the root causes of food waste in foodservice units, including supermarkets, is poor execution by food handlers, a lack of motivation, a lack of experience, insufficient leadership and a lack of commitment. Long working hours and the demanding nature of the foodservice unit work are other impediments to managers scheduling food handler training (Soon 2020:4).

The level of knowledge and qualifications of food handlers should be consistent with the nature of the tasks they perform. Bilska *et al.* (2020:14) confirm that employees' levels of

knowledge and qualifications should be appropriate for the type of work they perform. Errors caused by a lack of experience and appropriate qualifications may result in food losses. It is critical to invest in the theoretical and practical training of food handlers through educational programmes (World Health Organization [WHO] 2020:1). Using multiple training strategies, such as rewarding or incentivising employees who significantly reduce waste or devise new waste-reduction strategies, will increase effectiveness (EPA 2014:8).

Kitchen food handlers usually want to help reduce food waste at work but require more clarification and direction from management. Regular staff meetings, informal discussions, formal training, or even peer learning opportunities can all be used to provide such instruction (Clowes, Hanson & Swannel 2019:8). Mabaso and Hewson (2018:11) indicate that food waste management training for food handlers improves employees' ability to understand and implement related strategies. As a result, employees should be trained to act in accordance with a food waste reduction culture and to maintain good food waste management practices. Management should also strive to remove any perception of blaming staff for causing waste (Clowes *et al.* 2019:8).

2.8.7.3 Interval between training sessions of the food handlers

Habiballah, Al-Shakhsheer, Al-Sabi and Masadeh (2018:141) determined that certain workplace environment elements promote the transformation of knowledge and learned skills into proper food handling practices, such as reinforcement programmes and the availability of necessary resources. According to McFarland, Sielaff, Rasco and Smith (2019:124), reinforcement training programmes, such as food handler refresher training are necessary because proper food handling practices and knowledge fade over time if there is limited exposure to training programmes. As a result, training should not be a one-time event, but should be improved through refresher training.

2.8.7.4 Technical expertise to perform specific tasks

Suhairom, Musta'amal, Amin, Kamin and Wahid (2019:207) discovered a link between technical competency and individual work performance. Employees with technical skills are capable of doing their jobs well. However, due to the high turnover of staff in the foodservice industry, foodservice units are sometimes hesitant to invest in professionally trained food handlers (Lomaire, Afifi & Healy 2020:203). Some foodservice establishments rely on employees with relatively low education and corresponding wages, which are not the most appealing to retain skilled and knowledgeable workers for long periods of time. As a result, employee turnover is high and there is no time to cultivate strong relationships based on friendly cooperation, trust and long-term dedication to the work and operational tasks (Galabov 2020:128). Nonetheless, Dhir, Talwar, Kaur and Malibari (2020:8) emphasise the importance of competent and skilled staff as one of the control measures in kitchen food waste control. Professionally trained chefs are undeniably more competent than cooks and have advanced culinary expertise, food knowledge, skills and abilities to perform better in the industry (Suhairom *et al.* 2019:208).

2.8.7.5 Job descriptions and its impact on food waste

According to Purchase (2021:163), job descriptions set the stage for employee hiring, expectations, evaluation and apply directly to the responsibilities expected of the employee in performing the job. The first step in writing a job description is to gather as much information as possible about the task that the employee will be performing. According to Beata and Pato (2017:1020), a job description can lead to a common understanding and professional functioning toward the company goals, as well as a tool used to avoid misunderstandings at workplaces. Khairat (2016:225) recommends that managers explain the role of job descriptions to their employees because it leads to effective work performance because it summarises the most important elements of a job in detail. As a result, management of foodservice units should ensure that food handlers clearly understand their job roles in the kitchen to avoid any misunderstandings that could

lead to food waste, as well as outline the company's policies and procedures that inform food waste management (Mabaso & Hewson 2018:9).

The literature discussed in the above section reiterates the importance of knowledge, training, technical expertise and the importance of job descriptions for all food handlers and foodservice staff working with food, in the fight against reducing food waste.

2.8.8 Availability of food waste management plans in preventing food waste

This section discusses food waste management plans that include green practices, in-store green practice initiatives, kitchen waste management practices and food waste audits

2.8.8.1 Green practices

Becoming green or going green has become a popular catchphrase in a variety of industries around the world (Mohamed, Zohry, Mohamed & Elsaied 2018:133). Green initiatives, in essence, optimise eco-friendly products that may be organic or manufactured with fewer natural resources and with social and ethical respect for the labour force, require less energy during usage and can be recycled (Guyader, Ottosson & Witell 2016:319). According to DiPietro and Gregory (2013:2), green practices are those used by organisations to reduce their carbon footprint and harm to the environment, such as excessive resource use, the use of non-recyclable products, ineffective recycling processes and harmful chemical products. Green practices are also known as green retailing in the retail sector, which is defined as a management approach that aims for environmental protection, cost reduction and increased revenue all at the same time (Sinha & Dhume 2014:113).

According to Clowes *et al.* (2019:8), the participation of food handlers is an important factor in determining the effectiveness of food waste management. Appointing food waste

champions in the kitchen emphasises the importance of preventing food waste across all food groups and by providing kitchen posters displaying both good and bad examples of food waste prevention constantly reminds the food handlers about food waste. REFED (2018:27) also notes that incentives may motivate food handlers to implement food waste reduction efforts. Supermarkets can also develop a structured recommendations system or other mechanisms for food handlers to provide input on waste reduction throughout the management chain. As a result, employee education on the barriers and constraints to more sustainable food surplus and waste management is critical (Papargyropoulou, Lozano, Steinberger, Wright & Ujang 2014:111).

Because of the daily interactions with customers, supermarkets are in a unique position to inform and motivate customers about food waste. Employee training on food waste management programmes can also encourage customer interaction. For example, employees in the fresh produce department are trained to engage with customers about ugly fruit and vegetable offerings, why they differ from other items and how they can help the customer while reducing waste (REFED 2018:26). However, some argue that supermarkets should take a more active role in raising customer awareness of the issue of food waste (Filimonau and Gherbin 2017:1192), for example, host in-store educational events on food waste prevention.

2.8.8.2 Kitchen waste management practices

Loeurng (2021:3) study findings indicate that for green practices, some foodservice establishments have implemented the three Rs (reduce, reuse, recycle) approach. Examples of the Rs include accurate prediction of food orders with the help of predictive ordering digital technology, to have a plan for excess food, for example, using yesterday's leftover chicken parmesan in a lunch special today if it is not past its use by date, making sure that recycling bins are clearly labelled and used only for recycling to prevent recycling from getting mixed together, compost food scraps or partner with composting companies and label the stored food with 'serve before' and a 'donate before' to easily determine

what goes in the bin and what is suitable for donation (Australian institute of food safety 2021).

Other supermarkets, according to Smith *et al.* (2020:6), have a waste management system in place, but there is a lack of understanding of how to use it for the right reasons, which are not just about making money, but also about the environment. The most difficult challenge is that the team does not follow the process correctly; however, what supermarkets have in place has worked and continues to work when used correctly. Therefore, engaging employees is a good way to improve food handling and waste disposal, some organisations have begun to raise employee awareness of food waste and separation, but these efforts should be supplemented with in-store visual information, such as posters, to broaden the communication (Lewis *et al.* 2017:26).

2.8.8.3 Food waste audit

In foodservice kitchens, including supermarkets, there is always a significant amount of unrecorded food waste that is difficult, if not impossible, to track (Eriksson 2015:23). The findings of Gao, Bao, Li, Liu and Wu (2021:82) also indicate that the quantification of food waste in foodservice businesses is low. However, the Association of Whistler Area Residents for the Environment [AWARE] (2016: 7) states that waste cannot be managed unless it is measured. As a result, ongoing waste monitoring enables businesses to effectively manage food waste, save money, improve recycling performance and reduce the collective carbon footprint. Furthermore, Silvennoinen, Nisonen and Pietilainen (2019:103) state that it is critical to measure and monitor the amount of food waste (FW) in order to discover new ways to reduce it and to validate the efficacy of the new methods. Companies can benefit from measuring FW as well. It may assist them in better understanding how and where FW is generated in their operation. On the other hand, the information about FW provided by the companies allows for national-level monitoring of FW and policy planning to meet FW reduction targets. As a result, methods for monitoring

food waste begin with visual observations, reviewing waste data with a waste carrier and conducting a full waste audit (AWARE 2016:78).

Furthermore, according to Martin-Rios, Hofmann and Mackenzie (2020:5), the existing food waste measuring methods used for capturing food waste data in the hospitality industry are primarily manual. All these methods are time-consuming, inaccurate and expensive and they do not provide a comprehensive picture of the food thrown away. As a result, collaborating with third-party companies to use technological innovations can be a strategic and cost-effective way to supplement a company's open innovation activities (Martin-Rios *et al.* 2020:7).

Figure 2.7 indicates a food waste weighing scale that automatically records all food waste data for discarded food items, including weight and time (Kitro 2021). Kitro provides an automated food waste data collection and analysis solution that can be used by food and beverage establishments all over the world. Kitro's quantification methodology is an exceptional technology solution for food waste management. It employs both a hardware and a software system. The hardware consists of a camera mounted above the customer's existing waste bin and linked to a scale mounted beneath it. Images of the contents of the waste bin are collected whenever new waste is disposed of in the bin (Martin-Rios *et al.* 2020:7).

Figure 2.7 Kitro technology (Kitro 2021).

2.8.8.4 Waste separation

Kitchen waste is generated during the food storage, preparation and cooking stages (Kirsi, Nisonen & Pietilainen 2019:101). Food waste must be separated, for example, by separating the 'wet' fraction of total municipal waste before it can be diverted to available treatment options (Joshi & Visvanathan 2019:541). Edjabou, Boldrin, Scheutz and Astrup (2015:95) state that source-sorted waste is waste that is disposed of in the intended waste bin; for example, source-sorted food waste is food waste that is disposed of in a food waste bin. Incorrectly sorted waste fractions are waste fractions that have been disposed of in the incorrect waste bin; for example, incorrectly sorted residual waste is residual waste that has been disposed of in a food waste bin and vice versa.

Numerous studies have found that employees are not adequately trained in the proper disposal of food waste (Kasavan, *et al.* 2019:76; Edjabou *et al.* 2015:100; Jamal, Szefler, Kelly & Bond 2019:288; Baul, Sarker & Nath 2021:4). One of the most difficult challenges in pursuing sustainable FW disposal in island landfills is the lack of waste separation (Kasavan *et al.* 2019:76). In addition, Jamal *et al.* (2018:289) and Baul *et al.* (2021:4) discovered that some commercial kitchens have limited bin space, lack appropriate infrastructure for food waste recycling and lack convenience source segregation of food waste. To maximise recycling and minimise contamination, waste sorting areas should be convenient, easy to use and intuitive. Consider how food handlers move through the establishment and make sure waste-sorting stations are visible, easily accessible and used correctly (AWARE 2016:11).

2.9 FOOD WASTE MANAGEMENT GUIDELINES

The transition to sustainable food systems must be supported by appropriate policies at multiple levels, including global, national, regional and civil society. Both the public and private sectors can help achieve this by creating an enabling environment (No More to Food Waste 2015; FAO 2015; WWF 2017).

Food waste initiatives

The Save Food Initiative is a global programme launched by FAO and is built on four pillars: collaboration and coordination, awareness raising and research. Other United Nations (UN) organisations, including the World Food Programme (WFP), the International Fund for Agricultural Development (IFAD) and the United Nations Environment Programme (UNEP), have backed FAOs Save Food Initiative. These organisations collaborate in support of the United Nations Secretary- General's Zero Hunger Challenge (FAO 2015). Some of the benefits of partners include access to information from and networking with other save food partners around the world, as well as technical advice and support (FAO 2015).

Think. Eat. Save is another global anti-food waste campaign launched in January 2013 and led by UNEP, FAO and the United Nations Secretary General's Zero Hunger Challenge, with the goal of providing a global vision for reducing food waste and accelerating action. The campaign raises awareness of the serious issues caused by the large amount of perfectly edible food that is wasted and it seeks to change attitudes and behaviours so that food waste can be significantly reduced around the world by targeting relevant policies, programmes, actions and behavioural changes by governments, businesses, civil society organisations, households and individuals (UNEP 2018). Think. Eat. Save is also the South African theme, which is celebrated on June 5th, World Environment Day (South African Government 2022). However, the question of how effective are the awareness and campaign programmes that have been implemented in South Africa to teach society and businesses about food waste remains unanswered. A whole country collaborating and becoming effective members of global food waste initiatives is important, which could lead each country to always stay informed about other food waste programmes taking place in other countries.

2.9.2 Food recovery waste hierarchy

Globally, retailers are adopting a variety of initiatives and approaches in order to contribute to the UN SDGs (Parker, Sikobi & Jones 2019:18). The EPA (2019) also created the Food Recovery Hierarchy, which prioritises the various methods of managing food waste around the world. The most and least preferred solutions are depicted in Figure 2.8 furthermore, the Waste & Resources Action Programme [WRAP] (2020) developed a food and drink material hierarchy, which lays out steps that provide general guidelines for food waste, such as the priority order of prevention, recycling, recovery and finally, landfill dumping. To reduce food waste effectively, foodservice units, including supermarkets, may implement a model of food recovery hierarchy. South Africa could adopt this model because the country's current waste hierarchy requires revision, particularly in terms of waste prevention and promoting alternatives to landfilling for organic waste, such as composting and waste to energy (NWMS 2019:7).
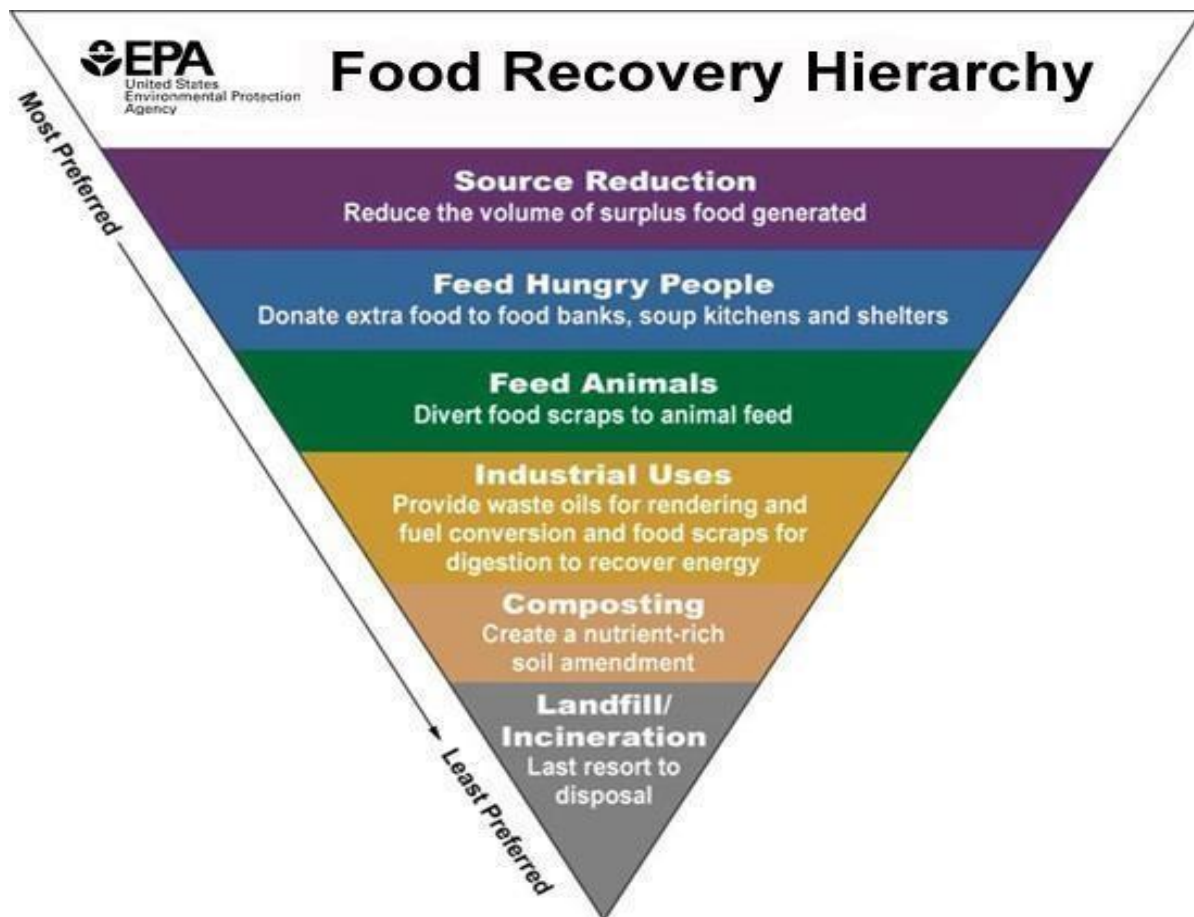
Figure 2.8 The food waste recovery pyramid (EPA 2019).

Figure 2.8 indicates the food recovery hierarchy, which begins with encouraging the prevention of food waste and progresses to providing excess food for use in hunger programmes, animal feed, industrial uses, composting and finally, incineration and landfill. Prioritising action at the top of the food recovery hierarchy is important, with prevention strategies offering the best chance for both cost savings and environmental gain (Pearce & Berkenkamp 2017:6). Through free online manuals and tools, the EPA (2020) also provides guidance and links to partnering organisations on how to manage food waste. The food hierarchy steps are further discussed in the next section.

2.9.2.1 Source reduction

As shown in Figure 2.8, prevention (or source reduction) is the first step in managing food waste. Preventing food waste in the first place saves water, electricity, time and money in the long run. Prevention approaches often provide the greatest financial advantage to food companies by lowering the cost of purchasing, handling and eventually disposing of food that is not consumed (Pearce & Berkenkamp 2017:5). Indeed, the EPA (2020) claims that by reducing food waste, disposal and labour costs will be reduced as a result of more efficient food handling, preparation and storage. Therefore, a substantial amount of food waste can be reduced by adapting to patterns and practices through sustainable options (Calmfors & Omar 2019:22).

2.9.2.2 Feeding hungry people

The reuse of food surpluses to feed people experiencing food insecurity is the second most preferred option. The goal is to use food for the original purpose for which it was produced, namely human consumption, before recycling it (Schneider 2013:755). However, in many cases, the initiative would have to come from a charitable organisation; without the charitable organisation approach, processes may never be realised. The company would also be in charge of the distribution processes, which would have to be efficient (Calmfors & Omar 2019:65). Therefore, surplus food redistribution to non-governmental organisations (NGOs) has been promoted and other countries have been subsidised, resulting in significant reductions in food waste (Facchini, Iacovidou, Gronow & Voulvoulis 2018:896).

In South Africa, most businesses invest heavily in food donations to NGOs and non-profit organisations (NPOs), but public reporting focuses on corporate social investment in food donations. Some of these donations are most likely made up of surplus foods (WWF 2018).

2.9.2.3   Feeding animals

When food donation is not possible, such as with vegetable trimmings, the next best option is to give uneaten food to farms for animal feed (Pearce & Berkenkamp 2017:5). However, Calmfors & Omar (2019:25) indicate that the primary distinction between food donations to animals and food donations to people is the physical appearance of the food; it is expected that food that is not physically presentable be donated to the animals. Furthermore, animal food donations are subject to the food waste regulations of each country. Some countries prohibit food donations for animal feed, while others restrict what can be donated. Businesses, for example, cannot donate coffee grounds or high-salty foods because they can harm animals (EPA 2021).

Swill feeding of pigs is prohibited in South Africa under the Animal Disease Act (Act 35 of 1984) unless it is properly boiled for at least one hour or treated and sanitised. Scraps or food waste that contains or have come into contact with meat or meat products are referred to as swill. Swill feeding to pigs is prohibited due to diseases like African Swine Flu, which is spread through infected swill or contact with infected pigs (South Africa 2022). As a result, such restrictions make it illegal for supermarkets to donate kitchen food waste to farms.

2.9.2.4   Industrial use and composting

The fourth level employs food waste for industrial purposes, such as the production of biogas via anaerobic digestions. Composting is the next tier and should be avoided; however, some inedible parts of food may remain and can thus be transformed into compost and nourish the soil (Calmfors & Omar 2019:20). Therefore, when food cannot be eaten by humans or animals, composting or anaerobic digestion are the best alternatives (Pearce & Berkenkamp 2017:5). In the absence of oxygen, microorganisms break down organic products such as food scraps and manure during anaerobic

digestion. This process generates biogas, which can be used to generate electricity, fuel, or heat, as well as material that can be composted and returned to the soil (EPA 2019).

In South Africa, efficient and innovative waste collection and disposal approaches are critical to leveraging the economic value of waste through increased rates of reuse and recycling, as well as the application of alternative waste treatment technologies such as composting and waste to energy. In order to separate and manage waste streams, municipalities must collaborate more closely with private sector partners and the informal sector. It also necessitates a greater emphasis on extended producer responsibility, particularly in terms of product design and packaging (NWMS 2019:9). Therefore, collaboration between FSC actors is vital to building sustainable solutions that work with a circular economy approach (Halloran, Clement, Kornum, Bucatariu & Magid 2014:300).

2.9.2.5   Landfill and incineration

Landfilling and incineration are the least preferred options from an environmental and social standpoint because they emit greenhouse gases and remove organic matter and nutrients that could otherwise be recycled into new products (Pearce & Berkenkamp 2017:5). Thus, the majority of countries have joined the Zero Waste International Alliance, which promotes the conservation of all resources through responsible production, consumption, reuse and recovery of products, packaging and materials without prohibition and without discharges to land, water, or air that endanger the environment or human health (Zero Waste International Alliance [ZWIA] 2018). However, stakeholders should also remember that the term zero waste does not mean that no waste is created, but rather that no waste is sent to a landfill (ZWIA 2018). Diverting organic waste from landfill through composting and energy recovery is also one of South Africa's strategic goals, as a large percentage of food waste is still disposed of in landfills (NWMS 2019).

2.9.3 National food waste initiatives

When a country or government decides to pursue food waste prevention goals, a variety of policy-related mechanisms should be used to achieve those goals. It is critical that any strategy for preventing food and beverage waste is linked to the larger policy and legislative landscape in the region or country. Furthermore, if preventive and reduction practices must comply with legally binding requirements, the public is more likely to take an active role. As a result, policymakers must consider adopting holistic preventive initiatives, as well as actions involving all stakeholders at all levels of the food value chain (UNEP 2014).

South Africa's government is a signatory to the United Nations SDGs and aims (UN 2015 to meet target 12.3, which calls for a 50 percent reduction in food waste by 2030. (CGCSA 2019). Given this level of commitment, one would expect to find examples of food waste reduction initiatives or legislation in South Africa, but there are few interventions. End-of-pipe solutions, such as composting, are the focus of known organic or food waste interventions. This demonstrates the disparity between the goals set and the actual activities on the ground (WWF 2017:17). Nonetheless, recycling rates for paper, plastics, glass, metals and tyres are relatively high in South Africa (NWMS 2019:15).

2.9.4 Regional and local food waste initiatives

Municipalities, which provide waste management services, play an important role in transitioning South Africa from dumping food waste at landfills to promoting food waste minimisation and diversion. The lack of capacity and awareness about this issue in municipalities are two of the most significant barriers to implementing a transition from using landfills to minimising or diverting food waste. Thus, there are few national, provincial, or municipal food waste reduction programmes, with the exception of a few projects in the Western Cape Government, eThekwini Municipality and the City of Cape Town (WWF 2017). Diverting edible food to charity is the only widely used strategy for

many retailers and food industry players, either directly through local charity relationships or through organisations such as Food Forward (WWF 2018). As a result, food retailers cannot succeed in implementing food waste reduction programmes without the participation of other sectors such as municipalities and non-governmental organisations.

2.10 OTHER FOOD WASTE REDUCTION SOLUTIONS

This section further unfolds other directives/ measures that could be a solution in foodservice units, including supermarkets, regarding food waste. The prevention, recovery, recycling as well as landfilling of food waste solutions are discussed.

2.10.1 Food waste prevention solutions

2.10.1.1 Standardised date labelling

The use by and best before dates on packaging have a significant impact on consumer purchasing habits. These are frequently misunderstood because many customers regard the best before date as a safety indicator (Toma, Font & Thompson 2017:554). As a result, there is little desire to pay for stale food or food that has passed its expiration date. (Aschemann-Witzel, De Hooge, Amani, Bech-Larsen & Oostindjer 2015:6462). Food products are not legally required to provide explanatory text to describe the date labels, leaving this up to the customer's interpretation. Therefore, standardised data labelling is critical to avoid misunderstandings that contribute to excessive waste (WWF 2017) and effective education is an important factor in food waste prevention (Bilska *et al.* 2016:275). Supermarkets should work directly with suppliers to adapt the label language on the packaging of all privately branded products to the "best if used by" date label in order to provide clear, accurate and consistent information to consumers (REFED 2018). Thus, consumer awareness programmes should also educate customers about date labelling descriptions.

The actual food date meanings are categorised and described as follows:

- Best before date

Indicates the end date of the period during which the product is completely marketable and retains any specific qualities. It is used to rotate stock, but the food is still safe to eat and has only deteriorated in quality (Department of Health [DoH] 2020).

- Sell by date

Indicates the final date of the sale to the buyer, after which a reasonable storage period at home remains. This date is not intended for customers; rather, it informs the retailer when the supplier wishes the product to be removed from the shelves (WWF 2017).

- Use by date

The date indicates that the food is no longer edible after that date (DoH 2020). As a result, food would not be considered marketable. This includes fresh, perishable and pre-packaged foods. After this date, it is illegal to sell food (WWF 2017).

2.10.1.2 Demand forecast

The goal of demand forecasting is to accurately predict demand for specific products in order to support business decisions such as replenishment. Inaccurate forecasting has been identified as one of the leading causes of food waste at the retailer level (Mena, Adenso-Diaz & Yurt 2011:656). According to Stenmarck, Hanssen, Silvennoinen, Katajajuuri and Werge (2011:3), one reason for the generation of food waste in supermarkets is the unstable demand for food products. Because of the unpredictability of demand, forecasting is unreliable and the resulting difference between actual and expected sales results in significant food waste. This is usually due to overstocking, which does not reflect the true demand for the product. Inaccurate forecasting results in products remaining on the shelves for longer periods of time before being discounted or lost (Krasteva *et al.* 2019:83). The EPA (2014:8) suggested implementing in-store food

purchasing policies that include guidelines and goals for reducing spoilage and waste. Specific policies may include a just-in-time purchasing system that orders only what is required when it is required, as well as a system that identifies over-purchased food items and avoids excess wasted food.

Improving the demand forecasting process can provide more support for replenishment decisions and help to avoid excess inventory (Felix 2018:9). Accurate forecasting is especially important when it comes to preventing food waste. To accomplish this, some foodservice operators employ automated forecasting systems, which allow them to accurately predict the number of customers to serve in order to avoid food surpluses (Papargyropoulou *et al.* 2016:332). Several software packages for advanced demand planning forecasting in the food industry are available, allowing effective demand prediction and thus significantly contributing to the reduction of food waste (Derqui, Fayos & Fernandez 2016:5). Supermarkets in developed countries have now implemented automated sales-based systems that forecast demand for a specific store and allow orders based on a just-in-time approach (Lefadola, Viljoen & du Rand 2018:12).

2.11 GREEN PRACTICES

Leading South African food retailers have expressed a strong desire to commit to implementing initiatives to reduce food waste in their stores in order to meet the United Nation's Sustainable Development Goal of halving global food waste by 2030 (Consumer Goods Council of South Africa [CGCSA] 2019). Indeed, retailers have been identified as one of the most important actors capable of influencing changes in sustainable consumer patterns (Lehner 2015:404). Programmes such as Love Food Hate Waste (LFHW) involve a wide range of consumer-facing and in-store campaigns to assist consumers in wasting less food by providing targeted tips, advice and guidance directly to consumers as well as through partners such as local government and retailers (One Planet Network 2017). To date, LFHW has reduced consumer food waste by 12 percent, or 8 million tonnes in the United Kingdom (UK); thus, other countries could adopt such initiatives or

become partners with WRAP, which licenses the LFHW campaigns to other countries and organisations if they wish to participate (One Planet Network 2017).

Mukonza and Swarts (2019:843) study indicates that responsible green production and consumption is embedded in the store's culture. Therefore, retail executives must conduct ongoing research to develop greener innovations and practices, as well as develop customer oriented green marketing strategies, in order to maintain a sustainable competitive advantage. For example, in the UK, WRAP is collaborating with retailers and brands to develop their own campaigns by providing resources such as well-researched tips, recipes, messages, creative and consumer insights through LFHW programme (WRAP 2020).

Additionally, green retailers interact with customers in four ways: first, through green advertisements; secondly, through green product assortment; thirdly, through green promotional campaigns and; fourthly through green processes such as eco-friendly carry bags and eco-friendly cooking methods (Kumar & Polonsky 2019:24; Guyader *et al.* 2017:319; Fuentes & Fredriksson 2016:502). In essence, supermarkets' green practices in-store are the gatekeepers between consumers and eco-friendly products; thus, retailers can easily influence consumers' intentions to make green purchases by displaying relevant information, orienting consumers inside the store and offering eco-friendly product assortments (Guyader *et al.* 2017:319).

2.12 NON-GOVERNMENTAL ORGANISATION'S ROLE ON FOOD WASTE

Charalampopolou (2016:1), founder of the UK charity known as Feedback, encourages local governments and foodservice units worldwide to respond to the public appeal for food waste reduction and more companies to join the food waste battle in order for the NGOs voices to be heard. Normally, NGOs work as food collectors, collecting and redistributing dry and cooked food from donors to community canteens. NGOs also collect food from donors and distribute it to charity homes. Collaboration with NGOs is

encouraged in order to reduce food waste in the environment, which leads to a more sustainable environment (Jadhav, Narendrababu & Banu 2015:1).

In addition, in countries such as the United States (US), the retail food waste guide was developed through the collaboration of food waste management, NGOs and public sector leaders to accelerate waste reduction activities across the food supply industry through REFED (2018:1). This initiative has released a new roadmap to reduce food waste in the US by 20 percent. Furthermore, through networks and information platforms, awareness campaigns have become one of the most widely used interventions for food waste education (Priefer, Jorissen & Brautigam 2016:155). NGOs in Zanzibar have recognised the government's inability to meet the needs for food waste management. Thus, NGOs have joined the effort to improve governmental and private efforts in solid waste management (Rahaman & Said 2018:15). Municipalities, non-governmental organisations and businesses may serve as partners to implement community campaigns, such as by hosting public events and workshops (Soma, Li & Maclaren 2020:2). Retail sector in South Africa can adopt the similar patten to work with NGO's in food waste reduction initiatives.

South African food manufacturers and retailers gradually collaborated with other countries, expecting to learn from one another, share experiences and best practices. The Department of Trade, Industry and Competition (DTIC) began planning the formation of a voluntary agreement to reduce food waste by manufacturers and retailers. The DTIC collaborated closely with a NGO based in the UK called Waste and Resources Action Programme (WRAP), the cities of Tshwane and Johannesburg, as well as WWF and CGCSA (CGCSA 2020:5). Therefore, collaboration with other countries and NGOs plays a significant role in food waste management.

2.13 SOUTH AFRICAN SUPERMARKETS FOOD WASTE PROGRAMMES

To combat food waste and poverty in South Africa, large formal supermarkets such as Pick n Pay, Shoprite and Food Lovers' Market have partnered with FoodForward South Africa (2015) Pick n Pay (2017) and Shoprite Holdings (2019). FoodForward is a company that distributes food items to South African community hunger relief organisations that have passed their retail sell by date but are still fit for human consumption. The collaboration's goal is to reduce the amount of food that ends up in landfills as waste simply because it has passed its sell by date on retail shelves (FoodForward South Africa 2015). The focus is only on packed dry food or raw food items. Shoprite Sustainability Report (Shoprite Holdings 2019:57) indicated composting options, as well as the potential of anaerobic digestion, are still being explored. Indeed, organic food waste management appeared to be still a problem in South African supermarkets including other foodservice units at the time. Organic waste is still primarily transported to landfill sites, accounting for 4.3 percent of South Africa's greenhouse gas (GHG) emissions (Waste to Food [W2F] 2016). The organics waste landfill ban is not yet implemented in South Africa (WWF 2018).

Pick n Pay, one of South Africa's largest supermarket chains, is also one of W2Fs partners in sourcing and supplying organic waste to W2F in Philippi, Cape Town (W2F 2016). The W2F has developed a set of technologies to address the widespread disposal of organic waste to landfills, while also promoting employment and food security. Food waste is collected by W2F from large producers such as retailers and hospitality groups, as well as from markets, through partners. With its innovative processing system, the waste is then recycled into industrial high-quality vermi-compost. After that, the organic compost is sold to commercial customers such as garden centres, seedling growers and farmers (W2F 2016). According to the report, only Pick n Pays in Cape Town have implemented an organic recycling solution. Other retailers in other provinces may take similar steps.

According to Woolworths (2016), they recognise that a significant portion of the waste they generate as a company occurs outside of their own operations, in consumers' homes and at other stages of the supply chain. As a result, in addition to donations, the Woolworths Trust's flagship initiative, EduPlant, focuses on addressing food security in schools through the training of permaculture educators and the establishment of food gardens in collaboration with Food and Trees for Africa.

Converting organic waste into compost for use by local community farmers is a new initiative being tested at one of SPARs distribution centres. Spar anticipates that other facilities will follow suit in the future (Spar 2018). Taking Action for a New Future is the Spar distribution centre's Vitality uncertainty complexity ambiguity (VUCA) project, which was launched in 2018 to address food waste management challenges. The goal of this initiative is to reduce food waste in canteens (approximately 9 kg per day) by involving stores and consumers while raising awareness. The emphasis is on food waste management education, especially during Food Waste Month in October and World Food Day on October 16th. A competition was held to encourage employees and departments to make a pledge to reduce food waste (SPAR 2018).

According to sustainability studies on waste food management, the majority of supermarkets have systems in place. However, organic food waste management appears to be a continuing issue in South Africa, so supermarkets have set a goal of burning all organic waste from landfill sites (CGCSA 2019:17). Despite the fact that the majority of major formal food retailers and manufacturers have strong corporate social and environmental responsibility initiatives, there is a lack of food waste policy enforcement (WWF 2017). Furthermore, retailers in South Africa are primarily concerned with feeding the hungry, composting food waste and finally dumping food waste at landfills, which is one of the least preferred options. Ideally, retailers should invest in implementing techniques to properly handle food items before they are lost, maximising the utilisation of the source (du Toit 2018:10).

2.14 FOOD WASTE MANAGEMENT CHALLENGES IN SOUTH AFRICA

South Africa faces some food waste management challenges that include policies, legislation and regulations, quantifying of food waste and inadequate food recycling facilities, which are discussed in this section.

2.14.1 Policies, legislation and regulations

In South Africa, there is no legislation that governs food waste specifically; rather, food waste is governed by legislation that governs waste or waste management in general. Environmental health practitioners, the Department of Water and Sanitation and the Department of Environmental Affairs enforce the legislation (WWF 2017). However, the CGCSA (2019:7) food waste workshop report, which included major food retailers (Checkers, Foodlovers, Woolworths, Pick 'n Pay and Spar) and stakeholders, including the Departments of Agriculture, Forestry and Fisheries and Environmental Affairs should take the lead on the food waste challenge. Furthermore, one of the challenges in achieving SDG 12.3 is the lack of a consolidated and clear legislative framework in South Africa, which calls for halving global food waste per capita at retail and consumer levels by 2030, as well as reducing food losses along production and supply chains (United Nations Development Programme [UNPD] 2020).

Another issue in South Africa is that donors, such as retailers and food banks, are required to carry liability insurance because they are not protected by Good Samaritan legislation, as is the case in other countries such as Italy (CGCSA 2019:25). The Good Samaritan food law shields individuals and organisations that donate food in good faith from civil or criminal liability arising from the age, packaging, or condition of wholesome foods or grocery products donated to non-profit organisations (Foodforward South Africa 2018). Food donation is also hampered by a lack of clear food safety guidelines. Food safety laws governing food establishments such as restaurants, cafeterias and retail stores differ by countries. Food donors and food recovery organisations frequently

struggle to determine which food safety regulations apply to the food they wish to donate or distribute because these food safety laws generally do not cover food safety for food donations. Thus, liability is a significant barrier to food donation. Potential food donors, including supermarkets, are concerned about incurring liability if someone becomes ill after eating donated food (Harvard Law School Food Law and Policy Clinic and the Natural Resources Defense Council 2017:5).

Filimonau and Gherbin (2017:1194) revealed that corporate policies have been identified as another barrier to implementing sound food waste management practices at the store level. The adaptability may make it easier for supermarkets to make more efficient decisions to reduce food waste while also contributing to the health of food handlers and local communities. In light of this, adaptable food waste management policies are critical at the local level and this is an underappreciated issue.

South Africa is governed by numerous pieces of legislation that shape the waste management and recycling landscape. This section present policies, legislation and regulations that should be responsible for the management of food loss and waste.

- The National Environmental Management: Waste Act 59 of 2008 and the Waste Amendment Act 26 of 2014 are both part of the National Environmental Management: Waste Act. Both of these acts are required to regulate waste management and documentation, including the licensing of waste permits. Most notably, local governments must establish comprehensive waste management systems for food loss and waste in order to reduce food loss and waste (National Environmental Management 2020).

- The National Waste Management Strategy (NWMS), which had a government goal of reducing waste to landfill by 25 percent by 2016 and permits are required for 80 percent of waste disposal sites. Potential waste reduction initiatives are also mentioned, with Goal 1 being the most important for reducing and removing food

waste from landfills by encouraging waste minimisation, reuse, recycling and recovery, as well as Goal 3 to increase the waste sector's contribution to the green economy. To ensure implementation, the plan also calls for the appointment of waste management officers to coordinate waste management activities within and across government levels (NWMS 2011). However, according to NWMS (2020), one of the existing challenges to prevent food waste is the fact that it is not recognised in the general waste classification of general waste and is, therefore, not reported or counted for, despite that organic waste contributes more than 50 percent contribute to the landfills which includes one third of food waste.

- The food legislation is in accordance with the Food, Cosmetics and Disinfectants Act 54 of 1972 and the Health Act 63 of 1977. The Act also addresses food regulation and manufacturing, as well as food labelling. Because it also controls food production and related incidental issues, the role of this regulation has more power to provide with directives on food waste reduction.

The aforementioned regulations are thought to help reduce food waste. Furthermore, due to a lack of government support, insufficient regulations and irresponsible consumer behaviour, there will continue to be a food waste problem, as well as limited internal resources that hinder the implementation of more advanced management approaches (Filimonau & Gherbin 2017:76). Food waste can be avoided by external regulators' policies, laws and regulations that influence foodservice operations activities (Lefadola *et al.* 2018:11).

2.14.2 Quantifying food waste

According to CGCSA (2019:7), South Africa is one of the countries currently grappling with the challenge of quantifying food loss and waste at each stage of the supply chain and accurate data is required. There are few published sources of information available (du Toit 2018:4). Due to a lack of information, the FAO (2011) food waste estimates study

on food waste quantity is still widely cited. Individuals and decision makers typically require more information to guide action, including the types of food wasted, where it is made and where it goes, in addition to understanding how much is wasted. Therefore, quantifying FLW is required to determine whether action is required to understand so-called hotspots so that action can be prioritised, to evaluate a solution or initiative and to monitor targets (Annual Review of Environment and Resources 2019:129).

Additionally, insufficient information on where food waste occurs and its primary causes demand more academic research (Krasteva *et al.* 2019:1). Foodservice kitchens may employ cutting-edge technological innovations such as computerised weighing scales with scanners and digital cameras to enable foodservice personnel to easily capture food waste data for routine monitoring (Ofei, Holst, Rasmussen & Mikkelsen 2014:55).

2.14.3 Inadequate food recycling facilities

Food wholesalers and retailers are limited in their ability to recover organic food waste for composting or anaerobic digestion due to a scarcity of facilities. Due to cost implementations, the number and capacity of food rescue and food waste recycling facilities are limited, particularly in regional and rural areas (Lewis *et al.* 2017:20). South Africa faces the same challenge, with approximately 6 656 234 million tonnes of organic waste produced, 8 440 28million tonnes landfilled and only 12 percent recycled (SAWIC 2018:18), despite the country's limited composting treatment plants and licensed bio-gas plants. (SAWIC 2018:27). This increases waste generators' demand for alternative waste treatment solutions (GreenCape 2018). Thus, if there are no other options for recycling unavoidable organic food waste, supermarkets are forced to dispose of it in landfills. However, waste generators have an obligation to take the lead in developing environmentally friendly methods for organic waste management; thus, collaboration between all food supply chain stakeholders, government at all levels and public representatives such as non-governmental organisations (NGOs) is vital (No More to

Food Waste 2015; CGCSA 2019), as they all share a common goal of sustaining the environment.

2.15   SUMMARY

The literature has indicated that food waste comes at a high cost in South Africa, economically, socially and environmentally. There is a significant amount of food waste produced by the foodservice industry. However, at the commencement of this study there were no policy that enforced food waste reduction practices in foodservice units in South Africa. The literature indicates that irresponsible staff attitudes, practices and their disinterest in minimising food wastage are also a challenge for food waste management. Employees' engagement in the delivery of environmental management initiatives is crucial in the reduction of food waste.

Therefore, the literature has created a foundation to support the main objective of this study, to determine knowledge on food waste and waste prevention practices of food handlers in supermarket kitchens in Soweto. The quantitative survey and observations are the best way to achieve the objective of the study, given that the survey will measure what people say they do or know while the observations will measure what people do, rather than what they say they do or did.

Chapter 3, which is the methodology chapter, will deal with the application of the quantitative survey and observation to determine knowledge and food waste prevention practices of food handlers in supermarket kitchens in Soweto in terms of food waste.

3

METHODOLOGY

3.1 INTRODUCTION

The main purpose of this study was to determine knowledge of food waste and current waste prevention practices of food handlers in the supermarket kitchens in Soweto, South Africa. The purpose of this chapter is to describe in detail the research design and methodology applied in this study. In addition, the chapter outlines the research approach and also provides a comprehensive overview of the methods used in the study. This study used a non-experimental quantitative research design and a descriptive design, which will be discussed in this chapter.

The study's first sub-objective was to determine the level of food handlers' knowledge on food waste. The aim was to evaluate food handlers understanding and awareness of food waste in order to identify the gaps they have on food waste knowledge and practices. The second sub objective was to determine current waste prevention practices of food handlers on food waste. The identified practices were analysed to identify factors associated with food waste in supermarkets food sections and finally assess whether their level of knowledge correlates with their practices.

3.2 ADMINISTRATION

To conduct this study, the following procedures were followed.

3.2.1 Permission

The research was conducted in Ward 21 within Soweto township and surrounding areas. To conduct the study, the researcher first requested permission from the ward councillor (Annexure B) and supermarkets' management (Annexures C, D & E). The researcher made an appointment with each supermarket's management and explained the purpose

of the study. Permission letters were signed as a form of agreement to partake in the study and served as informed consent. The researcher was able to secure permission in October 2020 from three supermarkets that met the predefined criteria and that were willing to allow their kitchen employees (food handlers') to take part in the study. The date and time for data collection were discussed and agreed upon with the management.

3.2.2 Ethical consideration

The ethical clearance for the study was applied for and the clearance was granted (Ethics reference number: FREC/HS/14/08/2020/6.1.1) (Annexure A) through the Faculty Research Ethics Committee Faculty of Human Sciences (FREC). This study was conducted upon the permission of the establishments and in acceptable ethics in terms of honesty and integrity. Participants had the right to withdraw from the study at any stage if they wished to do so. Respondents were informed of the purpose of the study and completed the informed consent form (Annexure F), which is a statement that they understand what they were involved in and that participation is voluntary. No information was disclosed using the respondent's name; privacy for respondents was considered to be very important in this study. Instead of respondent's names, codes were used. Offensive, discriminatory or unacceptable language was not used in the formulation of questionnaires.

3.2.3 Intellectual property rights

The findings of this study were reported for the purpose of a Magister Technologiae Food and Beverage Management qualification. The intellectual property rights for the MTech study belong to the VUT.

3.3 STUDY DESIGN

A quantitative, descriptive research design was chosen to give a descriptive analysis in determining the knowledge and practices of food handlers in the supermarket kitchens for this study. Therefore the researcher will apply two sets of data collection methods for determining the knowledge and the practices. The systematic empirical investigation of observable phenomena using statistical, mathematical, or computational techniques is known as quantitative research. The goal of quantitative research is to create and apply mathematical models and theories about phenomena (Bhawna & Gobind 2015:49). The values that underpin quantitative research include objectivity, neutrality and the acquisition of a broad range of knowledge. When the primary goal is to explain or evaluate, this approach is generally appropriate (Leavy 2017:9). According to McCusker and Gunaydin (2015:537), quantitative research seeks to study social life aspects, which include experiences and attitudes of the community or individuals about a specific phenomenon that is interpretable in numbers, rather than words, as data analyses. A quantitative approach is useful when the researcher seeks the facts of a social phenomenon and to remain objective (Lancaster 2005:67). One of the major benefits of quantitative research is the ability to collect a wide range of data from a large number of populations, making quantitative research quite flexible. Quantitative methods are not appropriate for all phenomena (Sukamolson 2007:4). One limitation is that data do not provide evidence for why people think, feel, or act in a certain way (Goertzen 2017:13)

Quantitative observational studies usually concentrate on a specific type of behaviour that can be quantified through some measure; each occurrence of the behaviour is counted to determine its overall frequency (Leedy & Ormrod 2015:155). However, there may still be some confusion between the qualitative and quantitative observational research methods, but the quantification of observations is the main distinction (Mertler 2016:111). The food handler's practices were directly measured through observations to determine exact experiences of food handlers during meal production without the researcher being

involved, which is one of the benefits of observation studies (Mansell 2011:6) and to answer the study's objectives.

In addition, the advantage of observation is that it provides first-hand data and allows the researcher to learn what people actually do. Observations are used not only for directly observing people's behaviours, but also for observing behavioural signs (Humberstone & Prince 2019:71). Physical clues, such as soap and water near the latrine, covered food and scattered garbage, often provide the observer with a quick and easy indication of the presence or absence of health behaviour. These physical cues may also be used to replace direct observations of behaviour that are too sensitive to observe or perform in the presence of an observer, or that are too difficult to observe because they occur infrequently or at irregular times.

There are two types of quantitative research designs: experimental and non-experimental. A review of non-experimental research, which is the focus of this study, is provided for the purposes of this study. Non-experimental research does not involve the manipulation of an independent variable; instead, the researcher simply measures variables as they occur (Haradham 2020:12). Non-experimental designs can be used to (1) describe the phenomenon in detail, (2) explain the relationship and differences between variables and (3) predict the relationship and differences between variables. The disadvantage of using a quantitative non-experimental design is that researchers cannot make claims about cause and effect because the independent variables are not manipulated (Schmidt & Brown 2019:182). Descriptive research, correlational research and casual-comparative research are the three basic types of non-experimental research designs (Mertler 2016:126). Cross-sectional design, which is one of the methods of an observational study that measures the characteristics of research participants at one point in time (Majid 2018:2), was employed. Thus, the observations of food handlers in the kitchens were conducted once-off without the intention of future observations on the same group. This design was selected based on its advantage of being relatively faster and inexpensive compared to other types of observational studies (Setia 2016:263).

3.4 STUDY GEOGRAPHIC DEMARCATION

The demarcation of the study was Soweto township, Johannesburg region in Gauteng province of South Africa. In South Africa, townships are areas that were designated under apartheid legislation for the exclusive occupation of people classified as Africans, Coloured and Indians. Townships have a distinct history that has had a direct impact on the socioeconomic status as well as how people perceive and operate within them (Department of Co-operative Governance & Traditional Affairs [CoGTA] 2009:6). Soweto township falls under the City of Johannesburg Metropolitan Municipality. In South Africa, according to the number of inhabitants by municipality, Johannesburg is the largest municipality, with 80 percent of black Africans. Region D (Soweto), as indicated in Figures 3.1 and 3.2 has the highest population, accounting for 23 percent of the total population in the City of Johannesburg. An approximate 1,219,886 total population is situated in Soweto township (Grocery retail market inquiry [GRMI] 2019; City of Johannesburg 2020). IsiZulu is the most spoken language in Soweto, with 37.1 percent and Sesotho is the second most spoken language out of South Africa's 11 languages (South African market insights 2015).

Due to the number of inhabitants by municipality, Soweto township has the highest rate of waste collected by the municipality (South African Cities Network 2016:174). According to the Johannesburg Integrated Development Plan [IDP] (2017:20), Soweto township, which is also referred to as Region D, is faced with a challenge of illegal dumping and signage. Therefore, the above information regarding the growth of formal supermarkets in Soweto, its large population in South Africa and the highest rate of waste collection and illegal dumping in Region D justifies the importance of the selection of this demarcation in fulfilment of this study in Ward 21 within Soweto township and surrounding area.
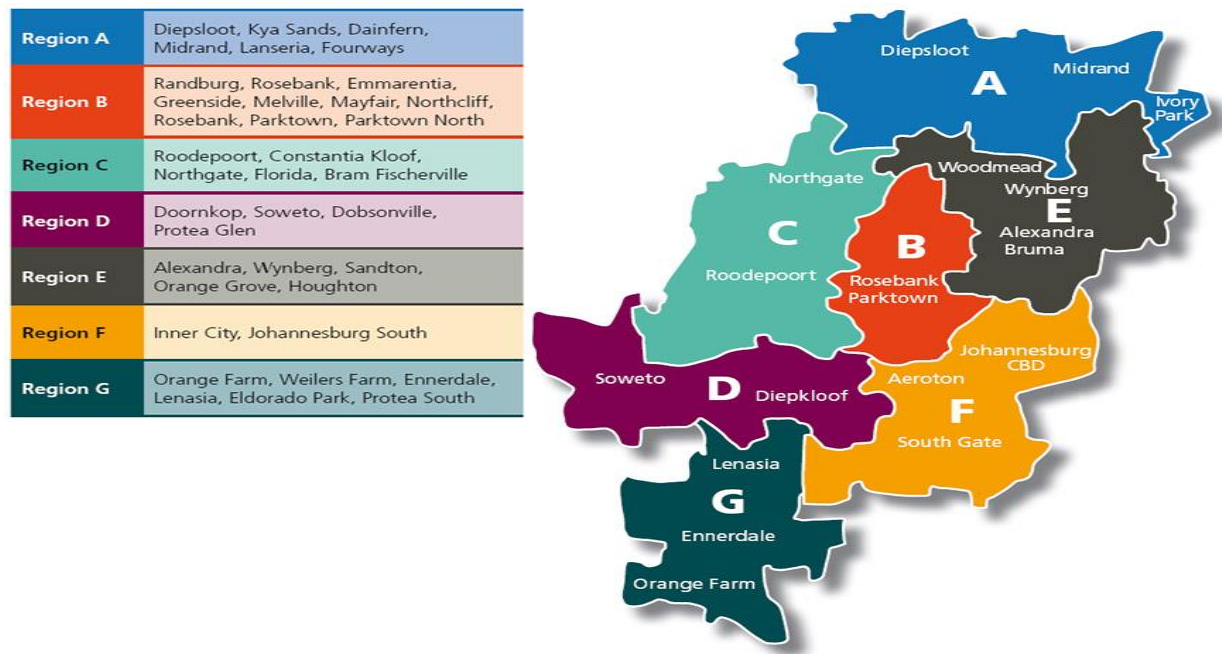
Figure 3.1: Johannesburg regions map indicating Soweto's location (Pikitup 2015).
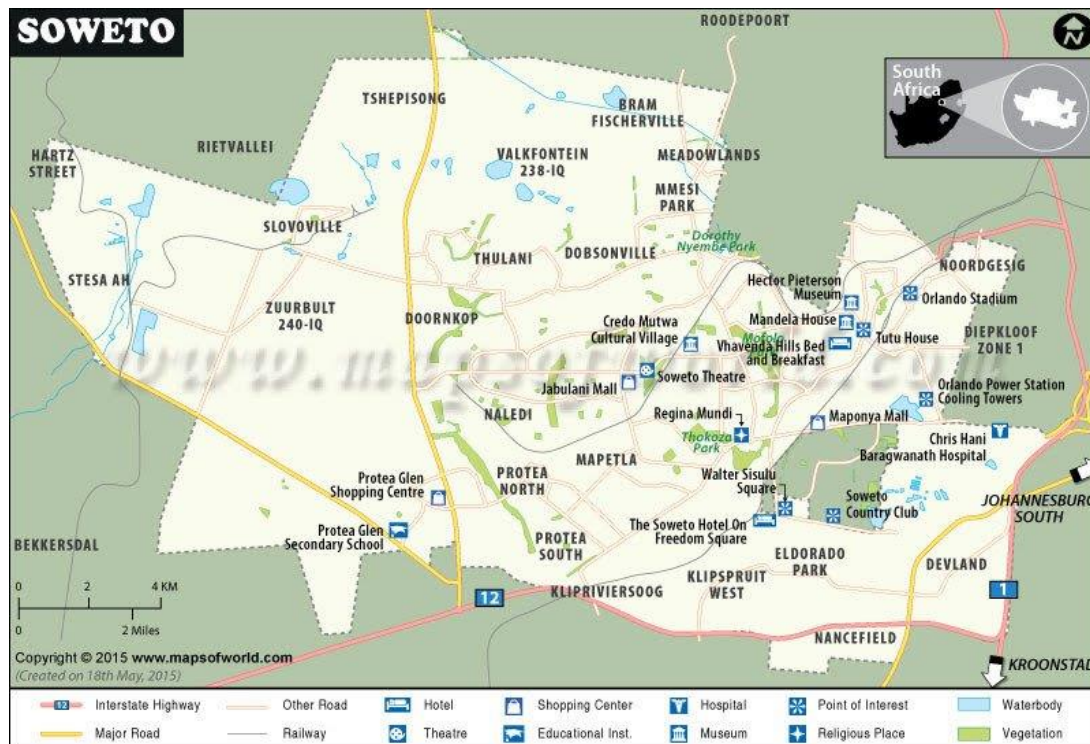
Figure 3.2 Soweto map (Maps of world 2015).

3.5 STUDY POPULATION

The study population consisted of 11 branches of grocery supermarkets focusing on food handlers in the supermarket kitchens. The population of the supermarkets was represented by one of the big five largest supermarket franchise stores in South Africa. In the 11 branches of grocery supermarkets franchise stores, approximately 20 to 35 food handlers are employed by each supermarket (± 220 total) in Soweto. The number of food handlers' information was provided by the supermarkets managers and supervisors.

3.5.1 Study sample size

The employees who were selected to partake in this study from the three supermarkets were those who work with food, including service, food production and scullery staff, chefs and cooks. Typically, such employees are engaged in food waste procedures within the foodservice units' context. A sample is defined as a group of respondents that are selected to represent the entire population (Curtis & Drennan 2013:136). From the population of ± 220 food handlers, the survey system calculator was used to calculate the sample size. The sample size of the study was a total of n=107 food handlers from three same franchise supermarkets. The sample size represents the units of the population, which is a subset of a population that is selected to represent the whole group (Cherry 2018:1). For reliability, a confidence level of 85 percent and 5 percent of margin of error was employed to calculate the sample size. Below is the formula for the sample size (Raosoft 2004).

$$SS = \frac{Z2 * (p) * (1-p)}{C2}$$

SS = sample size

Z = Z value (85% confidence level)

P = Percentage picking a choice, expressed as decimal (5%)

C = Confidence interval, expressed as decimal (±4)

3.5.2 Sampling technique

The study followed a non-probability sampling method. Purposive sampling was used to select the grocery supermarkets and participants were conveniently sampled. The purposive sampling technique is an intentional choice of respondents owing to the characteristics and qualities respondents hold (Etikan, Musa & Alkassim 2016:2) Therefore, the grocery supermarkets' sample were purposefully selected to participate in this study. Non-probability sampling is when the samples are grouped in a process that does not give everyone in the population equal chances of being selected (Alvi 2016:13). The sample of the kitchen employees was conveniently selected owing to the nature of convenience sampling where participants meet certain criteria such as easy accessibility, research geographical proximity and willingness to participate (Jager, Putnick & Bornstein 2017:15).

3.6 PROCEDURES FOR DATA GATHERING

In this study, similar procedures to those used by Mabaso and Hewson (2018:6) for instrument development were used as indicated below. Before data collection began in October to November 2020, the researcher visited each of the supermarkets involved, first to design a research strategy that could be applied to all of the supermarkets and, secondly, to observe the staff working patterns during a shift, ensuring access to real-time data and reducing the possibility of workplace function interruption. Thirdly, in order to ensure consistency in data collection, an initial visit was made to identify specific areas of food waste generation across all of the sites surveyed as a pre-planned strategy.

In addition, the following steps and goals in the use of structured observation adapted from (Bentley, Boot, Gittelsohn & Stallings 1994), indicated in Figure 3.3, were applied on the development of the instrument and data gathering for this study.

Step 1

Deciding if structured observations are needed and can be done considering available resources

a. Determine the research needs.
b. Determine if structured observations are necessary to meet these research needs.
c. Decide if available resources are sufficient to do observations.

Step 2

Generate list of potential key behaviours (practices) through literature review and interviews with informants

a. Review the literature and brainstorm.
b. Develop preliminary list of key behaviours.

Step 3

Refine list of key behaviours and determine the heterogeneity of the population

a. Refine the list of behaviours to be observed in a structured format.
b. Determine behavioural markers, if needed.
c. Ascertain cultural, economic and religious heterogeneity of the study population.
d. Check the work with the decisions in step 1

Step 4

Identify who to observe, where and when

a. Identify who (and what) to observe.
b. Identify locations where key behaviours occur.

Step 5

Choose methods of structured observations to conduct

a. Do the minimal options exercise.
b. Use flow chart to select methods of structured observations.

Step 6

Estimate reactivity and variability of key behaviours

a. Select test sites.
b. Estimate variation in key behaviours.

Step 7

Design instruments and data sheets

a. Operationalise and define key behaviours.
b. Design continuous monitoring/spot check instruments.
c. Prepare observation summary.

Step 8

Determine data collection schedule

a. Determine the number of days for data collection.
b. Determine the mean number of observational episodes.
c. Determine the number of observers required to conduct structured observations.

Step 9

Train observers and pre-test instruments

a. Involve observers in development of structured observations
b. Develop field manual and code books and carry out the training.
c. Pre-test instruments.

Step 10

Implement data collection and data management

a. Conduct the structured observations.
b. Review data sheets and store properly.

Step 11

Clean data set(s)

a. Conduct range checks.
b. Conduct consistency checks.

Step 12

Process the data

a. Determine frequencies of key behaviours
b. Determine amount of time spent on key behaviours.
c. Create behavioural scales

Step 13

Conduct data analysis and use study results for project evaluation

a. Do descriptive analysis.
b. If necessary or desirable, do further statistical analysis.
c. Maximise the use of the results of the study.

Figure 3.3: Structured observations steps (Adapted from Bentley, Boot, Gittelsohn & Stallings 1994).

3.7 RESEARCH INSTRUMENTS

The research instruments that follow the quantitative approach, will be reviewed in this section.

Descriptive research methods are commonly divided into two categories: surveys and observational studies (Mertler 2016:126). Descriptive design focuses on the research subject's elaboration (what) rather than the reasons (why) for the research subject (Bhat 2018:1). The goal of descriptive research is to describe a phenomenon in detail. Descriptive designs depict a situation as it occurs naturally, with no manipulation of the variables. The advantage of a well-controlled descriptive study is the flexibility in the methods that can be used to collect data, which often leads to faster data collection and cost savings. The inability to establish causality is the primary disadvantage of this type of design (Schmidt & Brown 2019:183).

A survey questionnaire and an observation checklist were used to obtain numerical data that were analysed statistically to determine food waste knowledge and practices in supermarket kitchens. In the following section, the quantitative survey questionnaire and the observations as research instruments appropriate to the current study are described and discussed below.

3.7.1 Quantitative survey questionnaire

Survey studies enable the collection of data directly from a person participating in the research via a set of questions organised in a specific order. It is also possible to obtain information about a specific phenomenon by formulating questions that reflect the opinions, perceptions and behaviours of a group of people. The most important advantages are the method's high representativeness of the entire population and low cost when compared to other alternatives. However, one limitation is that the reliability of survey data is highly dependent on the survey structure, which does not capture respondents' emotions, behaviour and emotional changes (Queiros, Faria & Almeida 2017: 381).

3.7.2 Quantitative observations methods

The quantification of observations is the main difference in a quantitative design when compared to a qualitative design (Mertler 2016:111). According to Crowther and Lancaster (2009:108), observational research entails gathering primary data or first-hand information by looking, recording, watching, or noticing with all of our five senses: seeing, touching, tasting, hearing and smelling (Gifford 2016:11). This enables researchers to discover more about what people do. The researcher observes respondents' real-world behaviours, environments and contexts without intervening (Majid 2018:1). As previously stated, observation can be used not only for directly observing people's behaviours, but also for observing 'signs' of behaviours. Signs of behaviour, or so-called physical clues found in the environment, such as a menu on the wall, soap and water near the kitchen hand wash basin, covered food and many others, usually provide the researcher with a quick and easy indication of the presence or absence of a behaviour or practice (Zikmund, Babin, Carr & Griffin 2013:238; Grigorenko 2012:190). These physical cues may also be used to replace direct observations of behaviours that are too sensitive to observe or perform in the presence of an observer, or that are too difficult to detect because they occur infrequently or at irregular times (Gifford 2016:31).

3.7.2.1 Classification of observations

Observations are classified into two, namely unstructured and structured observations. The literature review of the structured observations will be provided in detail as it was the method followed in this study.

- Unstructured observations

When observations are unstructured, they are not organised in a complete or detailed manner. Unstructured observations are especially useful for understanding behaviours in their physical and socio-cultural contexts (Sharma 2016:167). There are three types of unstructured observations, which are described in Table 3.1 below:

Table 3.1 Classifications of unstructured observation (Sanjay 2020:66; Veal & Darcy 2014:226).

Informal observations	In participant observation	Indirect observation
These are spontaneous observations that take place while walking through the community, visiting houses, market places, water points, schools, restaurants and so on. No formal rules stablished. The observer seeks to describe the phenomenon of interest and develop explanation and understandings in the process (Veal & Darcy 2014:226).	The observer shares the life and activities of the people for a few days, weeks, several months, or even years. Through participation, the observer will experience the behaviours and combine this with observations and unstructured interviewing about what is happening. The purpose of such participation is to develop an insider's view on people's behaviours (Sanjay 2020:66).	The observer remains an outsider and is a spectator only. The purpose of such observation is to investigate and describe one or more behaviours fully (Sanjay 2020:67).

- Structured observations

Observations are structured when an observation list is used with a fixed number of points to notice and when this list is applied in a pre-determined number of situations, or with a pre-determined number of people. Structured observations are particularly useful when the researcher wants to collect information about the extent to which particular behaviours occur, including information about the frequency, intensity and duration of the behaviours (Sharma 2016:167). Table 3.2 provides the types of structured observations.

Table 3.2 Structured observation methods

1) Continuous monitoring	
Descriptions	**Types**
This observation involves observing and recording the behaviours that the researchers are interested in for an extended period, for example, several hours or a full day. It may focus on waste disposal patterns, handwashing behaviour, food preparation and so on. For example, if the researchers want to observe the preparation of hot food preparation behaviour/ practices, the researchers may wish to know how the foods are prepared and whether or not they are prepared fresh each time. If not prepared fresh each time and if reheating of food occurs, may wish to examine how and for how long hot foods are stored (Lazaridis & Colbeck 2010:128).	**Extended observation**. Extended observation is continuous observation over an extended period (usually several hours) at a place where the observation is to take places such as a school or foodservice unit. It is the most common form of structured observation and most suitable when a series of behaviours or infrequent behaviours have to be observed. In extended observations, the behaviours of interest are noted down in a structured format as and when they occur. Extended observations require a high level of commitment and concentration of the observer to avoid missing any important behaviours of interest over the entire observation period (Houser 2009:285). **Time-point observation.** This differs from extended observation only in that the observations are carried out at fixed points in time. Examples are spotting all behaviours during the first five seconds of every minute, or spotting the behaviours of interest every 30 minutes throughout the day. Time-point observation reduces the risk of lapses in concentration that are common in continuous monitoring. This type is only useful for observing behaviours that occur frequently (Houser 2009: 285).
2) Spot check	
Description	**Types**
Spot check are a particular type of structured observation whereby the observer records the presence or absence of a behaviour or physical clue at the first moment of observation (Lazaridis *et al.* 2010:128). For example, waste container covered.	Spot checks involve recording of people's **behaviour** or **physical clues** at the first moment of observation. Spot checks are usually carried out immediately upon arrival of the observer at the place where the observations will take place. This may have the advantage that the 'real situation' can be observed, undisturbed by the reactions of the people to the presence of the observer. However, a problem could be that, on the arrival of the observer, all normal

	activity ceases immediately. Spot checks of physical clues may often be easier and more reliable than spot checks of behaviour (Thomas, Andres, Borja-Vega & Sturzenegger 2018:52; Glennerster & Takavarasha 2013:212)

3) Rating checks (Rating scales)	
Description	**Types**
Rating Checks resemble spot checks but require the observer to make a judgement about what is observed (Neukrug 2016:386; Saracho 2015:37). Examples are the cleanliness of food handler's hands, or the freshness of food.	Rating checks involve the observation of physical clues of behaviour to which the observer adds a value judgement (Sharma 2016:168). For example, 'Food handler washes his/her hands' is a pure observation of a behaviour of a person, food handler's hands cleanliness requires a judgement by the observer. Rating checks can be used both for **individual behavioural ratings**, such as clean or dirty hands, short or long nails and for **environmental ratings**, such as good or poor food waste disposal, big or small garbage pile (Whitcomb 2018:291; Podmore & Luff 2012:46; Grigorenko 2012:191) Rating checks provide a quick method for a quantitative indication behaviour, as the observer does not have to wait for the behaviour to occur (Barkley 2011:23). The problem with this method is that is it very difficult to make consistent judgements such as about clean or dirty, good or bad, thorough or superficial, more or less. If it is even difficult for one observer to make consistent judgements for similar observations, more difficult to maintain consistence among several different observers. It is therefore recommended to use ratings only if unavoidable and when ratings are used, to take ample time for training the observers to ensure that everybody is making similar judgements all the time. It will help when the ratings are specifically defined (Matson 2017:97; Barkley 2011:21).

3.7.2.2 Advantages of structured observations

There are several important advantages in using structured observations for behaviour studies. Some of the disadvantages are as follows:

- The researcher observes participant's real-world behaviours, environments and contexts without manipulation (Majid 2018:1).
- Structured observations gather the information that participants may not realise are important, such as physical or environmental cues (Gray 2020:449).
- Allows data to be collected at the point of occurrence and does not rely on participant recall or event interpretation (Gray 2020:449).
- Should produce more reliable data because the results can be replicated by the same researcher at a different time or by other researchers (Gray 2020:449).

3.7.2.3 Disadvantages of structured observations

There are disadvantages to the use of structured observations and these should be considered before deciding on the suitability of this research method in practice or behaviour study, namely:

- Very time consuming, requiring prior preparation and the researcher's availability to visit the location where the event occurs. Therefore, the costs involved are typically higher (Williamon, Ginsborg, Perkins & Waddell 2021:99).
- Because data collection for the study of behaviour is a skill that must be learned, more qualified field staff are required, as is more training than is required for the use of unstructured observations (Williamon *et al.* 2021:99; Profetto-McGrath, Polit & Beek 2010:249).
- The research analysis is quite sensitive, because data interpretation is done solely by the researcher, which may be biased (Queiros *et al.* 2017:376).

Unfortunately, there is no general rule for determining whether one observation period is sufficient and, if not, how many observations should be performed. When people

are aware that they are being observed, they may react or behave differently, which may influence the number of observations required. This problem of 'reactivity', also known as the Hawthorne effect, is discussed below.

3.7.3 Reactivity or Hawthorne effect

It is quite normal for people to react to the presence of an observer or to behave unusually. When people are aware that they are being watched, people tend to show their best side or behave in a manner that is believed the observer would prefer. Also, some behaviours may be considered to be too sensitive to display and thus people wait until the observer has left. This is known as 'reactivity' and because it influences obtaining a reliable picture of actual behaviour, it should be dealt with it as best as possible (Berscheid & Regan 2016:117; Hecker & Thorpe 2015:60).

From the review of the observation method, it became clear that each type of structured observation and each variety can be used separately, but a mix best suited the purpose of the current study within the time and resources available.

3.8. Development of measuring instruments

3.8.1 Food waste knowledge questionnaire

To measure food handlers' knowledge on food waste, a questionnaire was developed (Annexure G) by the researcher after the researcher had reviewed the previous literature related to the study as discussed in chapter 2 and also had identified the potential areas of food waste in the sites. The questionnaire was in English as all food handlers working in the supermarkets were able to read and write English. The researcher was available to translate in Zulu to clarify concepts if and when necessary. A questionnaire was best suitable for this study because it provides quantifiable answers, is relatively easy to analyse and it can reach a large number of people easily and economically (Malkanai 2018:38). A structured self-administered questionnaire

with closed-ended questions was developed. In order to achieve the study's objectives, the questionnaire comprised of the following sections and elements:

- Section A: Demographic profile of food handlers

A demographic profile that comprises information such as gender, level of education, age, race and home language of food handlers was incorporated in this section. This information is important to understand the participant profile. This section involved nominal data information, which is non-numeric data that consist of two or more categories (Bhat 2018:2) and ordinal scale data, which involves both numerical and nominal data that are grouped in classes (Maree 2016:165).

- Section B1: Knowledge about profile of the customers

Nine ordinal scale questions about the knowledge of customer's profile were developed in this section. Answers were yes or no options.

- Section B2: Knowledge about food waste

In this section, the Likert scale, which is a type of rating scale used to measure respondents' perceptions (Stephanie 2015:1) was included. There were 20 ordinal scale questions that were divided into general knowledge, food storage and food preparation sections. Answers consisted of strongly agree, agree, disagree and strongly disagree, as well as never, sometimes and always options.

- Section C: Knowledge about green practices on food waste

This section was developed to measure food handlers' knowledge on green practices on food waste. Thirteen questions that had nominal scale information that required respondents to indicate their response with yes or no or not sure answers, as well as multiple choice answers, were developed in this section.

3.8.2 Observation checklist

For the development of the observation checklist (Annexure H) the first step involved deciding if structured observations were needed and could be done considering

available resources. The research needs were determined, which were to determine the food handler's practices on food waste during meal production. The structured observations were considered necessary to meet the needs of the research as the researcher needed to find out what people actually do (practices of food waste in supermarket kitchens). The researcher needed to observe the behaviours, environment and context of participants in the real-world without manipulation (Majid 2018:1). The researcher also intended to observe food handlers' practices at the time they occur (Gray 2020:449). The available resource such as finances, duration of the study (maximum of three years) the COVID-19 pandemic, its regulations and its effect on the availability of fieldworkers and participants influenced the observation process.

The second step entailed generating a list of potential key behaviours, which in this study were the practices. This was done through the literature review and informal interviews with informants, such as management. The researcher adapted some of the factors that contribute towards preventing food waste in foodservice units identified by Kinaz, dos Reis and Morais (2015) for this study. The developed preliminary list of key behaviours that were used by the researcher during the structured observation of food handlers' practices on food waste included the criteria listed in Table 3.3.

Table 3.3 Food handlers' practices that contribute to food waste (Adapted from Kinaz *et al.* 2015).

Actions observed	Actions for the factor
Menu planning	Careful menu planning contributes towards preventing food waste.
Menu execution	Careful menu execution contributes towards preventing food waste.
Practices during the distribution of meals	Proper practices during the distribution of meals contribute towards preventing food waste.
Waste management plan	Having a waste management plan contributes towards preventing food waste.
Management practices during storage	Good management practices during storage and in the inventory control of foods contribute towards preventing food waste.
Food handling practices	Applying good food handling practices contribute towards preventing food waste by spoilage.
Working conditions	Proper working conditions prevent errors and accidents, contributing towards minimising food waste.

Step 3 involved refining the list of key behaviours and determining the heterogeneity of the population. The researcher was required to first refine the list of behaviours; for the purpose of this study, these were referred to as practices that needed to be observed by making a more definitive list. Secondly, determine the behavioural market by ascertaining the behaviours that can be directly observed from the list of behaviours that had been created by the researcher as it may be inappropriate or insensitive to observe other behaviours in other studies (Oakley 2019:34). Thirdly, ascertain cultural, economic and religious heterogeneity of the study population, which was done by testing of the questionnaires for reliability in KwaZulu Natal (KZN) where the majority of participants were Zulu-speaking people and represented one of the black ethnicity groups that were part of the main study as aforementioned. Lastly, check the work so far with the decision in step 1 by constantly checking if the selected behaviours (practices) to be observed really met the study's objectives and gave answers to key questions formulated.

Additionally, step 4 required the researcher to identify who to observe, where and when. Thus, food handlers who were regarded as participants in the study were those who work with food, including scullery staff, chefs, cooks and food servers. Also, the locations where the key practices occurred were identified as food preparation, cooking, storage, bakery and food delicatessen (deli) serving areas. The researcher also identified times that key behaviours (practices) occurred in each section of the kitchen, guided by the supervisors who had information about staff work schedules. Observations were conducted during different times of the days and months and observed food handlers during busy and less busy days, in the morning and afternoon and at the beginning, during and month end. These are the different times where key behaviours occur in different ways. Therefore, on the development of structured observations, factors concerning time of observations were considered.

Choosing the methods of structured observation to use in this study was the fifth step. This involved doing the minimal options exercise and the use of flow charts to select methods of structured observation (see Figure 3.4). From the literature review of the observation methods, it became clear that each type of structured observation and

each variety can be used separately. However, usually a mix will best suit the purpose of the study within the time and resources available. A mix of methods was used for the current study guided by the study duration and resources available. A combination of continuous monitoring, which uses time-point monitoring, where observations are carried out at fixed points in time was combined with a spot check method, which involved recording of people's behaviour or physical clues at the first moment of observation. However, the first moment of observation was altered to address the effect of reactivity, which will be addressed at a later stage in this study.
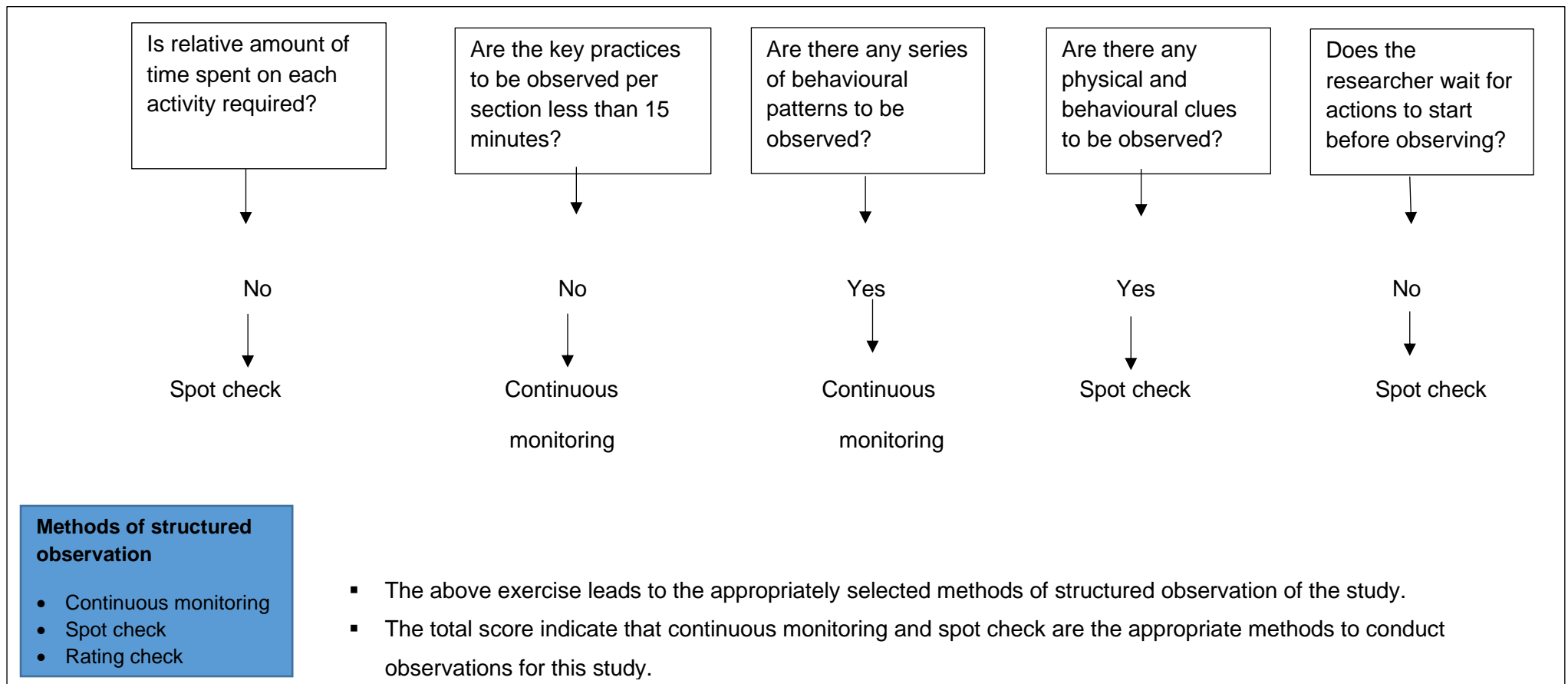
Figure 3.4: Methods of structured observation selection flow chart

Step 6 involved estimating reactivity and variability of key behaviours. This involved selection of test sites and estimating variation in key behaviours. Given that a couple of issues are reported that hinder research to be conducted in foodservice operations, such as the reluctance to co-operate with scientific bodies and also staffing problems in foodservices establishments, which result in any additional activity putting an extra burden on staff (Filimonau & De Coteau 2019:243), it was deemed necessary to have initial visits to research sites. The researcher made initial visits to each of the sites where the study was to be conducted before the data collection commenced, first, to design a research strategy that could apply to all the sites and, secondly, to observe the staff's working patterns during a shift to estimate reactivity to ensure accessibility to real-time data and to decrease the possibility of interruption of workplace functions, thirdly, to identify the specific areas of food waste generation across all the sites surveyed, to help ensure consistency in data collection, which limits variability of key behaviours.

In step 7 on the design of the instruments, the researcher clearly defined and operationalised under what circumstances the behaviour will be considered to be present or absent and different forms of the behaviour will be recognised. An example of this is observing at what circumstance food handlers prepare food properly? Is there any standardised recipe that is followed or visible on the wall? Are scales used to weigh ingredients? Such circumstances define the presence or absence of behaviour. Then for the spot check, a checklist was developed. A checklist is a list of characteristics or behaviours, which a researcher looks for. The researcher indicates whether each item on the list is observed, present, or true or, is not observed, present, or true (Leedy & Ormrod 2015:161). The observation checklist is developed as an instrument for recording the number of a specific action or behaviour that occurs at specific intervals of time or frequency throughout the day (Mertler 2016:112). Yes, or no options were developed to indicate whether a specific food handler's behaviour or action that will be observed has been demonstrated or not. Lastly, the researcher prepared a notebook to be used to clarify information related to the behaviour of interest that will help to analyse and interpret data.

Step 8 involved determination of a data collection schedule. Based on the resources that were available and time frame to complete the study, observations were

scheduled to be conducted for two days in each supermarket. There are four sections of the kitchen that were scheduled to be observed (see step 4) per day. Observations were scheduled to be conducted by the researcher only, hence the spot check and continuous monitoring were selected methods to conduct the structured observations. The researcher was the only observer and no fieldworkers were trained based on the reasons addressed in following steps.

3.8.3 Measures to ensure quality measurements

3.8.3.1 Survey questionnaire

A reliability test (pilot testing) was conducted on a smaller scale of the main or full-scale study. The testing of questionnaires is necessary in order to improve the quality and efficiency of the main study (In 2017:601). Thus, one grocery supermarket in KZN province in Mtubatuba town was selected randomly for this study as it was conveniently close to the home of the researcher at that time, and the participants spoke bothe English and Zulu. The purpose of testing the questionnaire was to ensure the instrument's accuracy aspects for the main study, minimise unnecessary effort from the researcher and participants, as well as the dissipation of research resources (In 2017:604).

A convenience selection procedure was used and care was taken to ensure that the respondents were selected to represent similar criteria of the main study such as the nature of the job of food handlers in supermarket kitchens. The researcher pre-tested the questionnaires with the same group of ten food handlers once per week, for four weeks to test for validity and reliability. The pre- testing of questionnaires took place between November to December 2020. To measure the internal consistency of questionnaires, the Cronbach alpha score of above 0.7 was accepted as reliable for the total sum of all questions.

3.8.3.2 Observation checklist

The measures to ensure quality of the observation instrument were addressed by following step 9, which stipulates that training of observers and pretesting of instruments should be done (Figure 3.1). The sub-step in step 9 indicates that observers should be involved in the development of structured observations. Training of observers should be carried out on the use of field manual and code books and, pre-testing of the instruments. Due to the limitation of resources, cost implications and COVID-19 regulations there was no need for field workers and training, research supervisors and the literature were consulted in the development of structured observations. There was no need to pre-test because the key behaviours were validated and adapted from Kinaz *et al.* (2015). Therefore, no reliability test was conducted based on all the above information.

3.8.3.3 Validity and reliability

3.8.3.3.1 Validity

According to Heale and Twycross (2015:66), validity is the degree to which an instrument accurately measures what it is required to measure. There are three types of validity, namely face, content and construct validity that were measured in this study.

- Face validity

Face validity refers to the degree to which an instrument looks valid and is approved by the experts if it measures the intended concept (Maree 2016:240). To comply with face validity in this study, measuring instruments were scrutinised and approved by the researcher's supervisors as the experts and pre-tested in the field of food and beverage services.

- Content validity

Content validity is defined as the extent to which the instrument accurately covers the content that it is supposed to measure (Taherdoost 2016:30). In fulfilment of the

content validity in this study, the researcher reviewed the previous literature reviews that are related to the study to develop measuring instruments. The experts in food and beverage services again analysed if the instruments consist of the relevant content to be measured. Tested and validated practices that contribute to food waste by Kinaz *et al.* (2015) were used.

- Construct validity

Construct validity refers to the extent to which an instrument measures the theoretical correlation aspects of the concept expected to be measured (Heale & Twycross 2015:66). To meet the construct validity, the researcher explored different research literature sources that fall within food and beverage services, which outline all aspects related to food waste practices within the hospitality sector. All that information was used to measure the variables, which answered the objectives of the study. The approval of the instruments was examined by the research experts within the hospitality department at VUT.

3.8.3.3.2 Reliability

Reliability is the extent to which the researcher's score from the study produces stable and consistent results (Taylor 2013:121). As mentioned earlier, based on the Cronbach alpha score of above 0.7, the questionnaire was to be accepted as reliable.

3.9 FIELD DATA COLLECTION

Appointments to conduct the study were made in advance with the relevant supermarket managers. Data were collected by the researcher using a combination of self-administered questionnaire and an observation checklist. Both methods of data collection are discussed in the following section.

3.9.1 Survey questionnaires

As already indicated in Section 3.6 (procedure of data gathering), by the time the data collection commenced (April 2021), the researcher already had a clear operational understanding of each site because of the initial visits. The understanding of the site served to streamline the self-administering of the questionnaires by minimising the extent of disruption occurring within the fully operational supermarket kitchen.

The researcher was first given an opportunity to explain the purpose of the study and the process of completing questionnaires to managers and deli and bakery supervisors. The process to work with the rest of the food handlers was easy since supervisors were there to assist. Each supermarket was visited three times for data collection (Table 3.4), as per the arranged dates with supervisors who knew how the roster of food handlers was scheduled.

Table 3.4 Survey questionnaire data collection dates

	Dates
1st supermarket	19/04/2021
	03/05/2021
	07/05/2021
2nd supermarket	30/04/2021
	03/05/2021
	07/05/2021
3rd supermarket	10/05/2021
	21/05/2021
	25/05/2021

A consent form was signed by participants to affirm their voluntarily participation and their right to withdraw from the study if they so desire. Structured questionnaires were distributed to each supermarket food handler to complete (see Figures 3.5 and 3.6) and a brief explanation on the aim of the study before they commence with filling in the questionnaire was given by the researcher. The questionnaire for each respondent was coded to ensure anonymity. Each questionnaire required approximately 15

minutes to complete. The respondents were allowed to ask the researcher questions for more clarification if needed.
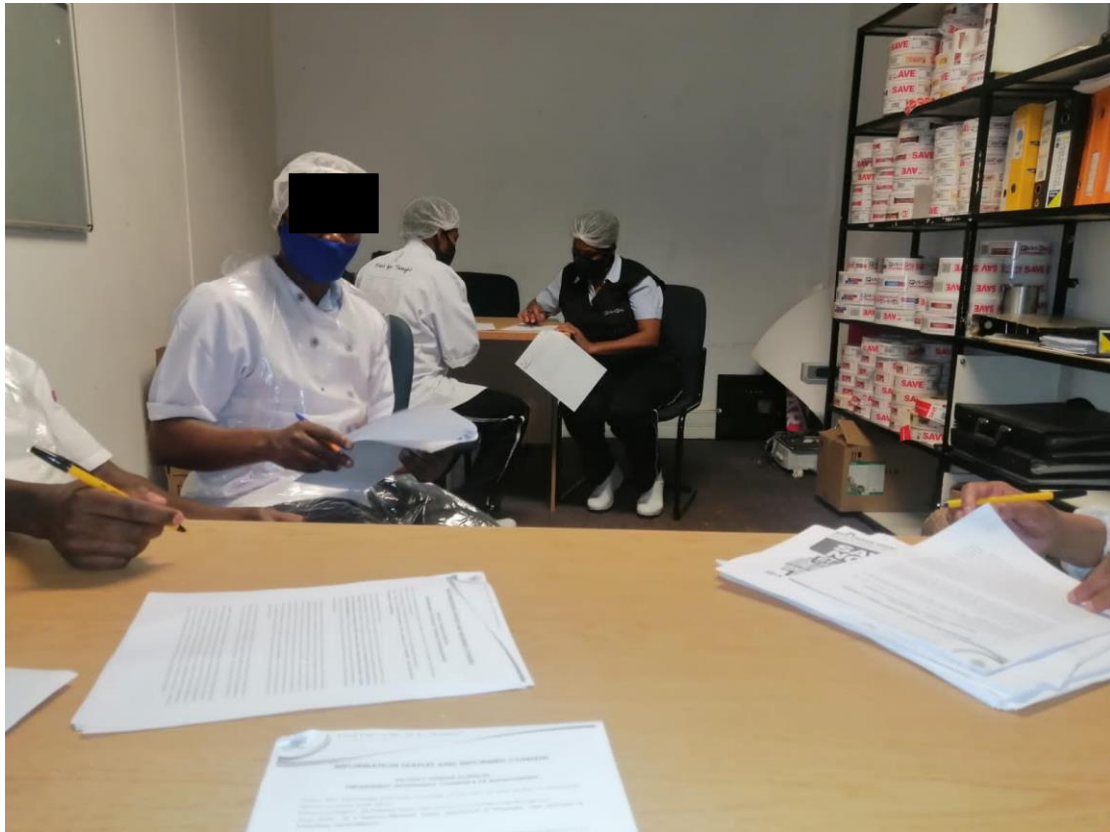
Figure 3.5 Food handlers filling in questionnaires in Supermarket A

Figure 3.6 Food handlers filling in questionnaires in Supermarket B

3.9.2 Quantitative observations

Each supermarket was visited by the researcher on the agreed date and time with the management between April and May 2021. Dates and times for observations are indicated in Table 3.4. The researcher conducted the observations twice per supermarket. The researcher observed food handlers by means of a direct observation where respondents know they are being watched (Sykes, Gani & Dullabh 2016:320). However, structured observation was done by the means of not informing the participants as to what is being observed. This was to resemble a natural and unchanged setting. Only the management was aware of the role of the researcher. Each session of observation lasted up to a maximum of two hours per day. The researcher observed the participants by occupying one corner of each section of the kitchen during the observations to minimise disturbance. All the kitchen Standard Operating Procedures (OSP) were adhered to by the researcher during the observation processes.

Before the observations began, the researcher was alert about the reactivity problems. According to the literature concerning reactivity, it is quite normal for people to react to the presence of an observer or to behave differently than usual (Berscheid & Regan 2016:117). The researcher used a strategy of the food handlers being accustomed to her presence by first visiting without collecting data, whereafter the researcher collected data through survey questionnaires, which is the first phase of this study and initial visits paid before the development of structured observation. This was done for the participants to get accustomed to the researcher's presence, which allows the individuals to habituate to the presence of the observer. Even though participants could still act differently under observations the reactivity problem appeared to be reduced through the repeated observations, as the participants grew accustomed to the presence of the observer, hence the observations were conducted for two days (Hecker & Thorpe 2015:278).

Data were collected during different times of the month, in the middle of the month and month end. This was to measure the consistency of food handlers' behaviour during different times of the month e.g. how food handlers behave during the busiest and

normal days of the month). Also, the observations were conducted at different times of the day in each supermarket in order to measure the behaviour that was demonstrated by food handlers in the morning and in the afternoon (e.g., food handlers' not following proper food handling practices during food preparation and distribution due to tiredness in the afternoon). Collective instances of food waste practices were observed without observing participants individually.

Concerning the review of data sheets and proper storage, which is part of step 10, the researcher constantly consulted with the study supervisors about the data gathering process and difficulties encountered. At the end of the observations, data sheets were safely stored and recorded on a computer as numerical codes to ensure proper data storage.

Table 3.5. Observational checklist data collection dates and times

	DATES	TIME			
		Food production areas			
		Bakery	Preparation and cooking (hot & cold)	Deli/ front service areas	Food storages
1st supermarket	19/04/2021 26/04/2021	30 minutes	45 minutes	30 minutes	15 minutes
2nd supermarket	30/04/2021 07/05/2021	30 minutes	45 minutes	30 minutes	15 minutes
3rd supermarket	10/05/2021 25/05/2021	30 minutes	45 minutes	30 minutes	15 minutes

3.10 DATA CAPTURING AND STATISTICAL ANALYSIS

3.10.1 Reliability test

A spreadsheet for each week's data was designed to capture data. Statistical analysis was performed using a Statistical Package for Social Science (SPSS) version 27 to show the scores and descriptive statistics frequencies and Cronbach Alpha. The Cronbach Alpha score of above 0.70 was regarded acceptable as aforementioned.

3.10.2 Survey questionnaire

All primary data collected for this study were captured into a Microsoft Excel spreadsheet by the researcher. The captured data were then screened to eliminate error entries by the researcher with the assistance of a peer and data were exported to a SPSS version 27 for statistical analysis.

For the knowledge question, either five options or three possible choices options for answering the different dimensions, were provided as follows:

1. For the five possible choices, namely strongly agree, agree, not sure, disagree and strongly disagree were provided. *For the correct or desired answer strongly agree and agree; and disagree and strongly disagree were allocated one mark to determine the knowledge level, not sure was not included given 1 point were also summed up to give 1.*

2. The three possible choices which were never, sometimes, always and the other possible choice being yes, no and not sure, each of the response was also allocated a point.

The answering options were selected as such, which can reduce the possibility of choosing the correct answers by chance. Each correct or desired answer was awarded one point each and the rest of the responses got zero. The total score was calculated by summing up the correct answers. Three levels were considered for this: scores 40 percent less were classified as poor knowledge, 40 to 60 percent as moderate knowledge and above 60 percent was considered as good knowledge.

3.10.3 Structured observations

The 11th step in Figure 3.3 is data cleaning, which includes range and consistency checks. Thus, the researcher performed a consistency check, identifying data that were out of range, logically inconsistent, or had extreme values. Data values that were out of range were unacceptable and corrected (Nunan, Malhotra & Birks 2020). For example, if an item was supposed to be coded 1=no and 2=yes, any number except 1 or 2 is an unknown code, which is out of range and inconsistent. Therefore, the

researcher did thorough and extensive checks to rectify data errors that might have happened during data entry.

Step 12 involved data processing by determining the presence or absence of key behaviours. In this study, a checklist was used. The amount of time spent on key behaviours to determine its presence or absence is as indicated in Table 3.5, which indicates the length of time spent in each section of the kitchen. A rating scale of yes or no was used to indicate whether a specific food handler's observed behaviour or action was demonstrated or not.

3.10.4 Descriptive statistics and statistical test

This section is applicable for both survey questionnaire and structured observations data. A statistician was consulted for the following statistical tests.

3.10.4.1 Survey questionnaires

Descriptive statistics was used to report the data, which describes a simple summary about the sample and transforms simple analysis; it interprets quantitative data in a meaningful way (Trochim 2007:1). For this study, descriptive statistics were used to analyse the food waste knowledge of food handlers in supermarket kitchens. Presentation of the results was in a form of graphs, tables and charts.

Simple summaries about the sample and about the observations were conducted. Mean and standard deviations were presented. A frequency table, also known as frequency distribution, was used to indicate the number of cases in each variable that was expressed in percentages and numbers of the sample size in each variable. The frequency table is used to organise raw data (Bryman & Cramer 2005:8) to analyse the statistical results of each independent variable score and to generate descriptive tables of percentages of each independent variable.

The Spearman's correlation method measures the strength and direction of monotonic relationships between variables (Chok 2010:5). The different correlation methods are

used to measure two or multiple relationships among variables, often represented as X and Y variables (Bryman & Cramer 2005:66). Therefore, to measure the strength and relationship degree of food waste knowledge of food handlers, a Spearman's rank order correlation approach was employed.

3.10.4.2 Structured observations

Step 13, which is the last step as indicated in Figure 3.3, required the researcher to conduct data analysis and use study results for project evaluation. A statistician was consulted for descriptive analysis and statistical tests to analyse. Maximising the use of the results was addressed in the last chapter of this study where the researcher formulated the recommended actions in the research report, together with food waste guidelines as one of the objectives of the study. This was done to maximise the use of the results of the study by applying the results in the project.

3.11 SUMMARY

Chapter 3 provided detailed research methodology that was applied in conducting this study. The chapter outlined the population and sample size of the study. In addition, the processes that were followed such as obtaining permission to conduct the study, development of the measuring instruments and the collection of the data in order to answer the research questions that were posed with the aim of achieving the study objective were also described in this chapter.

Two instruments, namely a survey questionnaire and an observational checklist were developed and used for data gathering. A survey questionnaire was used to measure food handlers' knowledge on food waste. To determine the food handler's waste prevention practices on food waste during meal production, an observation checklist was applied. Given the limited studies conducted in supermarkets regarding food waste in South Africa, with specific focus on food handlers in supermarket kitchens, the use of these two instruments was deemed useful to unpack the insights on food waste knowledge and practices by food handlers. The survey questionnaire provided

the self-reported knowledge on food waste by the food handlers while the observation checklist enabled the researchers to discover more about what food handlers actually do in relation to the self-reported knowledge they have. In the next chapter, results and discussions will be presented.

4

RESULTS AND DISCUSSIONS

4.1 INTRODUCTION

The main purpose of this study was to determine knowledge on food waste and waste prevention practices of food handlers in supermarket kitchens in Soweto. This chapter reports the results of two sub-objectives. The first sub-objective was to determine the level of food handlers' knowledge of food waste using a food handler's questionnaire. The aim was to determine food handlers' understanding and awareness of food waste in order to identify knowledge levels they have on food waste. The second sub-objective was to observe current food waste prevention practices of food handlers by using an observation checklist.

The presentation of data analysis and interpretation for this study was collected from 107 food handlers for the survey questionnaire and from three (3) supermarket kitchens in Soweto through structured observation checklists. Collective instances of food waste practices were observed for each supermarket, not observing participants individually. Therefore, the results will be presented as per the three supermarkets. The sample size that was calculated using the Rao soft survey system calculator was n=107, which was achieved by the current study, as the results are reported of n=107; no withdrawals from the study by the participants were experienced, all participants from whom written consent was obtained participated throughout the study. For the questionnaires, the results cover Section A, which involved food handlers' demographics profiles, Section B1 was customers profile and Section B2 consisted of food waste knowledge. Section C comprised of green practices on food waste. Finally, the results and interpretation of results on food waste prevention practices that were collected through a quantitative structured observations checklist are also presented. The factors and actions that were observed include menu planning, menu execution, practices during the distribution of meals, waste management planning, practices during storage and inventory control, good food handling and work conditions.

4.2 RESULTS AND DISCUSSIONS

The results of the study will be presented by first presenting section A: Questionnaire results of the food handlers' knowledge on food waste then Section B the observation results will follow.

4.2.1 Section A: Questionnaire results of food handlers' knowledge on food waste

4.2.1.1 Demographic profile

The demographic profile (Section A of the questionnaire) of the respondents is presented in Table 4.1 and indicates that the majority of participants were women (60.7%) and 39.3 percent were men. Most of the respondents (48.6%) were between 35-44 years old, followed by 32.7 percent between ages of 25-34 years, 11.2 percent between 18-29 years, 5.6 percent between 18-24 years old and 1.9 percent between the ages 55-64 years. These findings imply that more women are employed within the supermarket kitchens in Soweto with the majority being adults. Haddaji, Albors-Garrigos and Garca-Segovia (2017:51) revealed that, although the kitchen work environment has been described as hard physically and emotionally, it was considered as masculine and a difficult one for women, also highly stressful with long hours. Despite the abovementioned, the findings indicated that women chefs stated that various skills are mandatory in order to succeed in the kitchen workplace. From their perspective there are no longer gender differences in the workplace. Furthermore, from the current study, the findings showed that the majority of food handlers are adults, which is in line with the employment status report in SA (STATS 2020), which indicated that in SA, employers prefer to employ those with previous work experience, enabling older adults' better chances of employment due to experience, when compared to young adults.

The age distribution of the food handlers of between 30-54 years old was also reported by Fariba, Gholamreza, Saharnaz, Ehsan & Masoud (2018:250) in Tehran. The

portfolio established by the current study is strengthened by what was determined by Goh and Jie (2019:129) and Abdullah, Yusof, Gani, Mohammad and Ishak (2018:12) whose research focused on hospitality employees in the hospitality industry and revealed that the majority of employees are females in foodservices kitchens and the majority are above 30 years old.

Table 4.1 Participants demographic profile (n=107)

		Total groups	
		N=107	%
A1. Gender	Male	42	39.3
	Female	65	60.7
A2. Age	18-24	6	5.6
	25-34	35	32.7
	35-44	52	48.6
	45-54	12	11.2
	55-64	2	1.9
	Above 65	0	0
A3. Current Position at work	Deli assistants	26	24.3
	Supervisors	9	8.4
	Bakery/ confectionery	43	40.2
	Front line/ deli counter	10	9.3
	Managers	2	1.9
	General assistants	17	15.9
A4. Highest grade completed	Secondary	98	91.6
	Diploma	7	6.5
	Other certificates	2	1.9
A5. Number of years at work	3-6 months	8	7.5
	≥6-12 months	12	11,2
	≥1- 3 years	17	15.9
	More than 3 years	70	65.4
A6. Do you have written job descriptions?	Yes	78	72.9
	No	29	27.1
A7. Do you have the technical expertise to perform specific tasks	Yes	52	48.6
	No	55	51.4
A8. Have you ever been sent for practical training by your employer?	Yes	73	68.2
	No	34	31.8
A9. Have you ever been sent for theoretical training by your employer?	Yes	73	68.2
	No	34	31.8
A10. Is the interval between training sessions less than six months?	Yes	59	55.1
	No	48	44.9

In terms of the current position at work, the respondents indicated that 40.2 percent were in the bakery section, followed by deli assistants (24.3%), the rest with minority percentages were general assistants (15.9%), front line/ deli counter (9.3%), supervisors (8.4%) and bakery managers (1.9%). When determining the level of

education of the respondents, the majority had secondary school qualifications (91.6%), the minority percentages were reported to have diploma qualifications (6.5%) and other certificates (1.9%). The results on the number of years at work that the participants had, most of the participants were employed for longer than three years (65,4%), followed by participants that had been employed between one to three years (15.9%), the remaining respondents had been employed less than a year (6-12 months (11.2%) and 3-6 months (7.5%).

The above results reflect a true hospitality industry (foodservice industry). The industry uses a diverse workforce, which includes a variety of positions that may or may not have a strong educational component. These results suggest that a cheaper labour force is employed in these kitchens. The prerequisite level of education to execute the tasks is the entry levels based on the fact that the majority of the participants had secondary school qualifications, hence, a larger portion of the participants were in the general assistant positions. The results of this study are similar to what was reported by Okumus, Taheri, Giritlioglu and Gannon (2020:4) that the highest education level of food handlers was high school level and the majority had been employed for longer periods as food handlers. The study by Ababio and Adi (2012) in Ghana also reported similar results with a low level of education among food handlers. Most food handlers in Ghana had only a basic level of education.

When the participants were asked if they had a written job description, the majority of food handlers indicated that they had written job descriptions (72.9%) and 27.1 percent did not have job descriptions (Table 4.1). The results indicated that the majority of food handlers that had knowledge of what is expected of them on the job task performed and a group that performs any task delegated to them. It could be difficult for food handlers without written job descriptions to set goals and achieve maximum productivity in any task given. A lot of mistakes may occur, which may contribute to food waste as a results of misunderstandings due to performing any task assigned without clear and concise guidelines. Khairats' (2016:218) results regarding the important role of job descriptions are confirmed by the high percentage (84.9%) of participants who assured the importance of the role that job descriptions play; the rest

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of the participants (15.1%) perceived that the role of a job description is not important. However, the importance of a job description is to lead the employee and employer to have a common understanding and professional functioning towards the company's goals; a job description is also a tool used to avoid any misunderstanding in workplaces (Beata & Pato 2017:1020).

The results for food handlers on whether they had the technical expertise to perform specific tasks showed that 48.6 percent affirmed that they had technical expertise and 51.4 percent did not have technical expertise. Similar scores of 68.2 percent of affirming and 31.8 percent not affirming were obtained for two questions when the respondents were asked if they have ever been sent for practical training by the employer and also if they have ever been sent for theoretical training by the employer. Furthermore, the response for the question, *is the interval between training sessions less than six months*, indicated that 55.1 percent said yes and 44.9 percent said no. The results reflect that the level of productivity expected from food handlers who have attended training will not be the same as those who have not received training. Lack of training could lead to lower levels of performance due to less knowledge and that can eventually lead to unhappy employees and mistakes that can contribute to food waste.

Furthermore, it would be of interest to know which food handlers had technical experience, and who were sent for training, whether being a permanently employed worker or employed on contract basis influenced staff members training opportunities. However, the job status of the employees was not determined by the current study, posing a limitation on the results. It will be of interest to see how this training component will have an influence on knowledge since the educational attainment was indicated to be at entry level.

Heikkila *et al.* (2016:450) stated that the lack of professional skills of food handlers in foodservice kitchens is one of the elements that contributes to food waste and it is easier for an untrained employee to make mistakes, which may result in food being thrown away. Mistakes may be due to interpreting or reading a recipe incorrectly or

carelessly. Care, meticulousness and the ability to follow instructions are important components of professional skills. Research has found that there is a strong relationship between the knowledge and training received by food handlers and their ability to practice the subject matter (Dudeja, Singh, Sahni, Kaur & Goel 2017:53). McFarland *et al.* (2019:124) identified that there is a significant improvement in employee knowledge after attending training, therefore, the reinforcement training programs, which include food handler's refresher training sessions, are essential as proper food handling practices and knowledge fade over time if there is limited exposure to training programs.

4.2.1.2 Knowledge about the profile of the customers

It was deemed important to determine the knowledge about the profiles of the customers by the respondents, as knowing the customer's profiles is critical to meeting customer needs and preferences within available resources. Customers' profiles play an important role in the menu planning process (Egan 2015:63). Therefore, successful menu plan and knowing the customer's profiles go hand in hand and may aid in the reduction of food waste.

The results on the question, *knowledge about the major customer* (Section B of the questionnaire) are presented in Table 4.2.

Table 4.2 Knowledge about major customers (*n*=107 in %)

12.1 ITEM		F/H	C	F	BG	AY	M	STD
KPC1	B11. Who are your major customers?	29.9	37.4	1.9	29.0	1.9	2.36	1.238

Note: F/H=families/households, C=community, F-females, BG, both gender, AY=adults and youth,
         M=mean, STD=standard deviation

The main responses to the questions about who are the major customer are as follows: community members were the main customer group, which indicated 37.4 percent, families/ households (29.9%), both genders (29.0%), females (1.9%) and adults and youth (1.9%). The results implied that food handlers had knowledge about major

customers, which indicates an understanding of a target market and market segmentation. According to Deepak and Jeyakumar (2019:16), market segmentation is the practice of dividing the target market into approachable groups. This helps to create subsets of major customers based on demographics, needs, priorities, common interest and other psychographic or behavioural criteria used to better understand the target audience. Therefore, if major customers are not known, customers' food preferences are also not known, there will be high chances of food not being sold, eventually discarded and contributing to food waste.

Table 4.3 presents the results of knowledge about profiles of the customers. The response to all the questions in this section was indicated with yes or no. Three levels of knowledge were considered as follows: scores 40 percent or less were classified as poor knowledge, 40-60 percent as moderate knowledge and above 60 percent was considered as good knowledge. The results indicated that from 107 respondents, 47.2 percent on average of these eight questions, had moderate knowledge about profiles of the customers. On the other hand, 52.8 percent (on average) were regarded as lacking knowledge about profile of the customers by the incorrect responses. Overall, food handlers had moderate levels of knowledge about profiles of the customers.

Table 4.3 Knowledge about profile of the customers (n=107 in %)

12.2	ITEM	Y	N	M	STD
KPC 2	B12. Do you know estimated number of customers per day?	33.6	66.4	1.66	1.238
KPC 3	B13. Do you know gender distribution of customers?	57.0	43.0	1.43	0.497
KPC 4	B14. Do you know the food habits of and preference of the customers?	76.6	23.4	1.23	0.425
KPC 5	B15. Do you know the age range of the customers?	49.5	50.5	1.50	0.502
KPC 6	B16. Do you know the educational level of the customers?	37.4	62.6	1.63	0.486
KPC 7	B17. Do you know the socioeconomic status of the customers?	39.3	60.7	1.61	0.491
KPC 8	B18. Do you know the level of physical activities the patrons engage in?	41.1	58.9	1.59	0.494
KPC 9	B19. Do you know the religion of the most customers?	43.0	57.0	1.57	0.497

Note: Y=yes, N=no, M=mean, STD=standard deviation.

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The results showed that only 66.4 percent of food handlers indicated to know the estimated number of customers that would be served per day, the rest of the food handlers (33.6%) did not know. The majority (57.0%) of respondents indicated that they know the gender distribution of customers and 43.0 percent did not know. While 76.6 percent had knowledge of food habits and preferences of the customers, only 23.4 percent did not know. Half (49.5%) of respondents had knowledge of the age range of the customer and 50.5 percent did not know. Only 37.4 percent of food handlers had knowledge about the educational level of the customers, most of food handlers did not know (62.6%), whereas 39.3 percent had knowledge about the socioeconomic status of the customers and the rest (60.7%) had no knowledge. Regarding the knowledge of the level of physical activities that the patrons/ customers engage in, 41.1 percent had knowledge and 58.9 percent of food handlers did not know. The results of knowing the customers' religion showed 43.0 percent with affirming response and 57.0 percent did not affirm. The standard deviation distribution from the mean is also presented and indicates the distribution of food handlers' responses regarding the knowledge about profiles of the customers. The majority of the dimensions are reliable as STD are clustered around the mean with exception of only one question of the knowledge on estimated number of customers per day.

The results suggest that to a larger extent, the food handlers have limited or insufficient knowledge on the customer's profiles, which indicates that customer needs, preferences and buying power may not be known, which may pose a bigger contribution to food waste. Dhir, Talwar, Kaur and Malibari (2020:7) findings discovered that the demographic customers' profiles such as age, gender, cultural and geographic location differences were found to be associated with the causes and prevention of food waste regarding food consumption patterns. Visschers, Wickli and Siegrist (2016:75) findings confirmed that older consumers usually eat different food compared to younger consumers. Sometimes elderly consumers tend to restrict food intake because of health and financial reasons. This may be attributed to health considerations in food consumption that are particularly related to a certain age group's food intake and dietary guidelines, such as youngsters consider eating healthy food because of peer pressure and adolescent self-confidence

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Thus, an understanding of the customers' profile is vital as it will enable food handlers to prepare meals that are suitable for customer preferences, which also reduces food waste.

Regarding the knowledge about the education level of the customers, Secondi, Principato and Laureti (2015) findings revealed that people with lower education are perceived to have lower income levels and there is a link of this category of consumers to specific personal values that are subsequently assigned to food consumption pattens. Furthermore, Drouillet-Pinard, Dubuisson, Bordes, Margaritis, Lioret and Volatier (2016:873) state that lower socioeconomic status is associated with high starchy foods consumption and lower consumption of fruits when compared to high socioeconomic status.

Lastly, Elshaer, Sobaih, Alyahya and Elnasr (2021:12) proved that knowledge about the consumers' religion has an impact on dietary habits and food waste generation, such as circumstances where each culture has its own habits about which parts of food are considered edible and which parts are thrown away. Food traditions on the ways used to produce, prepare and consume food are tied to such cultural and religious distinctions (Nemeth, Rudnak, Ymeri & Fogarassy 2019:27).

The results of the inter-item correlation matrix on the knowledge about the profile of the customer are presented in Table 4.4. Inter-item correlation values between 0.15 to 0.50 depict a good result. Lower than 0.15 means items are not correlated well. Values higher than 0.50 mean that items are correlated to a greater extent and the items may be repetitive in measuring the intended construct. The results reveal that question KPC1, *who are your major customers*, only correlated with question KPC2, *do you know estimated number of customers per day*, in this dimension. The remaining questions did not correlate well with question KPC1, *who are your major customers,* as each question reported lower than 0.15.

Table 4.4 Inter-Item Correlation Matrix on the knowledge about the profile of the customer

	KPC1	KPC2	KPC3	KPC4	KPC5	KPC6	KPC7	KPC8	KPC9
KPC1	1.000	.398	-.112	-.177	-.245	-.326	-.327	-.252	-.225
KPC2	.398	1.000	.059	.253	-.033	.022	.035	.008	.021
KPC3	-.112	.059	1.000	.457	.596	.593	.621	.687	.678
KPC4	-.177	.253	.457	1.000	.503	.381	.444	.461	.390
KPC5	-.245	-.033	.596	.503	1.000	.741	.658	.806	.688
KPC6	-.326	.022	.593	.381	.741	1.000	.882	.846	.773
KPC7	-.327	.035	.621	.444	.658	.882	1.000	.845	.848
KPC8	-.252	.008	.687	.461	.806	.846	.845	1.000	.809
KPC9	-.225	.021	.678	.390	.688	.773	.848	.809	1.000

Question KPC 2, *do you know estimated number of customers per day*, correlated with two questions out of the nine presented in the dimension of knowledge about the profile of the customer, namely KPC1, *who are your major customers* (0.398) and KPC 4, *do you know the food habits of and preference of the customers* (0.253). The majority of the question KPC5 (-0.33), KPC6 (0.022), KPC7(0.035), KPC8 (0.008) and KPC9 (0.021) were not correlated to question KPC2, reporting a value less than 0.15. Only question KPC 4, *do you know the food habits and preference of the customers*, correlated well with all the questions, except for question KPC1 *who are your major customers*. These are good results for this question. However, the total results for this dimension reflect an inter-item correlation matrix higher than 0.50, which means they are correlated to a greater extent and the items may be repetitive.

4.2.1.3 Knowledge about food waste

The knowledge about food waste section in the questionnaire was divided into three sections, namely general knowledge, food storage and food preparation, which will be presented in the following section.

4.2.1.3.1 General knowledge

General knowledge about food waste was the first part of the questionnaire and it showed good knowledge from the respondents (see Table 4.5). The correct response to all the questions in this section was a summed response of the answers strongly agree and agree. The results indicated that amongst the 107 respondents, 86.2 percent (on average) had a good level of general knowledge on food waste. On the other hand, a minimal number of food handlers (13.8% on average) were reported as lacking general knowledge on food waste as indicated by the negative response (NS=not sure, D=Disagree and SD=strongly disagree). The standard deviation dispersion scores indicate the distribution of food handlers' responses from the mean is low, indicating that the data are clustered around the mean.

Table 4.5 General knowledge about food waste (*n*=107 in %)

GK	ITEM	SA	A	NS	D	SD	M	STD
GK 1	B21. Food waste has environmental damages	47.7	40.2	12.1	0.0	0.0	1.64	.690
GK 2	B22. I know food waste affect the economy.	48.6	38.3	13.1	0.0	0.0	1.64	.704
GK 3	B23. Food waste has food security implications.	48.6	38.3	13.1	0.0	0.0	1.69	.745
GK 4	B24. Being environmentally conscious is part of my daily life.	61.7	32.7	5.6	0.0	0.0	1.44	.602
GK 5	B25. I am aware that reducing food waste could be a solution to waste management problems.	48.6	38.3	13.1	0.0	0.0	1.45	.676
GK 6	B26. I am responsible for preventing food waste.	60.8	29.0	6.5	3.7	0.0	1.53	.781
GK 7	B27. I have been taught/ attended training/ informed about food waste reduction before.	44.0	29.0	6.5	20.5	0.0	2.07	1.187
GK 8	B28. Careful menu planning contributes towards preventing food waste.	61.7	22.4	15.9	0.0	0.0	1.57	.790

Note: SA=strongly agree, A=agree, NS=not sure, D= disagree SD=strongly disagree, M=mean,
        STD=standard deviation.

Only 47.7 percent strongly agreed that food waste has environmental damages (GK1), 40.2 percent agreed and 12.1 percent were not sure. 48.6 percent strongly agreed to know food waste affects the economy (GK2), followed by 38.3 percent who agreed and only 13.1 percent were not sure. For the question GK3, food handlers strongly agreed (48.6%) that food waste has food security implications, 38.3 percent agreed and the rest (13.1%) were not sure. It was clear that some of the food handlers were

not sure (5.6%) that being environmentally conscious is part of their daily life (GK4), however, 61.7 percent strongly agreed and 32.7 percent agreed. 48.6 percent food handlers strongly agreed that they are aware that reducing food waste could be a solution to waste management problems (GK5), 38.3 percent agreed and 13.1 percent were not sure. Regarding being responsible for preventing food waste (GK6), the majority (60.8%) strongly agreed, 29.0 percent agreed, 6.5 percent were not sure and 3.7 percent disagreed. 44.0 percent strongly agreed to have been taught/ attended training/ informed about food waste reduction before (GK7), 29.0 percent agreed, 6.5 percent were not sure and 20.6 percent disagreed. Lastly, 61.7 percent strongly agreed that careful menu planning contributes towards preventing food waste, 22.4 percent agreed and the rest (15.9%) were not sure.

Results from the study conducted by Lins, Zandonadi, Rapose and Ginani (2021:10) indicated that it is vital to identify influential aspects of the environment, society and economy around food waste to be able to control the impacts, therefore, food handlers should have sufficient knowledge about food waste's impact on the environment, its effect on the economy and food security implications. Being aware that reducing food waste could be a solution and being responsible for preventing food waste were associated with Wakefield and Axon (2020:6) findings that individuals are aware of the need for sustainable waste management but are unable to act upon their concerns due to a lack of education, skills and knowledge in how to carry out sustainable practices.

The results of the inter-item correlation matrix on the respondent's general knowledge about food waste are presented in Table 4.6. GK1 question, *food waste has environmental damages*, correlated well in the same dimension with questions GK4 (0.470), *being environmentally conscious is part of my daily life*, question GK6 (0.477) *I am responsible for preventing food waste*, question GK7 (0.516) *I have been taught/ attended training/ informed about food waste reduction before* and question GK8 (0.513) *careful menu planning contributes towards preventing food waste*. The rest of the questions (GK2, *I know food waste affect the economy* GK3, food waste has food security implications, GK5, *I am aware that reducing food waste could be a solution to*

waste management problems) correlated to a greater extent and the items may be repetitive. Question GK2 correlated well with the majority of the questions (GK4, GK5, GK6, GK7 and GK8) except only two questions (GK1 & GK3) where there was a correlation to a greater extent and the items may be repetitive. Only questions GK3, GK5 and GK8 correlated to a greater extent and the items may be repetitive with the majority of the questions. However, questions GK4, GK6, GK7 had good results (between 0.15 -0.50) with the majority of the questions.

Table 4.6 Inter-Item Correlation Matrix on General knowledge about food waste

	GK1	GK2	GK3	GK4	GK5	GK6	GK7	GK8
GK1	1.000	.689	.849	.470	.587	.477	.516	.513
GK2	.689	1.000	.779	.506	.516	.365	.472	.435
GK3	.849	.779	1.000	.579	.596	.447	.581	.622
GK4	.470	.506	.579	1.000	.578	.481	.271	.619
GK5	.587	.516	.596	.578	1.000	.633	.416	.576
GK6	.477	.365	.447	.481	.633	1.000	.303	.558
GK7	.516	.472	.581	.271	.416	.303	1.000	.346
GK8	.513	.435	.622	.619	.576	.558	.346	1.000

4.2.1.3.2 Food storage

From Table 4.7, it is apparent that the food handler's knowledge on food storage was good. The positive response to all the question in this section was a total response of the answers strongly agree and agree. The results indicated that from 107 participants, 90 percent (on average) had good food storage knowledge, which may contribute towards preventing food waste. On average, 10 percent of food handlers indicated poor food storage knowledge as indicated by the incorrect response (NS=not sure, Disagree and SD=strongly disagree). Only the question on food that has reached sell by date received comparatively lower results. The lower results were 4,7 percent food handlers who were not sure, 9.3 percent disagreed and 15.5 percent who strongly disagreed that food that has reached sell by date should be thrown away. The results indicate the confusion of management on food that has reached sell by date. There was a lack of knowledge that sell by date food labelling only tells the store how long

to display the product for sale for inventory management, not meaning that the product is unsafe to consume after that date. Typically, one-third of a product's shelf-life remains after the sell by date. It is a store guideline to ensure that goods still have a reasonable shelf life after sale (Food facts 2019). Neff, Spiker, Rice, Schklair, Greenberg and Leib (2019:123) state that misunderstanding the meaning of food date labels is strongly associated with frequent food discards.

Table 4.7 Food storage (*n*=107 in %)

FS	ITEM	SA	A	NS	D	SD	M	STD
FS 1	B2 9. Improper food storage can cause food cross contamination	63.6	29.0	5.6	1.8	0.0	1.46	0.691
FS 2	B2 10. High risk cooked and raw food stored between $5^{o}C$-$60^{o}C$ can lead to food spoilage	60.7	36.5	1.9	0.9	0.0	1.43	0.585
FS 3	B2 11. Food rotation label is used to mark/ indicate food expiry date before storing	60.7	35.5	3.8	0.0	0.0	1.43	0.568
FS 4	B2 12. First-in, first-out (FIFO) is used to properly rotate stock.	61.7	31.8	5.6	0.9	0.0	1.46	0.648
FS 5	B2 13. Food that has reached sell-by date should be thrown away	35.5	35.0	4.7	9.3	15.5	2.33	1.426

Note: SA=strongly agree, A=agree, NS=not sure, SD=strongly disagree, M=mean, STD=standard deviation.

As presented in Table 4.7, the majority (63.6%) of food handlers strongly agreed that improper food storage can cause cross contamination in food, 29.0 percent agreed, 5.6 percent were not sure and the rest (1.8%) disagreed. The results indicate that, despite the overall good level of knowledge about cross contamination in food storage, there is still, remarkable, a relative proportion of participants who lack knowledge that cross contamination is a major way for bacteria to spread, multiply and contribute to food spoilage if all food storage rules are not adhered to. Fernandes (2018:63) states that cooked or ready-to-eat foods, as well as raw poultry, meat, or seafood, should be stored in separate sections of the refrigerator or freezer in the proper order. All food should be tightly wrapped or covered. To avoid cross contamination, raw meat should be stored below cooked food and dripping liquids of raw uncooked foods in cooked or ready-to-eat foods should be avoided (Atia & Abdelgawad 2018:22; Fernandes

2018:59). Grappsonni, Petreli, Scuri, Mahdi, Sibilio and Amento (2018:65) findings also presented the highest score of food handlers that had cross-contamination knowledge on safe food storage.

Only 0.1 percent disagreed that high risk cooked and raw food stored between 5°C to 60°C can lead to food spoilage, 1.9 percent were not sure, 36.5percent agreed and 60.7percent strongly agreed. The results indicated a good level of knowledge as the majority of participants responded that high-risk cooked and raw food stored between 5°C to 60°C can lead to food spoilage. These results align well with the fact that the majority of respondents (68.2%) indicated that they have been sent for theoretical training by the employer, hence, they had a good knowledge on cooked and raw food stored temperatures. The findings are contrary to Faour-Klingbeil, Kuri and Todd (2015:169) findings, whose study indicated that almost half (57.5%) of respondents did not know what the danger zone implies nor the range of temperature that is considered optimum for bacterial multiplication. However, the significant difference between trained and untrained groups was evident in this specific area as more than two-thirds of trained food handlers reported that they knew what the danger zone was. Therefore, food handlers training is essential to ensure correct food temperature knowledge and to avoid food spoilage that contributes to food waste.

Regarding the food rotation label that is used to mark or indicate food expiry dates before storing, the majority (60.7%) strongly agreed, 35.5 percent agreed and 3.8 percent were not sure on the usage of labels in food storages. The majority of participants' answers were correct, although the results imply that there is a small group of food handlers that lacked knowledge about the importance of food rotation label usage to ensure that food and ingredients are used within the acceptable period to avoid food discards and to ensure food safety. The findings are similar to what Calvo-Porral, Medin and Losada-Lopez (2017:57) who stated that there is confusion on food date labelling.

Concerning that first-in, first-out (FIFO) is used to properly rotate stock, 61.7% strongly agreed, 31.8 percent agreed, 5.6 percent were not sure and the rest (0.9%) disagreed.

The results indicate that participants had good level of knowledge about the FIFO principle, which ensures a proper stock rotation system, maximises food freshness and minimises food waste. However, there was still a small group of participants who lacked knowledge about the FIFO principle. Hasnan and Ramli (2020:3) research showed that when food items were not labelled to indicate the stock rotation in food storages the FIFO process can be compromised. The findings align with the results on the lack of knowledge on food storage labels presented in Table 4.7. The results confirmed that the use of food storage labelling and FIFO principle goes hand in hand to control stock rotation. A frequently used procedure to reduce food waste is to tag and mark food that has almost reached its expiration date. This is done by applying the FIFO principle where food with the shortest expiration date is placed in the front of the shelves (Narvanen, Mesiranta, Mattila & Heikkinen 2019:97). Applying the FIFO principle helps to save food quality characteristics and to avoid food waste (Khan, Goyal & Kalne 2019:271). The majority of the standard deviation variations from the mean were low, indicating that the data are clustered around the mean.

This following section present the results of the inter-item correlation matrix on the participants' knowledge on food storage, as presented in Table 4.8. FS1, *Improper food storage can cause food cross contamination*, indicated that there was a correlation to a greater extent and the items may be repetitive with all the questions on the same dimension, namely: FS2 *High risk cooked and raw food stored between 5^oC-60^oC can lead to food spoilage* (0.793), FS3 *Food rotation label is used to mark/ indicate food expiry date before storing (*0.840), FS4 *First-in* (0.560)*, first-out (FIFO) is used to properly rotate stock* except FS5 question *Food that has reached sell-by date should be thrown away*. The scores of 0.015 and lower for FS5 question (-0.230,0.204, -0.268 and -0.204) indicated that there was no correlation with all the questions.

Table 4.8 Inter-Item correlation matrix for knowledge on food storage

	FS1	FS2	FS3	FS4	FS5
FS1	1.000	.793	.840	.560	-.230
FS2	.793	1.000	.802	.546	-.204
FS3	.840	.802	1.000	.741	-.268
FS4	.560	.546	.741	1.000	-.204
FS5	-.230	-.204	-.268	-.204	1.000

4.2.1.3.3 Food preparation

The results presented in Table 4.9 indicate food handler's self-reported knowledge about proper food preparation. A scale of never (N), sometime (S) and always (A) was used to measure their knowledge. Three levels were considered for this: scores of 40 percent or less were classified as poor knowledge, 40-60 percent as moderate knowledge and above 60 percent was considered as good knowledge as per the responses to the questions.

Table 4.9 Food preparation (*n*=107)

FP	ITEM	N	S	A	M	STD
FP 1	B2 14.I peel all vegetables skin before cooking.	0.9	64.5	34.6	2.34	0.494
FP 2	B2 15. I boil all vegetable as a cooking method	0.9	69.2	29.9	2.29	0.476
FP 3	B2 16. I know the estimated number of customers when preparing food	15.9	43.0	41.1	2.25	0.715
FP 4	B2 17. I use the leftover quality food for the preparation of other meals	60.7	31.8	7.5	1.47	0.634
FP 5	B2 18. I display piles of food in the food display to attract customers	60.7	31.8	7.5	1.76	0.787
FP 6	B2 19. I use food garnishes e.g. with parsley for food presentation	27.1	57.9	15.0	1.88	0.640
FP 7	B2 20. I use/ follow standardised recipe when preparing food	15.9	10.3	73.8	2.58	.753

Note: N=never, S=sometimes, A=always, M=mean, STD=standard deviation

In food preparation, 64.5 percent of food handlers indicated that they sometimes peel all vegetable skin before cooking, 34.6 percent always peel all vegetable skin and 0.9 percent never peel all the skin. The results reflected a good level of knowledge regarding the appropriate methods of food preparation to minimise food waste. However, there is still food waste generated in the food preparation stage since a remarkable group of participants had a lack of knowledge about food preparation methods that reduce food waste. Food preparation results by Papargyropoulou *et al.* (2019:8) revealed that high preparation waste (15 – 55%) generated by the foodservice units was due to high aesthetic standards (e.g. shaping a whole watermelon into a flower for buffet decoration), poor preparation methods (discarded watermelon skin with a lot of the ripe, red edible part of the fruit still on the skin). Heikkila *et al.* (2016:449) findings indicate that the management has a significant effect on deciding on the amounts of food to be prepared, the results indicated that mistakes in recipes and preparing excess amounts of food leads to kitchen waste. Prescott, Bunning and Cunningham (2019:1273) also discovered that the most common reasons for food disposal, were from food trimmings and overproduction.

Whereas 0.9 percent of food handlers indicated that they never boil all vegetables as a cooking method, 69.2 percent sometimes boil all vegetables and the rest (29.9%) always boil vegetables. The majority of participants indicated a good level of knowledge about proper cooking methods. The results implied that there are participants who understand the appropriate cooking methods according to different types of foods. The lack of food handlers cooking skills can affect customers' satisfaction and leading to lower turnover. Pearson and Perera (2018:49) indicated that suboptimal cooking skills resulting in bad tasting food led to food being wasted. The findings by Filimonau, Nghiem and Wang (2021:9) concerning the cooking methods results revealed that some cooking methods lead to food waste and recommended the important role of chefs in minimising kitchen wastage by adopting less wasteful cooking practices and exploring different cooking techniques.

The results also reflected the loss of resources (electricity/ gas and water) and resources such as water and ingredients wasted when boiling vegetables instead of

steaming or roasting, which is faster and requires a minimal amount of water and energy than boiling cooking method. Hennchen (2019:679) further states that the knowledge of cooking methods and techniques, as well as food component arrangement, are essential for reducing kitchen waste. Therefore, if an appropriate cooking method is used it may reduce food waste.

Only 15.9 percent of respondents did not know the estimated number of customers when preparing food, 43.0 percent indicated that they sometimes know the estimated number of customers when preparing food and 41.1 percent indicated to always know the estimated number of customers when preparing food. Participants had a moderate level of knowledge in knowing the number of customers when preparing food. The results implied that there is either less or too much food prepared daily, as the majority of food handlers indicated to sometimes or never knowing the number of customers when preparing food. The results link to the results found by question KCP2 under customer profile that 33.6 percent of food handlers lacked knowledge on the estimated number of customers that would be served per day. The results indicated a poor level of knowledge about knowing the number of customers when preparing food, which contributes to food waste. These results relate with the findings of Pearson and Perera (2018:49) expressing inadequate planning around the amount of food prepared and an inaccurate estimate of customers when preparing food led to more food being wasted.

On the statement *I use the leftover quality food for the preparation of other meals,* the majority (60.7%) of respondents' answers showed that they had never used leftover quality food for the preparation of other meals, 7.5 percent indicated to always use leftover quality food for the preparation of other meals and 31.8 percent indicated to had never used the leftover quality food. Given that the majority of food handlers attested to never use leftover quality food for the preparation of other meals, the result implied that there is no repurpose of leftover quality food into new meals, which means fresh food is discarded even if it is fit to be eaten. This is contrary to Hennchen's (2019:679) findings where food handlers indicated to have good knowledge on what can be made from leftovers. The findings implied that there is an inability to prepare

other meals from excess food or ingredients that cannot be sold such as tomato paste from older tomatoes. The findings further highlighted that the sense of responsibility attached to food handlers as food professionals should drive them to see food as a valuable resource and be treated accordingly.

The participants were asked to indicate with always, sometimes or never on the statement *I display piles of food in the food display to attract customers*. 60.7 percent of the respondents indicated to have never displayed piles of food, 32.8 percent display piles of food and 7.5 percent indicated to always display piles of food in the display. Filimonau, Zhang and Wang (2020:8) findings also revealed that food handlers display piles of food to gain aesthetic standards in trying to attract the customers, it was indicated by one of the foodservice managers that people eat with their eyes and they want to see lots of food displayed, even if managers try to be economical by asking food handlers to display less food and replace as they go to reduce food wastage, customers want a lot to choose from. The results implied that it is possible to use small batches of food to refill the food display with fresh food as the amount of food decreases on the display to avoid the risk of plenty of unsold food that ends up being disposed, but there was a significant group of participants who reflected to still contributing to food waste by always or sometimes displaying piles of food in the display to attract customers.

With regards to the use of food garnishes, for example, parsley, only 27.1 percent of the respondents had never used food garnishes for food presentation, 57.9 percent sometimes use food garnishes, which showed a poor level of knowledge and the rest always (15.0%) use garnishes in food presentation. There was a moderate level of knowledge about proper food presentation. The results implied that there is a lack of knowledge regarding proper food presentation as the majority of participants did not understand the importance of using food garnishes. The results also reflect that food handlers have a lack of knowledge that food presentation has an impact to customer satisfaction. Kokaji and Nakatani (2021:7) findings confirmed that food garnishes enhance the appearance of the food, which contributes to the stimulation of the

appetite. Therefore, food garnishes give the customers a good impression of the food quality.

On the statement *I use/ follow a standardised recipe when preparing food*, a small percentage (15.9%) of food handlers showed to have never used/ followed a standardised recipe when preparing food and 10.3 percent sometimes follow a standardised recipe. The majority of respondents (73.8%) indicated to always use/ follow a standardised recipe. Considering that the majority of food handlers indicated good knowledge on the use of a standardised recipe when preparing food, the results implied that there is consistency in food production, which reduces chances of food waste since most of food handlers prepare exactly what is needed to produce the menu by using / following a standardised recipe. Ahmed's (2018:57) results found that the majority of kitchen staff prepare food according to their experience, not a standardised recipe. Therefore, it is important that food handlers prepare food by following a standardised recipe to avoid mistakes that can lead to food waste.

The results of the inter-item correlation matrix on the knowledge on food preparation are presented in Table 4.10.

Table 4.10 Inter-Item correlation matrix for knowledge on food preparation

	FP1	FP2	FP3	FP4	FP5	FP6	FP7
FP1	1.000	.705	-.162	.035	.503	.190	.105
FP2	.705	1.000	-.106	.047	.341	.210	.080
FP3	-.162	-.106	1.000	-.346	-.292	.026	.024
FP4	.035	.047	-.346	1.000	.343	.002	.040
FP5	.503	.341	-.292	.343	1.000	.053	.192
FP6	.190	.210	.026	.002	.053	1.000	.030
FP7	.105	.080	.024	.040	.192	.030	1.000

The results reveal that question FP1, I peel all vegetables skin before cooking, correlated to a greater extent and the items may be repetitive with one question FP2 I boil all vegetable as a cooking method. The majority of questions (FP5, I display piles of food in the food display to attract customers, FP6 I use food garnishes e.g. with

parsley for food presentation, FP7 I use / follow standardised recipe when preparing food) correlated well with question FP1 as each question reported values between 0.15-0.50, which indicated good results. However, there were two questions (FP3 I know the estimated number of customers when preparing food and FP4 I use the leftover quality food for the preparation of other meals), which did not correlate well with question FP1.

Question FP2 correlated well with questions KF5 (0.341) and KF6 (0.210) and did not correlate well with questions KP3 (-0.106) and KP4 (0.047) on the same dimension. Question FP2 also correlated to a greater extent and the items may be repetitive with question FP7 (0.080). Question FP3 correlated to a greater extent and the items may be repetitive with questions FP2 (-0.106), FP4 (-0.346), FP5(-0.292) and did not correlate well with questions FP1 (-0.162), FP6 (0.026) and FP7 (0.024) on the same dimension. Question FP5 did not correlate well with question FP4 (0.343) and correlated well with questions FP1 (0.503), FP3(0.341) and FP4 (0.343). However, did not correlated to a greater extent and the items may be repetitive with questions FP3 (-0.292) and FP7 (0.192). Question FP6 had good results by correlating well with questions FP1 (0.190), FP2 (0.210), FP7(0.030), but did not correlate well with questions FP3 (0.026), FP4 (0.002) and FP5 (0.053).

The summary of the results of Section B of the questionnaire, namely food handlers' level of knowledge about the profile of the customers (Section B1) and knowledge about food waste (Section B2) is presented. In Section B1, it was revealed that there was a moderate level of knowledge on the importance of knowing the profile of the customers as a factor that may contribute towards preventing food waste. On average, 47.2 percent of participants had good knowledge about profiles of the customers, but the majority (52.8%) had poor knowledge.

The knowledge about food waste (Section B) was divided into general knowledge, food storage and food preparation. It was discovered that the majority of respondents had a good level of knowledge (86.2%) on food waste and 13.8 percent had poor general knowledge on food waste. On average, 37.6 percent had good knowledge on

food waste generated in the food preparation stage and 62.4 percent lacked knowledge, which indicated a poor level of knowledge. Lastly, in the food storage section, 90 percent (on average) had good food storage knowledge and 10 percent of indicated poor food storage knowledge.

The results on green practices on food waste are presented and discussed in the next section.

4.2.1.4 Green practices on food waste

Becoming green or going green has become a popular catchphrase in a variety of industries around the world (Mohamed, Zohry, Mohamed & Elsaied 2018:133). Green practices are those used by organisations to reduce their carbon footprint and harm to the environment, such as excessive resource use and ineffective recycling processes. Therefore, it was vital to determine food handlers' knowledge regarding green practices in food waste reduction.

The practices on food waste were part of Section C of the questionnaire, which was divided into four sections, namely green practices knowledge, waste separation, managing food waste and types of food waste produced by the supermarket kitchens, which will be presented in this section.

4.2.1.4.1 Knowledge about green practices

Table 4.11 presents food handlers' knowledge about green practices. To measure the level of knowledge, a scale of yes and no or not sure was used. Three levels were considered for this: scores 40 percent or less were classified as poor knowledge, 40-60 percent as moderate knowledge and above 60 percent were considered as good knowledge. In this section, 51 percent of food handlers had good knowledge about green practices and 49 percent showed poor knowledge. Therefore, there was moderate level of knowledge about green practices overall. There was a narrow distribution of the standard deviation scores from the mean as indicated in the table

below. This implies that the variation of food handlers' responses regarding green practices knowledge was low.

Table 4.11 Knowledge about green practices (n=107 in %)

GPK	ITEM	Y	N	NS	M	SD
GPK 1	C1. I am well informed about green practices/ eco-friendly practices	57.0	10.3	32.7	1.76	0.920
GPK 2	C2. I know about food waste recycling methods	48.6	21.5	29.9	1.81	0.870
GPK 3	C3. I don't think green practices can prevent/ reduce food waste	34.6	28.0	37.4	2.03	0.852
GPK 4	C4. I need training about green practices on food waste	78.5	6.5	15.0	1.36	0.732
GPK 5	C5. I am confident that my company have initiated green practices on food waste to protect the environment.	43.0	25.2	31.8	1.89	0.861

Note: Y=yes, N=no, NS=not sure, M=mean, SD=standard deviation.

As indicated in Table 4.11, 57.0 percent were well informed about green practices/ eco-friendly practices, 10.3 percent were not informed and 32.7 percent were not sure. The results indicated that only almost half of the participants were well informed about green practices/ eco-friendly practices, which indicated moderate level of knowledge. This implied that there are limited measures in place to promote sustainability practice. However, Jauhari (2014:319) stated that failing to implement kitchen sustainability practices in foodservice units indicates the lack of commitment in preserving sustainable resources such as water, energy and food. Recycling and composting of organic food scraps are also part of the environmentally friendly practices, which cannot be possible if waste separation at source is not implemented in foodservice kitchens. Therefore, food handlers' knowledge regarding green practices is essential for the staff to act more responsibly and reduce the waste of resources.

Carino, Collins, Malekpour and Poter (2021:156) study indicated that the food handlers had a lack of knowledge on sustainable food waste practices, knowledge on basic recycling principles in food was reliant on their personal knowledge and views. Dedicated environmental sustainability personnel were seen as a valuable source of

bringing together sustainability teams. For example, participants believed in the importance of recycling and felt confident in recycling due to the training they had received. Therefore, education and training were recognised as enabling factors for sustainable practices.

With regards to food waste recycling methods, for the statement *I know about food waste recycling methods*, 48.6 percent of the respondents indicated to know about food waste recycling methods, 21.5 percent did not know and 29.9 percent were not sure. There was a moderate level of knowledge about food waste recycling methods. The results implied that there is lack of knowledge about food waste recycling and methods used towards waste recycling are not in place or not effective in supermarket kitchens. This linked with the findings on the knowledge about green practices, which indicated only 57.0 percent of food handlers were informed about green practices. A study by Michalec, Fodor, Hayes and Longurst (2018:2770) also discovered that the lack of knowledge is one of the barriers to food waste recycling for foodservice units. Not many people have the knowledge of what can and cannot be recycled without being taught or attending training. Therefore, food handlers training about food waste recycling has an influence on the amount of food waste produced in foodservice kitchens.

Participants (34.6%) did not think green practices can prevent / reduce food waste, 28.0 percent thought green practices can prevent food waste and the rest (37.4%) were not sure. The participants indicated a poor level of knowledge that green practices can reduce food waste. The results implied that the majority of participants have limited knowledge and understanding that green practices can prevent / reduce food waste. Chan and Hon (2020:182) study found that most participants (60%) had established an environmental program to promote green practices; however, employees' ecological behaviour was influenced by their psychological traits, sense of responsibility and environmental concern.

The majority (78.8%) of participants indicated that they needed training about green practices on food waste, only 6.5 percent did not need training and 15.0 percent were

not sure if they need green practices training. The results imply that the majority of food handlers confirmed that they have a poor level of knowledge about green practices on food waste, hence they indicated that training is need to improve their knowledge. Okumus (2020:300) found that the lack of communication with food handlers on why food waste needs to be reduced, lack of training about procedures and company policies, the challenge of encouraging the cooks to take ownership in controlling food waste and the lack of employee awareness to make sure they are held accountable to do their job properly in order to reduce food waste were the major reasons for and barriers to food waste reduction in foodservice units.

Only 43.0 percent of respondents were confident that the company had initiated green practices on food waste to protect the environment, 25.2 percent were not confident and 31.8 percent were not sure. There was a moderate level of knowledge on sustainable practices in food waste reduction. This implied that there are no or limited green practice initiatives that have been implemented regarding food waste reduction and to protect the environment in supermarket kitchens. Camilleri (2021:9) emphasised the implementation of circular economy initiatives in food service units that link consumers with foodservices. One of the examples is to utilise sharing economy platforms that link customers and food charities with foodservice units. Through economy sharing platforms, foodservice units can donate fresh food surplus to food banks and charities, which is also beneficial to food donors for tax deduction credits if they donate food surplus. Mobile users can purchase surplus food at a discounted price through sharing economy platforms, which also helps to minimise environmental footprint and reduce food waste.

The results of the inter-item correlation matrix on the knowledge on food preparation are presented in Table 4.12. The results indicated that question GPK1 *I am well informed about green practices / eco-friendly practices* correlated well with question GPK5 *I am confident that my company have initiated green practices on food waste to protect the environment* and did not correlate well with the rest of the questions (GPK2 *I know about food waste recycling methods*, GPK3 *I don't think green practices*

can prevent / reduce food waste and GPK4 *I need training about green practices on food waste*) on the same dimension.

Table 4.12 Inter-Item Correlation Matrix for knowledge about green practices

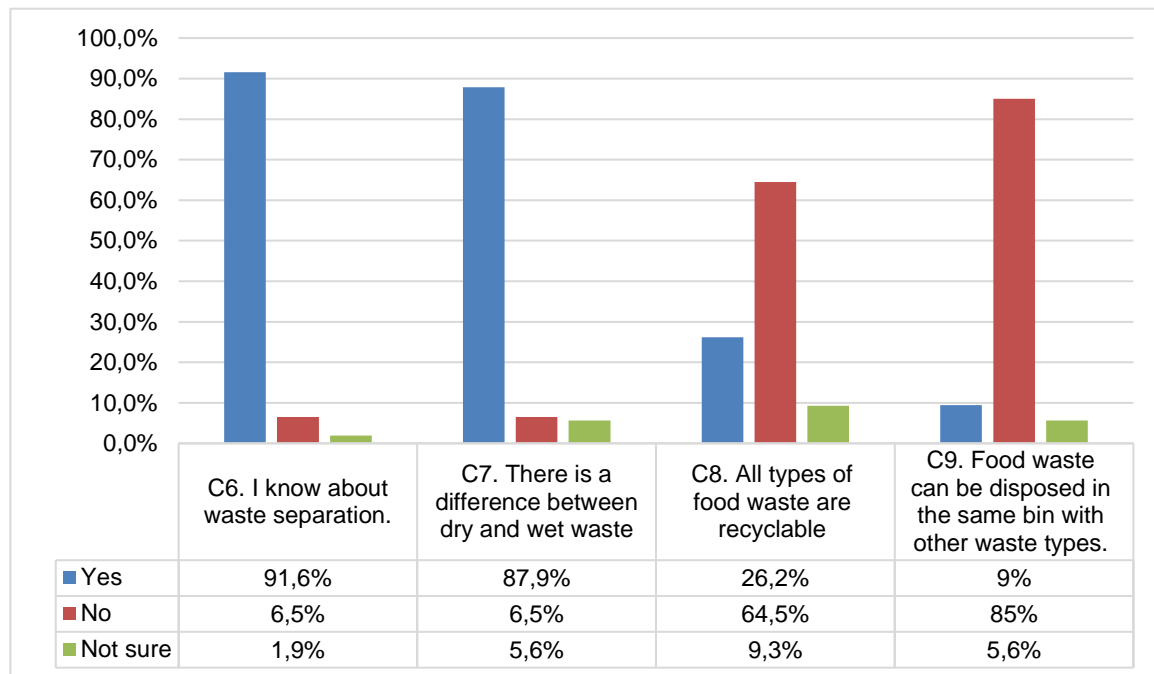|	GPK1	GPK2	GPK3	GPK4	GPK5
GPK1	1.000	.084	.033	.007	.358
GPK2	.084	1.000	.618	.093	.135
GPK3	.033	.618	1.000	-.047	.133
GPK4	.007	.093	-.047	1.000	.036
GPK5	.358	.135	.133	.036	1.000

There was a correlation between question GPK2 with question GPK5 (0.135), correlated to a greater extent and the items may be repetitive with GPK2 (0.618) and no correlation with question GPK1 (0.084) and GPK4 (0.093). Question GPK3 correlated well with question GKP5 (0.133), did not correlate well with question GPK1 0.033) and GPK4 (-0.047) and correlated to a greater extent and the items may be repetitive with question GPK2 (0.618). Question GPK4 did not correlate well with all the questions (GPK1, GPK2, GPK3 and GPK5 *I am confident that my company have initiated green practices on food waste to protect the environment*). Question GPK5 had good correlation with all the questions.

4.2.1.4.2 Knowledge about waste separation

Figure 4.1 presents food handlers' general knowledge about waste separation. To measure the level of knowledge, the scale of yes and no or not sure was used. On

average the results showed a good level of general knowledge about waste separation.

	C6. I know about waste separation.	C7. There is a difference between dry and wet waste	C8. All types of food waste are recyclable	C9. Food waste can be disposed in the same bin with other waste types.
■ Yes	91,6%	87,9%	26,2%	9%
■ No	6,5%	6,5%	64,5%	85%
■ Not sure	1,9%	5,6%	9,3%	5,6%

Figure 4.1   Knowledge about waste separation

Respondents were asked to answer with yes, no or not sure if they know about waste separation. As indicated in Figure 4.1, the majority (91.6%) indicated to know about waste separation, 6.5 percent did not know and 1.9 percent were not sure. There was a good level of knowledge about waste separation. The results implied that food handlers have an understanding of food waste separation at source. The results presented are contrary to Baul, Sarker and Nath (2021:4) findings, which indicated that none of the kitchen staff segregated waste at source, 67 percent had bins with lids and the rest did not have, 76 percent had buckets and 5 percent used plastics to dispose of food waste. The insufficient space of bins to store different categories of waste was one of the reasons behind the unsegregated waste according to the participants. Another reason was the lack of information about waste separation, it was revealed that waste collectors collect all types of waste together and separate if needed.

Most food handlers (87.9%) indicated to know the difference between dry and wet waste, 6.5 percent did not know and the rest (5.6%) were not sure. The results

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indicated a good level of knowledge on the use of different bins to dispose different types of food waste. In contrary to Kaur, Goyal and Saini (2019:68) who found improper segregation of wet and dry waste by food handlers, it was revealed that private daily waste pickers separated dry waste from wet waste and took what they needed on the temporal on-site waste storage, the rest was collected by the municipality.

On the statement *All types of food waste are recyclable*, 26.2 percent responded with yes, 64.5 percent answered with no and 9.3 percent answered not sure. The results indicated a good level of knowledge about recyclable and non-recyclable types of food waste. However, despite the majority indicating a good level of knowledge, there is still confusion and inconsistency on the knowledge about the types of recyclable food waste as there was a group that indicated a lack of knowledge. Michalec *et al.* (2018:2769) also found inconsistent results about food waste recycling, as some participants were involved in recycling programmes, others did not due to the lack of space for bins and a knowledge gap.

On the statement *Food waste can be disposed in the same bin with other waste types*, yes responses scored 9.4 percent, no responses scored 85 percent and not sure responses scored 5.6 percent. The results implied that the majority of participants had a good level of knowledge on the usage of different bins to dispose waste types. The use of different bins makes the separate waste collection become easier without having to waste time sorting waste before it is sent to different waste centres. Vinck, Scheelen and Bois (2019:45) also state that it is important for kitchen staff to make use of different bins according to the waste types so that there is less work for waste collectors from waste collection points.

The results of the inter-item correlation matrix on the knowledge on food preparation are presented in Table 4.13. The results reveal that question GPWS1 *I know about waste separation* correlated well with all the questions GPWS2 (*There is a difference between dry and wet waste)* and GPWS3 (*All types of food waste are recyclable*), which indicated good results. However, it did not correlate well with question GPWS4

(*Food waste can be disposed in the same bin with other waste types*) on the dimension.

Table 4.13 Inter-Item Correlation Matrix for knowledge about waste separation

	GPWS1	GPWS2	GPWS3	GPWS4
GPWS1	1.000	.462	.175	.095
GPWS2	.462	1.000	.360	.130
GPWS3	.175	.360	1.000	.311
GPWS4	.095	.130	.311	1.000

4.2.1.4.3 Managing food waste

The management of food waste results are presented in Figure 4.2. Participants were asked to indicate the method used in supermarkets to manage food waste. As indicated, none of the supermarkets participated in any composting activity to manage food waste. 79.4 percent food waste is disposed in supermarket A, 82.9 percent is disposed in supermarket B and 57.9 percent is disposed in supermarket C. The results implied that the disposal of food waste to the landfills is the commonly used method to manage food waste, which indicated the lack of knowledge about alternative methods of managing food waste. The results link with findings presented in Figure 4.1, which indicated that 25.2 percent participants were not confident and 31. 8 percent were not sure that the company have initiated green practices for food waste reduction and to protect the environment.

The results implied that the implementation of green practices is essential since the recommended method of reducing food waste is through the initiation of green practices within foodservice establishments in order to protect the environment. According to EPA (2020), sending food waste to the landfill should be the last option. Kaur *et al.* (2019:68) findings also indicated that the majority of waste from food services is disposed to the landfills, which is in line with the current study's results. The composting results, as one of the methods to manage food waste, relate to Kasavan, Yusoff, Ali and Masarudin (2021:56) findings where participants admitted

that they understand the concept of food waste composting but lack the knowledge on how to start doing it, hence, none of the biodegradable food waste was composted.
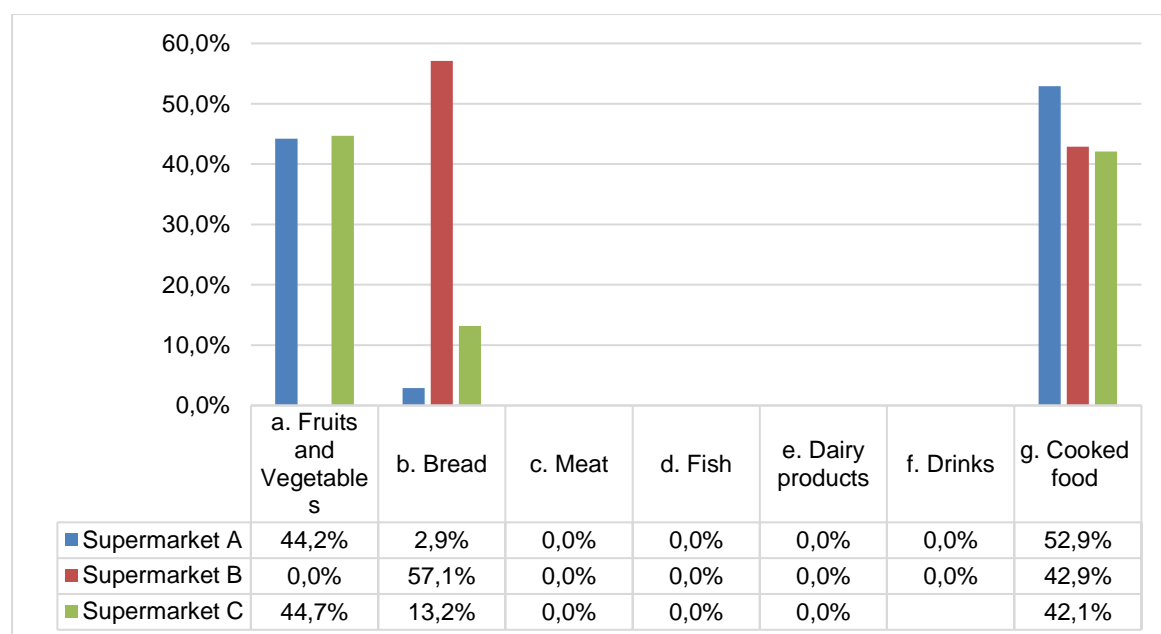
Only 11.8 percent of participants from supermarket A indicated that food is sent to the sharing schemes as a method of managing food waste, supermarket B showed 11.4 percent and supermarket C indicated 31.6 percent. Whereas, 8.8 percent of participants from supermarket A indicated that food is donated to food charities, 5.7 percent from supermarket B and 10.5 percent from supermarket C. The results implied that not much of the food is sent to food charities, hence, the majority of food is sent to the landfills. However, South Africa is challenged by the limited disposal sites, which requires foodservice establishments to utilise alternative methods to manage food waste (NWMS 2019). Furthermore, sending food to charities will not only feed the hungry people but also save the environment. In Sakaguch, Pak and Potts (2018:434) findings, 75 percent of participants indicated that the food safety accountability and law liability uncertainties kept them from donating excess food to charities and food sharing schemes, 79 percent did not have any collaboration with charities to donate surplus food due to limited time for food pickups since food services have leftovers in late evenings or at the end of the shifts.

	C10.Composting	C10. Disposal	C10. Food sharing scheme	C10. Donate to a food charity
Supermarket A	0,0%	79,4%	11,8%	8,8%
Supermarket B	0,0%	82,9%	11,4%	5,7%
Supermarket C	0,0%	57,9%	31,6%	10,5%
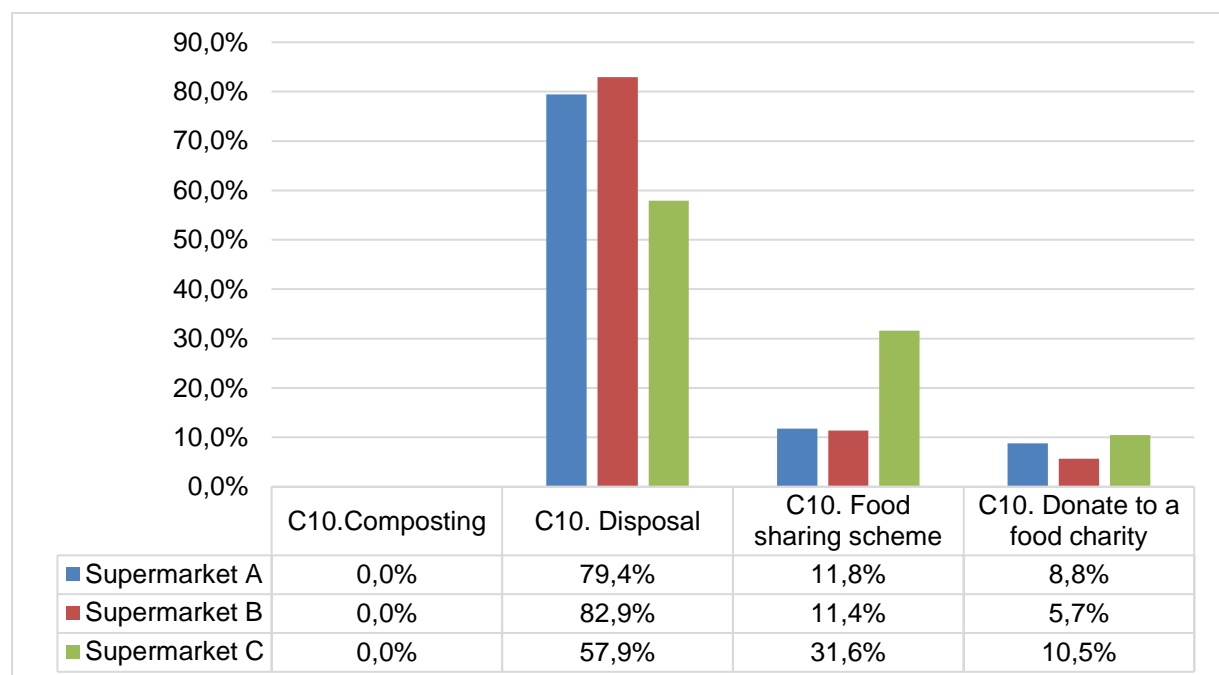
Figure 4.2 Methods used to manage food waste

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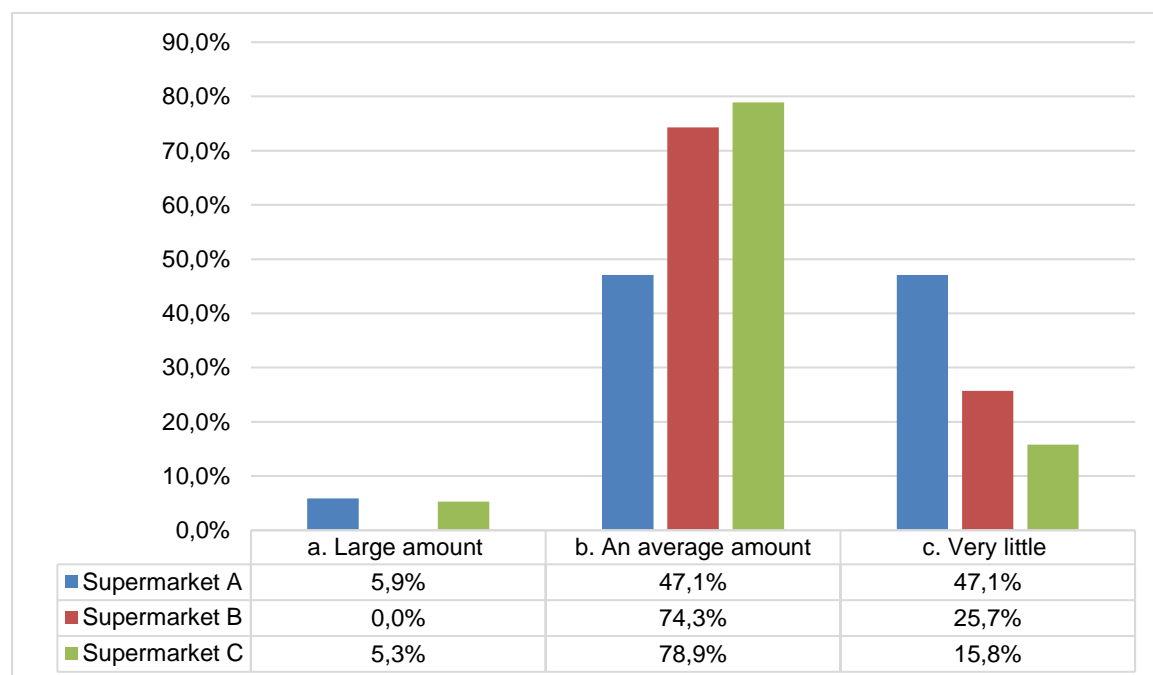## 4.2.1.4.4 Types of food waste in the supermarket kitchens

Participants were asked to indicate food items that were mostly wasted, as indicated in in Figure 4.3. In supermarket A, the majority (52.9%) of waste was from cooked food, followed by fruits and vegetables (44.2%) and bread (2.9%). Whereas, fruits and vegetables were not wasted in supermarket B, instead, bread (57.1%) was the most wasted food item, followed by cooked food (42.9%). Also, fruits and vegetables (44.7%) were mostly wasted food items in supermarket C, followed by cooked food (42.1%) and bread (13.2%). These results imply that forecasting based on the known numbers of customer may be a challenge and also there is no use of leftover foods. These results are linked to the lack of use of the leftover quality food for the preparation of other meals, as reported in Table 4.8. Similar results were found by Cicatiello, Franco, Pancino, Blas and Falasconi (2017:277) on bread (13%) as a most wasted item. A notable amount of fruits and vegetables was wasted, which is in line with the most wasted food items in SA (WWF 2017). Cooked food results were confirmed by Derqui and Fernandez (2017:439) findings who discovered 70 kg of cooked food not served and discarded in one day due to the fact that all types of food needed to be displayed until the end of service time at all display stations. Bread was also found to be a main contributor to food waste.

	a. Fruits and Vegetables	b. Bread	c. Meat	d. Fish	e. Dairy products	f. Drinks	g. Cooked food
Supermarket A	44,2%	2,9%	0,0%	0,0%	0,0%	0,0%	52,9%
Supermarket B	0,0%	57,1%	0,0%	0,0%	0,0%	0,0%	42,9%
Supermarket C	44,7%	13,2%	0,0%	0,0%	0,0%		42,1%

Figure 4.3 Types of food waste wasted most

4.2.1.4.5 The amount of food wasted in the supermarket kitchens

Food handlers were asked to indicate the amount of food waste, whether it was large amount, an average amount or very little. Figure 4.4 indicates that for supermarket A, 47.1 percent of the respondents reported an average and very little amount of food was wasted. Both supermarket B and C had a higher percentage of respondents (74.3% in supermarket B and 78.9 percent in supermarket C) who indicated that average amounts of food are wasted. The score for large amount of food waste was very low; 5.6 percent was indicated by supermarket A and 5.3 percent by supermarket C and with Supermarket B, no respondents indicated large amounts of food as waste. The results imply that although the respondents indicated on average good knowledge in relation to food waste, this indicates that there are factors other than knowledge on food that will need further research, which contribute to the identified food wasted in the supermarket kitchens. The food waste results were similar to Derqui and Fernandez (2017:439) study who found that different food service units indicated different amounts of food wasted, it was also found that there was a very low awareness on the amount of waste produced. Waste measurements and audits were never done in the majority of food services.

	a. Large amount	b. An average amount	c. Very little
Supermarket A	5,9%	47,1%	47,1%
Supermarket B	0,0%	74,3%	25,7%
Supermarket C	5,3%	78,9%	15,8%

Figure 4.4 The amount of food wasted

In summary, this section presented the results about green practice knowledge of food handlers on food waste as part of Section C of the questionnaire, which was divided into five sections, namely green practices knowledge, waste separation, managing food waste, types of food waste and amount of food waste. The results revealed that participants had moderate (45.4%) levels of knowledge about green practices. There was a good level (82.3%) of knowledge on waste separation. The results showed that the disposal of food waste to the landfills is the commonly used method to manage food waste. The majority of food waste was from cooked food, followed by fruits and vegetables in all the supermarkets, which were rated average and very little in quantity.

4.2.1.5 Cronbach's alpha coefficients for food handlers' questionnaire

The results on the reliability (Cronbach's alpha) of food handlers' knowledge questionnaire in Table 4.8 revealed that the questionnaire could be accepted as reliable for only two dimensions. The Cronbach's alpha results are a combined average for the questions within major dimensions measured.

Table 4.14 Cronbach's alpha coefficients for food handlers' questionnaire

Dimension	Cronbach's alpha	Number of items
Knowledge about profile of the customers	0.677	9
General knowledge about food waste	0.833	8
Food storage	0.399	5
Food preparation	0.359	7
Green practices knowledge	0.471	5
Waste separation	0.579	4

The observational results, which report the waste prevention practices of the food handlers as a collective, will be discussed in the next section.

**4.2.2 Section B: Observation results of food handlers' practices on food waste**

The results on the menu planning, menu execution, practices during the distribution of meals, waste management plan, practices during storage and in the inventory control,

food handling practices and working conditions as factors that contribute towards the prevention of food waste are presented in this section.

The presence or absence of the practices or the behaviour clues were indicated by selecting a Yes (1), No (0). When the researcher observed insufficient practices it was noted on the observation checklist and indicated with (0.5). The researcher calculated an average (%) for all the questions in each of the dimensions that was observed.

4.2.2.1 Menu planning

Careful menu planning factors that contribute towards preventing food waste were observed in supermarket kitchens and the results are presented in Figure 4.5.
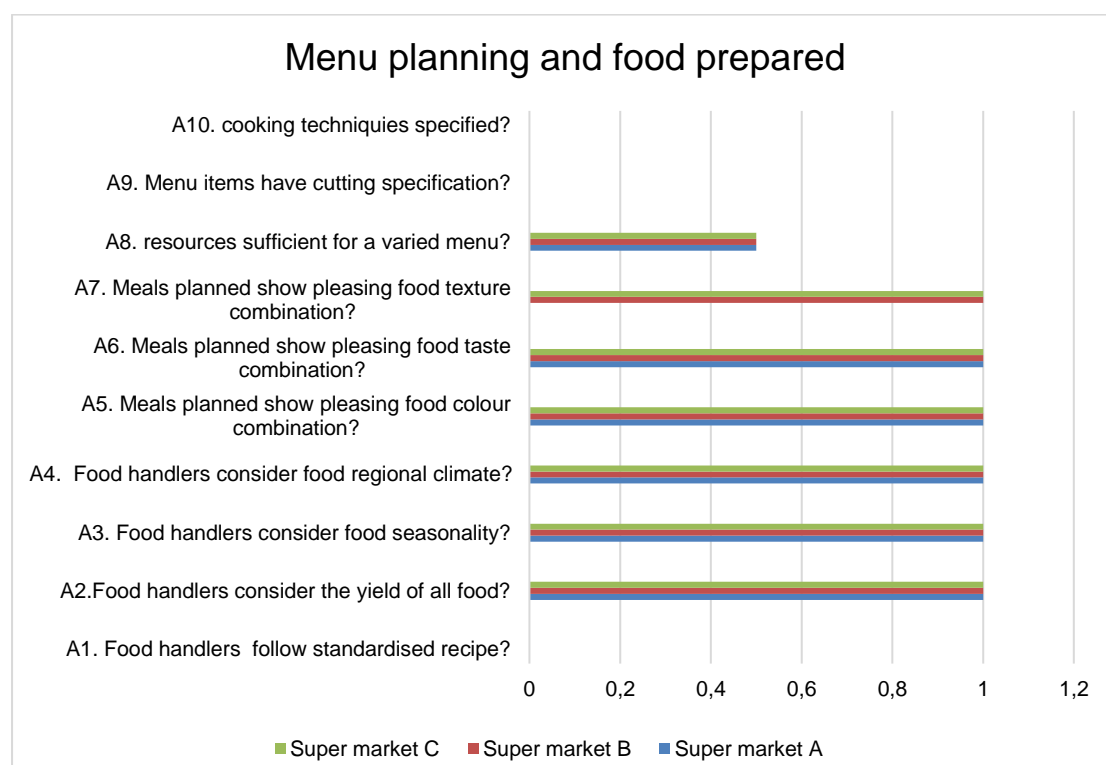
Figure 4.5   Menu planning factors and actions that contribute towards food waste

There were no standardised recipes for any of the items prepared identified for all the supermarket kitchens during the observations, which are 'signs' of behaviours or so-called physical clues found in the environment. Therefore, out of the 10 factors and

actions observed under menu planning in Figure 4.5, 95 percent of these factors were absent owing to the lack of visible written standardised recipes. Only the factor of "*Are the resources sufficient for a varied menu*" 5 percent of these menu planning factors could be observed. The resources for a varied menu were observed to be present but insufficient in all supermarkets. The above results showed incorrect practises by the food handlers in the supermarkets in terms of menu planning.

With the absence of planned menus, the researcher observed menu planning factors on the prepared meals as indicated on Figure 4.5. Nonetheless, the yield of all food, food seasonality and food regional climate factors were taken into account in the observed prepared meals. Meals showed pleasing colour and taste combinations for all the supermarkets. However, two out of the three observed supermarkets served meals with pleasing food texture combinations and only supermarket A served food that did not show correct texture combinations. On average, 56.67 percent of the factors and actions that were observed on food handler's practices were correct and 43.3 percent were lacking during food production in the kitchen.

Therefore, the results for the three supermarkets implied that lack of guidelines such as the availability of a standardised recipe in menu planning can negatively influence the execution of the menu, which that can lead to food waste. The absence of standardised menu findings aligns with the lack of customer profile knowledge findings presented in Table 4.3. Also, the lack of food texture combinations as one of the food quality elements influences customer satisfaction and can contribute to food waste. The absence of texture in preparation of meals by the food handlers in supermarket A is also visible in the results of types of food wasted and amount of food wasted (figures 4.3 and 4.4 respectively). This was attested by Derqui *et al.* (2017:439) findings that menu planning is closely related to food waste. This was identified after customers complained about the quality of the food offered. One of the reasons was the lack of food variety offered and failing to include customers' preferences. Since the researcher did not observe any standarised recipes or menus planned no cooking techniques were specified and there were no menu cutting specifications. Hence figure 4.5 does not show results.

4.2.2.2 Menu execution

Figure 4.6 provides the factors and actions that were observed regarding careful menu execution as it contributes towards preventing food waste. The researcher observed that the storage clerks were complying with the food item quantities ordered by the kitchen staff across the three supermarkets. The kitchen scale was used to weigh ingredients and food was prepared in separate sections for all three supermarket kitchens.
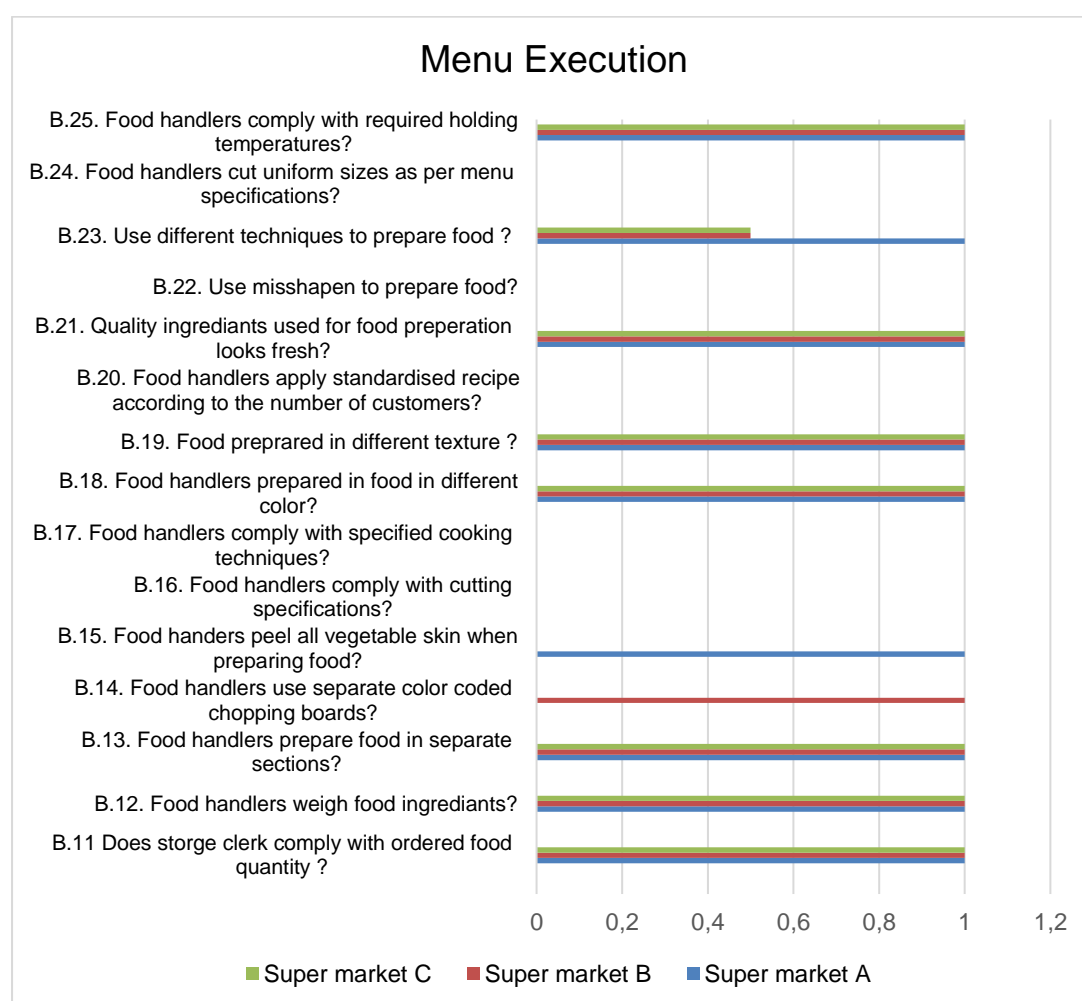
Figure 4.6   Menu execution factors and actions that contribute towards food waste

The researcher observed that food handlers in two supermarket kitchens (A and C) did not correctly use colour-coded chopping boards and the food handlers in

Supermarket B were the only one who used them correctly, despite the fact that colour-coded cutting boards such as 1 – blue (raw seafood), 2 – green-coded (raw fruits and vegetables), 3 – yellow (raw poultry), 4 – red (red meat), 5 – brown (cooked food)) were introduced to avoid cross contamination and to avoid confusion (Starovoytova 2019:55). Geppert, Struchtrup, Stamminger, Haarhoft, Ebert, Koch, Lohman and Bol (2019:208) findings also revealed that chefs were observed reusing cutting boards for food processing or as table mats without washing them in between. There was improper use of different chopping boards for different foods in the majority of the supermarket kitchens, which can lead to food contamination and contribute to food spoilage and waste; customer's health is also at risk from contaminated food as previously mentioned in chapter 2. Therefore, it is important to adhere to all food safe handling procedures in menu execution in order to reduce food waste.

Only food handlers in supermarket A were peeling all vegetable skins when preparing food while the food handlers in supermarket B and C had good practice in terms of vegetable preparation for cooking. No specifications were followed to cut the fruits, vegetables and meat or to follow cooking techniques since there was no standardised recipe identified in all supermarkets. The unavailability of the visible written standardised recipes made it impossible to see the number of food portions prepared for potential customers. The results implied that the unavailability of a standardised recipe, as one of the elements of menu execution, which can also serve as a guide on food preparation, may contribute to food waste in supermarket kitchens. Oliveira, De Moura and Cunha (2016:126) confirmed that the use of standardised recipes helps to reduce the amount of food waste as it provides consistent and accurate information since the same ingredients and quantities per serving are used each time the recipe is produced. Additionally, peeling all vegetable skins when preparing food implied the lack of food preparation skills of food handlers as the important skills needed in menu execution, which can be one of the causes of food waste as Okumus (2020:303) stated that food preparation is one of the most crucial stages of food waste.

Food handlers in the three supermarket kitchens prepared a variety of food in different colours, however, different texture in food was lacking in all supermarket kitchens.

Good quality of food ingredients was used for food preparation and the ingredients looked fresh and there were no identified misshapen (deformed) fruits and veggies used to prepare food. A variety of techniques were used to prepare food by food handlers in supermarket A, however, the other two supermarket kitchens used limited techniques in food preparation. All food handlers across the three supermarket kitchens observed complied with maintaining the required holding temperature between food preparation and service. The results implied that food attributes are not only limited to taste, ingredients and nutritive values but different textures in food is also one of the factors that influence customer decision to eat the food. Therefore, food that lacks food qualities can contribute to food waste in menu execution, as also indicated by the results of the type of most wasted food across all the kitchens being cooked foods indicated by the majority of the food handlers (Figure 4.3). The study by Kala (2020:445) also found that freshness of ingredients was good in food preparation and food was served at an appropriate temperature but the variety in the menu was poor. Food handlers demonstrated a moderate level on average of menu execution practices as 44.4 percent of the factors and actions that were observed on food handler's practices were correct and 55.6 percent were regarded as incorrect. It was observed that in none of the supermarket kitchens food handlers complied with specified cooking techniques and cutting specifications

4.2.2.3 Practices during the distribution of meals

Factors and actions observed and discussed in Figure 4.7 were on practices of food handlers during food distribution that contribute towards preventing food waste. Holding temperatures in the steam and salad buffets were adhered to by all food handlers in the three supermarkets, as well as the correct use of standardised food service utensils during food distribution of meals. In two of the supermarkets, namely B and C, food displays were piled up with a lot of food; only one supermarket (supermarket A) monitored the level of food displays and refilled with reserved fresh food as they go. The level of service demonstrated by food handlers for all three supermarkets was good as customers were served with agility and speed. Only two of the supermarkets' (B and C) food handlers were observed to use food garnishes for

food presentation, while supermarket A's food handlers did not make use of food garnishes. Therefore, overall food display looked attractive for the two supermarket (B and C) and supermarket A's overall food display did not look attractive as it was lacking food garnishes. Smith, White-McNeil and Ali (2020:24) findings also confirm that serving food at the correct temperature, good food taste, serving fresh food, healthy food and the overall appearance of food, has a significant impact on quality food and customer satisfaction. This implies that improper practices during the distribution of meals can contribute to food waste, such as failing to monitor the level of food displayed can result in too much excess food that ends up being discarded and the lack of food garnishes in food presentation can lead to food waste as food would be unappealing to the eyes of customers. Food handlers indicated good levels of practices regarding food waste on practices during the distribution of meals as 83.4% of the factors and actions that were observed on food handler's practices or actions were correct and 16.6% were regarded as incorrect.
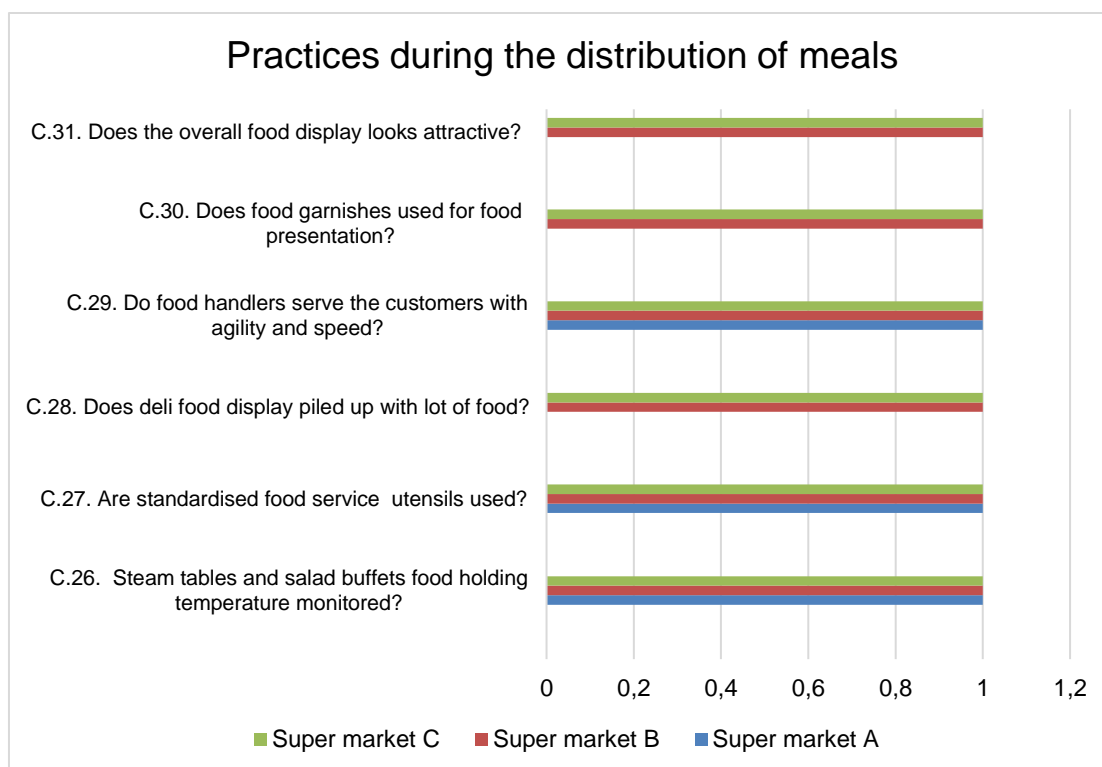
Figure 4.7   Practices during the distribution of meals, factors and actions that contribute towards food waste

4.2.2.4 Waste management plan

Factors that contribute to food waste regarding the waste management plan were observed, as indicated in Figure 4.8. It was observed that food handlers in supermarkets A and B used different bins to dispose different types of waste, only in supermarket C was it observed that the food handlers did not use separate bins. There were no separate bins to dispose organic and non-organic food waste in all supermarket kitchens. In supermarkets A and B, food handlers were observed closing the bin after use and all bins had lids, however, supermarket C did not have lids and used plastics bags and container crates to dispose food waste. The results suggested that there is lack of knowledge on waste separation, which is one of the practices that enables food recycling in waste management. Therefore, the lack of proper waste management planning contributes to food waste. On average, 46.7% of the factors and actions that were observed on food handler's practices or action were correct and 53.3% were lacking on waste management planning in supermarket kitchens.
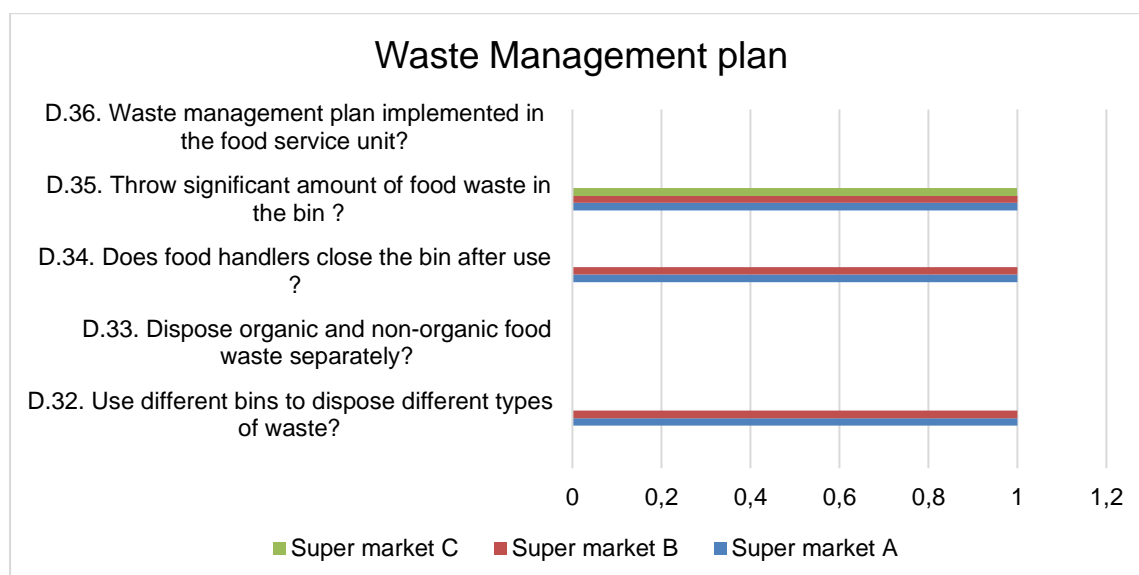
Figure 4.8   Waste management plan, factors and actions that contribute towards food waste

The results further revealed that there was a significant amount of food waste in the bins identified and there seemed to be no waste management plan implemented in all the food service units, as indicated in Figures 4.9 and 4.10. Derqui *et al.* (2017:439)

also found related results where there was very low awareness of the amount of waste produced but after the researcher revealed the results to the participants, the personnel were willing to implement initiatives to manage food waste. Furthermore, Sucheran and Olanrewaju (2021:65) study found that there is a lack of time for food waste management and tracking in food services, lack of financial resources to implement such programs, lack of skills and lack of interest and willingness of employees to change. It was also found that organic food waste management was not practised and no current waste management plan implemented and there was no collaboration with organic waste recycling companies. This is also evident in the current study's findings on the lack of waste sorting and disposal of organic and non-organic food as evident in figure 4.8.

Figure 4.9   The amount of food waste disposed

Figure 4.10   Food waste area

4.2.2.5 Practices during storage and in the inventory control

In Figure 4.11, practices during storage and in the inventory were observed. None of the food items were labelled/dated in the refrigerator by the food handlers in all the supermarket kitchens, however, potentially hazardous foods such as uncooked meat and poultry were observed to be stored separately from other foods in all supermarkets. Food in the refrigerator/freezer in the majority of the supermarkets (B and C supermarket were covered but the shelves in other supermarkets (A) did not allow the air circulation as food handlers stacked too much food in each shelf. No cleaning schedule for the storage areas in any of the kitchens could be identified during the observation. It is possible that food waste can be generated from the storage stage due to failing to adhere to all storage and inventory control rules. The lack of food labelling may contribute to food waste as there can be food spoilage or food reaching the expiry date without being noticed in the storage. Pests and food contamination are the results of improper food storage procedures. Storage and inventory control

findings are similar to Sucheran and Olanrewaju (2021:64) who discovered that the majority (91%) of foodservice units had correct storage control to avoid food spoilage, such as the application of FIFO, ensuring deliveries are well checked and free from contamination, however, some of the supermarket's shelves were overloaded with stock, which does not allow efficient air circulation. The factors and actions that were observed on food handler's practices (41.7%) were correct and the majority (53.3%) of practices were lacking on the storage and in the inventory control regarding food waste.
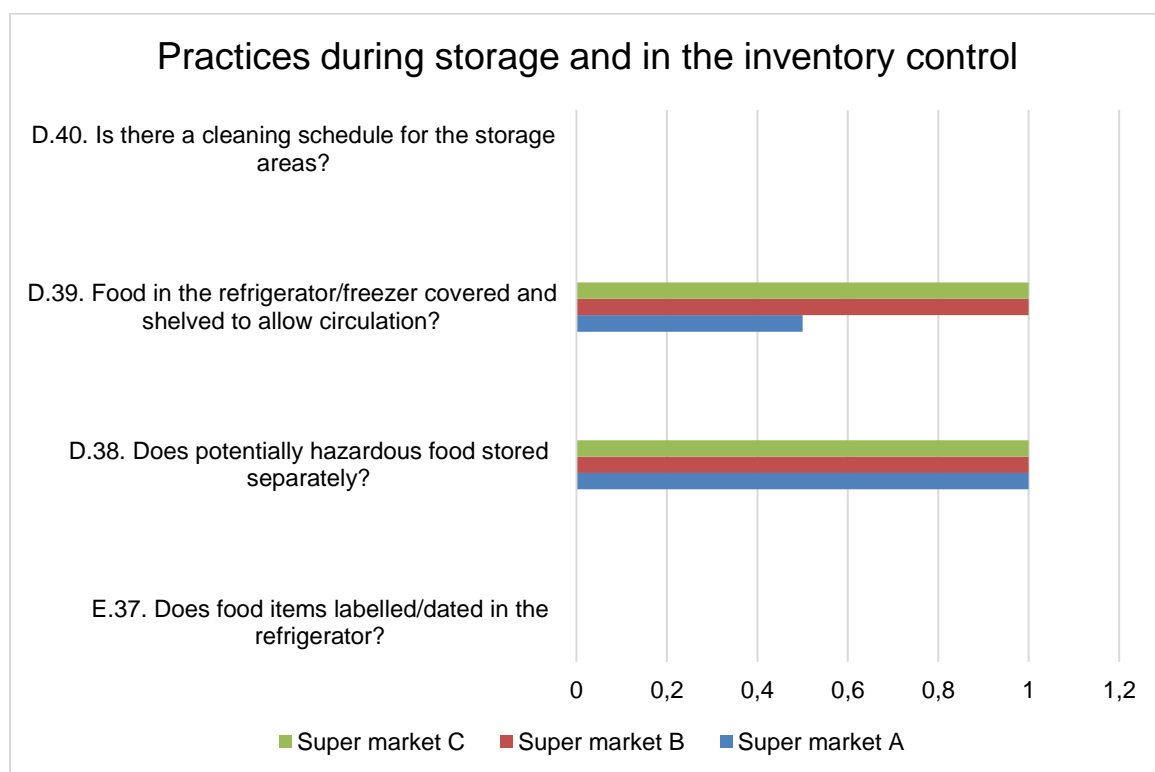
Figure 4.11 Practices during storage and in the inventory control as factors and actions that contribute towards food waste

4.2.2.6 Food handling practices

The factors and actions that were demonstrated for food handling as practiced by food handlers were observed. As indicated in Figure 4.12, food handling practices and the personal hygiene of food handlers were identified to be correct during the observation.

Nonetheless, none of the food handlers used gloves when touching ready-to-eat food such as sandwiches, however, they frequently washed their hands and no frequent touching of nose, ears, face and mouth while handling food was observed. Food handlers were not wearing any jewellery and kept their hair tied back and wore head net/caps in all supermarkets. It can be seen that good food handling practices results for the current study were positive, the observed results may have been strengthened by the newly introduced COVID-19 regulations.
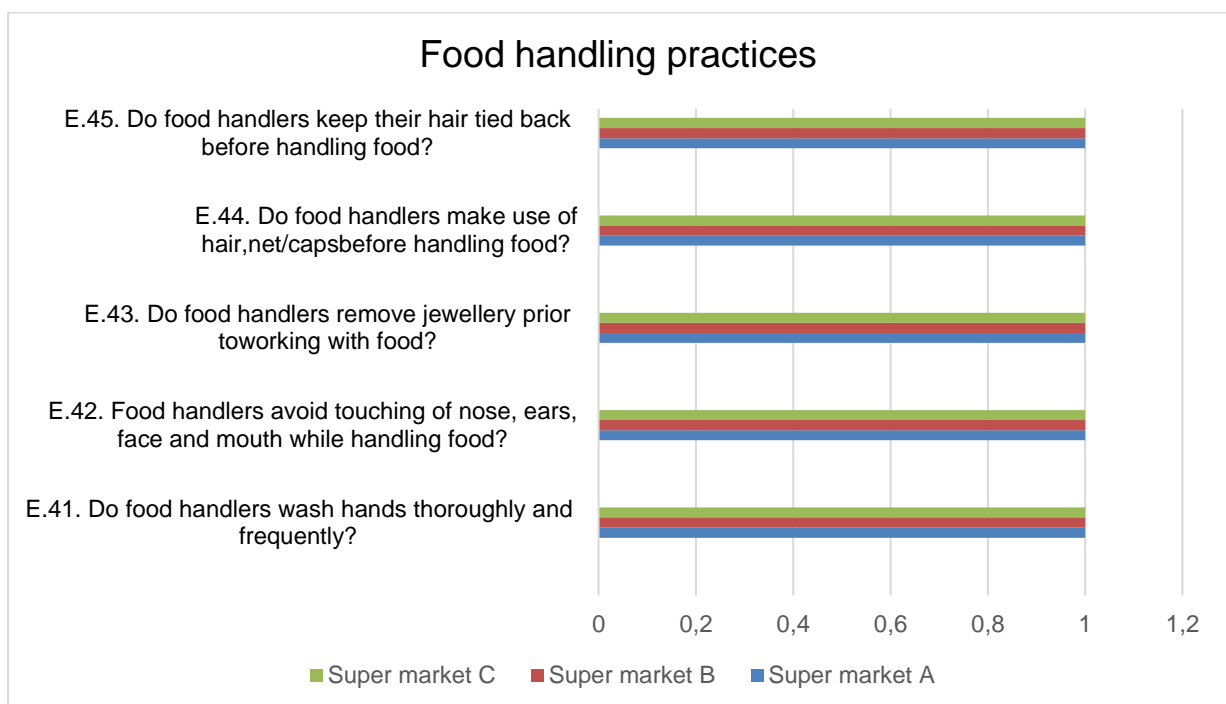
Figure 4.12 Food handling practices.

The results implied good practice on proper food handling practices by the food handlers in the supermarket kitchens in Soweto. These results are in contradiction to Geppert *et al.* (2019:206) who found that wiping dirty hands with tea towels during food preparation was the most common mistake, followed by not washing hands after coughing, sneezing, wiping the nose or sweat or touching their hair and eyes.

4.2.2.7 Working conditions

The results about the working conditions of food handlers are presented in Figure 4.13. It was observed that all food handlers wore their full and clean PPE in all supermarkets. The availability of PPE and wearing full and clean PPE contributes to preventing accidents. Kabir (2019:4) states that commercial kitchens are the occupational group with a high risk of injuries in the kitchen, such as handling hot oil and cooking vessels, which are dangerous. Therefore, being aware of such hazards in the kitchen, it is important that the correct protective clothing and equipment are used. Food handlers indicated good knowledge of ensuring their safety within the workplace, which reduces the risk of accidents from any kitchen hazards as kitchen accidents can lead to food wastage such the loss of food from slippery wet floor if safety boots are not worn.
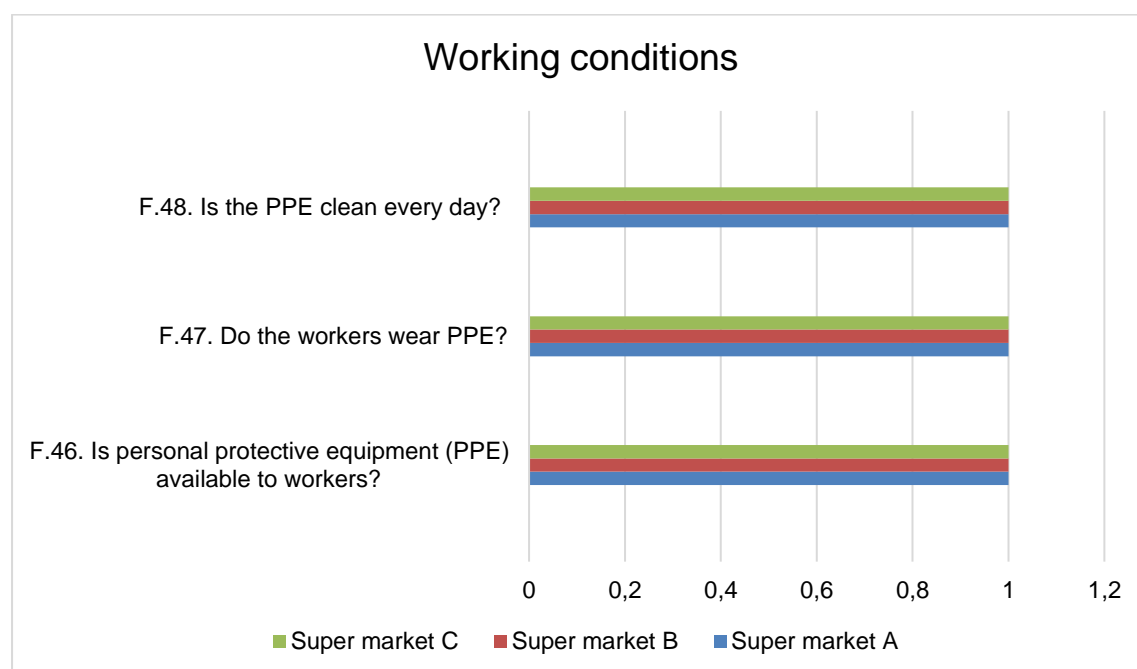
Figure 4.13 Working conditions as factors and actions that contribute towards food waste

In summary, the observation results revealed poor practices regarding food waste on menu planning. There were no visible standardised recipes for all supermarket kitchens as a guide for all the food preparation, as a menu is the backbone of every foodservice unit, which guides all its planning, including minimising food waste. The

menu informs all decision made in the foodservice unit. It was also observed that food handlers were lacking some of the factors regarding proper practices on menu execution, which may contribute to food waste. The level of practices during the distribution of meals was good. Some of the practices observed regarding food waste management plans were unsatisfactory. The observation found that the majority of the good practices were lacking on the storage and in the inventory control. There were good practices on proper food handling. Food handlers indicated good practices on ensuring their safety within the workplace.

The results of the current food waste prevention practices of food handlers in supermarkets revealed the necessity to develop food handler guidelines for food waste and green practice tailored for food handlers in super market kitchen. This is coupled with that from the commencement of this study until submission for examination there were no food waste guidelines in South Africa. Therefore the development of guidelines for food waste prevention and green practices for supermarket food handlers is presented in the following section.

4.3 DEVELOPMENT OF GUIDELINES FOR FOOD WASTE AND GREEN PRACTICES FOR SUPERMARKET FOOD HANDLERS

The steps in the development of guidelines for food handlers in supermarket kitchens based on the findings of the study were adapted from the Shekelle, Woolf, Eccles & Grimshaw (1999) guide that gives detailed steps on the development of guidelines. The results of this current study revealed poor practices regarding food waste in menu planning. There were no visible standardised recipes for all supermarket kitchens as a guide for food preparation, as a menu is the backbone of every food service unit, which guides all the planning, including minimising food waste. Therefore, it was evident that guidelines on practices for preventing food waste should be based on menu planning. Each step is discussed below.

Step 1: Identifying and refining the subject area of a guideline

The first step entails prioritizing the topic and refining the subject area, which involves identifying the topic and the focus area for the guidelines to be developed. Refining

the subject area involves narrowing the scope of the guidelines. For this study, the guidelines on menu planning as food waste preventing practices for food handlers in supermarkets were identified as necessary from the results coupled with the lack of literature on food waste in supermarkets as reviewed by the researcher as these guidelines as the basis.

Step 2: Guidelines development groups

Gathering the experts and the project team members is the second step in the development of the guideline. The development process requires different roles. Group members participate as individuals working in their field. Their role is to contribute recommendations based on their areas of expertise. Supervisors, who are experts in the field of Food and Beverage Management, were involved in this study to provide guidance. The researcher further reviewed the literature to gather data. Future research studies can work with different experts other than supervisors.

Step 3: Identifying and assessing the evidence

This step entails identifying and assessing the systematic review of the guideline. This is when the experts assess the applicability of the guidelines. The purpose of a systematic review is to collect all available evidence, assess its potential applicability to the participants under consideration, inspect the evidence for susceptibility, and extract and summarise the findings. The guideline assessment and evidence process were not done in this study. Assessing the applicability of the food waste guidelines is another topic for future research on food waste in supermarket kitchens.

The third step entails gathering evidence to determine whether a suitable, recent systematic review has already been published. The process includes various strategies for determining whether the same guidelines have previously been published and validating them. A similar process was done by the researcher to check if there were no existing food waste guidelines for food handlers in supermarket kitchens in South Africa. There were no published guidelines found that had been published for food handlers on menu planning as food waste preventing practice in supermarket kitchens in South Africa.

Step 5: Translating assessment evidence into a practice guideline

At this stage, the factors that contribute to the process of deriving expert recommendations are considered. The next step is to decide how to collect and assess expert opinion after deciding what role expert opinion will play. As previously stated, the guideline assessment process was not considered in this study. However, the literature used to develop the guidelines was from validated and applicable guidelines in food service units to manage food waste.

Step 6: Reviewing and updating guidelines

Guidelines should be subjected to outside evaluation to ensure the applicability, clarity, and validity of the content. The external reviewers should come from three different backgrounds: those with knowledge of the subject matter of the field, who can review it to ensure that the guideline literature review is comprehensive; those with knowledge of systematic reviews, guideline development, or both, who can review the process used to develop the guideline; and potential users of the guideline, who can assess its value. For this study, future research studies can further review and update guidelines as well as involve the food handlers and external experts to verify the guidelines' completeness.

The developed guidelines are presented in Annexure I. The guideline covers factors, which include careful menu planning, proper food storage and inventory control, proper food preparation, cooking methods, techniques, time and temperature control, proper practices during the distribution of meals, personal hygiene guidelines for employees, guidelines for ensuring food safety, green practices and proper food waste management plans, which were deemed necessary to guide the food handlers in reducing food waste within the supermarket kitchen

4.4 CONCLUSION

To conclude this chapter, it is evident that the supermarket food handlers may not be aware of the importance of a menu as a communication tool, which has a major influence on all the aspects of the foodservice unit. For a menu to be planned and

executed properly, the knowledge on customer profiles is the first aspect that should be known and understood by the management and also by the food handlers to reduce food waste. The insufficient knowledge about the profile of the customers by the food handlers may influence the generation of food waste in foodservice kitchens, including supermarkets. The factors such as knowledge on food storage and food preparation also influence the generation of food waste. It was also revealed that the knowledge and application of green practices are important in food waste management, which includes waste separation, different methods of managing food waste and the monitoring of the frequently wasted food according to the types of food categories. Lastly, actions and factors, which include menu planning and execution, practices during food distribution, waste management plan, food handling practices and working conditions have an influence on food waste.

CONCLUSION AND RECOMMENDATIONS

5.1 INTRODUCTION

This chapter presents the conclusion and recommendations firstly providing summary of the study results. This will be followed by the conclusion, value of the study and recommendations for supermarket kitchens on food waste management for further research. Limitations of the study are outlined.

The main purpose of this study was to determine the knowledge on food waste and waste prevention practices of food handlers in supermarket kitchens on food waste. The sub-objectives were:

- To determine the level of food handlers' knowledge on food waste using a food handler's questionnaire.
- To determine practices of food handlers on food waste by using an observation checklist.

5.2 SUMMARY OF THE RESULTS

Chapter 4 presented a comprehensive discussion of the study's findings. The summary of the results for the food waste knowledge and practices of food handlers in supermarket kitchens in Soweto is presented in this section.

5.2.1 Food handlers' knowledge on food waste

5.2.1.1 Demographic profile

The participants' demographic profiles revealed that the majority of food handlers' were females above 30 years of age with more than three years at work and secondary school level of education. The majority had job descriptions but most food handlers

had no technical expertise to perform their jobs. Some of the food handlers had attended practical and theoretical training, however, there was a notable amount who had not attended the training.

5.2.1.2 Knowledge about profile of the customers

Food handlers' knowledge about the customer profiles were inconsistent. The knowledge about the major customers was good, however, there was a percentage of food handlers that did not know the estimated number of customers per day and gender distribution. The majority knew the food habits and preferences of the customers but the knowledge about the customer's age range was average. There was inadequate knowledge on the education level of the customers, socioeconomic status, physical activities and religion of the most customers (Tables 4.2 and 4.3).

5.2.1.3 Knowledge about food waste

With regards to general knowledge about food waste (Table 4.5), the majority of food handlers knew the implication of food waste on the environment, economy and food security. Despite the notable amount of those that had never been taught, attended training and were informed about food waste reduction before, the majority indicated that being environmentally conscious is part of their daily life and felt that they are responsible for preventing food waste. Although most food handlers knew that careful menu planning contributes towards preventing food waste, there was a group that did not know the impact of careful menu planning on food waste.

From food storage findings (Table 4.7), there were very few food handlers who indicated to have insufficient knowledge on proper food storage, such as storing different food in separate sections to avoid cross contamination, storing procedures for high-risk and raw foods, proper food temperature storage and FIFO principle. But the knowledge regarding food date labelling reflected inadequate knowledge on whether the food that has reached sell by date should be thrown away or not, as responses were inconsistent. Regarding findings on storage and inventory control

practices, it can be concluded that even though potentially hazardous foods such as uncooked meat and poultry were properly stored separately from other foods, there were still unsatisfactory results since stored food items were not labelled/ dated. The majority of storage facilities were overloaded, which prevents air circulation and none of the cleaning schedules were identified in the storage.

The food preparation findings (Table 4.9) revealed that there was a remarkable group of food handlers that indicated a lack of knowledge on the factors that contribute to food waste in the food preparation stage, such as knowing the estimated number of customers when preparing food, use of leftover quality food for the preparation of other meals, avoid displaying piles of food in the food display to attract customers and the use of food garnishes for food presentation. Nevertheless, the majority of food handlers indicated to know the practices and cooking methods that reduce food waste such as avoiding to peel all vegetable skin before cooking and using different cooking methods. The majority also knew the importance of using a standardised recipe when preparing food, however, that was contradictory with the findings revealed during the observations, as none of the standardised recipes were identified during food preparation. There was no link between the knowledge and actual practice.

5.2.1.4 Knowledge about green practices

Thus, managers should encourage co-created green ideas by organising brainstorming sessions as well as appointing champions to share good and feasible green practices. Food handlers need training about green practices as indicated in Table 4.11 on food waste based on the knowledge about green practices findings. There was a notable group of food handlers that had a lack of knowledge about green practices/ eco-friendly practices, food waste recycling methods and prevention of food waste through green practices. The majority revealed that they were not even confident that their company had initiated green practices on food waste to protect the environment. This was confirmed by the findings on the level of knowledge regarding waste separation (Figure 4.1). The majority lacked knowledge on recyclable food waste and did not know the difference between types of waste bins, even though the

majority indicated to know waste separation and the difference between dry and wet waste. This indicates that in reality there was no food waste management in place. Based on the findings, it is clear that food handlers' training about food waste knowledge and green practices is vital. Establishments need to prepare their staff to meet organisational objectives, which lead to productivity through fragments of training and continuous supervision.

Considering the responses of food handlers regarding the method used to manage food waste in the supermarkets (Figure 4.2), disposal is the main method used to manage food waste, none of the supermarkets participated in any composting programmes. There were minority of the supermarkets that at least donate food to sharing schemes and to food charities. It was also found that the majority of food waste is from fruits and vegetables, bread and cooked food (Figure 4.3 and 4.4).

5.2.2 Food handlers' food waste prevention practices

5.2.2.1 Menu planning

The majority of menu planning factors (Figure 4.5) that were observed were unsatisfactory, such as the unavailability of standardised recipes, which is the core aspect in the foodservice unit and were not identified during food preparation as aforementioned. Most of the meals planned did not show pleasing food texture combinations.

5.2.2.2 Menu execution

Menu execution observation (Figure 4.6) also indicated the improper use of separate colour-coded chopping boards to avoid cross contamination. Notwithstanding that colour-coded chopping boards were designed to avoid cross contamination and given the fact that food spoilage and food-borne diseases have been linked to poor food preparation, therefore, colour-coded chopping boards were introduced. Also, there were limited techniques applied to prepare different foods. This might be due to the

insufficient resources identified for a varied menu, which was the unavailability of equipment to utilise different cooking methods in other supermarkets

5.2.2.3 Practices during the distribution of meals

The practices during the distribution of meals (Figure 4.7) revealed that the majority of supermarkets had deli food displays piled up with a lot of food and in one of the supermarkets there was a lack of garnishes for food presentation and unsatisfactory overall food display.

5.2.2.4 Waste management plan

There was a lack of waste management plans in the supermarkets as indicated in Figure 4.8. Considering that there were no separate waste bins to dispose of different types of waste in some sections of the kitchens, some bins had no lids to prevent the attraction of flies; there was a significant amount of waste disposed of, in all the kitchens observed. None of the waste management practices were identified during the observations, such as labelled, separate waste bins in each section of the kitchen, separate organic food waste bins or separate wet and dry waste bins.

5.2.2.5 Food handling practices

Food handlers adhered to proper food handling practices (Figures 4.11 and 4.12) such as washing hands thoroughly and frequently, avoiding touching of nose, ears, face and mouth while handling food, making use of hair net/ caps before handling food, keeping hair tied back before wearing a head net/ cap and none of the food handlers were identified wearing any jewellery during food handling. It is critical to adhere to proper food handling practices which can ultimately minimise food waste.

5.2.2.6 Working conditions

With regards to working conditions (Figure 4.13), factors and actions such as the availability of staff PPE were identified as well as a safe work environment.

5.3   CONCLUSION

When kitchen food handlers without former training on food waste management are hired, there is a high probability to produce unavoidable waste; the challenge is that education and training programmes are not always possible due to the operational pressures of the hospitality industry. Therefore, the researcher suggests continuous training. The use of standardised recipes is vital as it decreases the amount of food wasted during food preparation and production because it minimises production errors. Thus, it can be concluded that food handlers' level of knowledge findings on food waste did not reflect the findings revealed by observations during food production.

The insufficient knowledge on green practices might be associated with the lack of training. This was confirmed by the majority of respondents indicating a need for training on green practices and a low percentage indicating they are not confident that their company has initiated green food waste practices to protect the environment. Given that food handlers indicated positive knowledge regarding waste separation but did not implement what they know, indicated a gap. This might be due to the lack of responsibility or lack of motivation. This study demonstrated that even if participants were knowledgeable, future food waste training should focus not only on knowledge but also on why the practice should change. It was evident in this study that menu planning is the driver of any foodservice establishment and a lack of proper menu planning and execution can highly affect the generation of food waste.

It can be concluded that the sub-objectives and main objective of this study have been obtained. The level of food handlers' knowledge and the practices of food handlers on food waste has been determined.

5.4   VALUE OF THE STUDY

- The study's findings were used to develop the guidelines discussed in 4.3 (Annexure I) and can be used as a basis for understanding the knowledge and practices for food handlers in supermarket kitchens regarding food waste, particularly in the hospitality area, which is reluctant to co-operate with scientific bodies. Additionally, for SA, the findings contribute to knowledge on understanding the current food waste in supermarket kitchens, which can be applied to evaluate and meet the universal call to achieve target 12.3, which calls for halving global food waste and loss per capita at retail and consumer levels along production and supply chains by the year 2030 as the target of part of a set of 17 SDGs.

- This study provides food handlers with guidelines that could be a contributing factor to food waste reduction in the foodservice industry. The guidelines might be adopted in the supermarkets' food waste reduction in future, to overcome the accelerating problem of limited landfill space and deteriorating environment due to current waste disposal practices in South Africa.

- The study contributed to the literature on food waste in supermarkets, through recommendations of actual knowledge and practices on food waste.

5.5   RECOMMENDATIONS

- The developed guidelines for food handlers need to be tested and implemented for further studies

- The attitude concept in the theoretical framework of this study was not addressed further studies should incorporate the attitude concept.

- For the data collection the checklist used indicated only presence or absence and did not indicate anything about the context in which the observations were conducted. The researcher recommends a checklist with space to record additional comments.

- There is a need for training on food waste for food handlers, as the results of this study indicated that the food handlers did not undergo training in the last

six months. Information sheets such as standardized menus can be displayed in Foodservice units constantly reminding food handlers of what is expected. These information sheets needs to be changed regularly to avoid boredom and food handlers getting used to images resulting in ignorance.

- Food handlers are the primary drivers in food waste reduction in foodservice kitchens, thus they should be at the forefront in the development of food waste policies and be deep-rooted in a food waste sustainability culture through regular monitoring and training.

- Review food safety law requirements by considering the implementation of the Samaritan law, which protects people and organisations who donate food in good faith from civil or criminal liability due to the age, packaging, or condition of wholesome foods or grocery products donated to non-profit organisations.

- Collaborate with non-governmental organisations (NGOs) to donate prepared food surplus and for organic food waste recycling.

- Explore the best way to implement the reduce, reuse and recycle (3Rs) principle.

- The basic understanding of knowledge and practices on food waste of supermarket kitchen food handlers has been established by this study. Therefore the gap between the industry and the scientific body needs to be addressed.

5.6   LIMITATIONS OF THE STUDY

- The current study only focused on a quantitative approach. Future studies could employ mixed (quantitative and qualitative) approaches to determine food handlers' knowledge. A qualitative approach might allow food handlers to express the reasons behind their level of knowledge and practices regarding food waste in supermarket kitchens.

- The researcher faced some difficulties with the study's progress and data collection of face to face and observations due to change of management who gave permission to conduct the study in supermarkets and lockdown restriction,

which led to delays in the completion of the study. For future studies, video recording used for security aspects can be used to analysis the observations.

- The observation checklist design for the current study had limited rating scales of yes or no to measure participants' behaviour. Future research can include more options and additional comments.

- The busy nature of the targeted foodservice establishments, obtaining permission and access difficulties limited the number of participants in the study.

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ANNEXURE A Ethical Approval for the study

Vaal University of Technology
Your world to a better future

Faculty of Human Sciences
Tel: +27(0)16 950 9000
Fax: +27(0)16 950 9898

Chairperson
Faculty Research Ethics Committee
Faculty of Human Sciences
Vaal University of Technology
06 November 2020

RESEARCHERS: PH Xaba

PROJECT TITLE: Determining Food Waste Knowledge and Practices by Food Handlers in Supermarkets Kitchens in Soweto South Africa

QUALIFICATION: MTech Food and Beverage Management

Decision: Approval	**Ethics Reference Number:** FREC/HS/14/08/2020/6.1.1 **Student number: 218272235**

Dear Ms Xaba:

Thank you for your resubmission towards the above-mentioned application for research ethical consideration and approval. The resubmitted documents and your response letter were reviewed through an expediter review process. I am pleased to inform you that your application has now been approved.

FREC COMMENTS	APPLICANT RESPONSES	FREC RESPONSE
1. The invitation to participate in the research addressed to the supermarket managers does not make explicit reference to the fact that the research will be conducted through survey and through observation of employees. The procedure that will be followed during the observation should be explained and clarified. At the moment it is briefly mentioned under 'benefits of the project', which is not accurate. The revised letters will	Procedure of this project: In order to achieve the study aims, the study will be conducted in two phases, namely through survey (questionnaires) and observations. A survey will be conducted by the researcher through the use of the structured questionnaires to obtain information from the food handlers. Each food handler will receive a self-administered questionnaire that will consist of information related to food waste knowledge. The questionnaires will be completed in the presence of the researcher and this require approximately 15 minutes to complete. The food handlers will be allowed to communicate with the researcher if needed for clarity. The researcher will also observe practices of food handlers on food waste during the working hours, by	Accepted

have to be signed by each manager again and resubmitted to the FREC please.	using an observation checklist, which has theoretical list of relevant factors impacting the generation of food waste during meal production. The researcher will directly observe the participants by occupying one corner of each sections of the kitchen during the observations to minimize disturbance. Collective instances of food waste practices will be observed, not observing participants individually. See Annexures F,G,H	
2. In the letter to the managers it should also be stated that managers wil agree that no information gathered through the survey or observation may be used against employees.	The revised letters were signed by all the supermarket managers. Refer to Annexures F,G and H attached.	Accepted
3. In the application document, Question 3.3 leaves space for possible deception. A brief rationale for why observed participants will not be told what is being observed and a statement that no deception is intended will assist. In the IL to the participants, the observation process and presence of the observer needs to be clarified, i.e. will the observer be right next to the participants and move around them or will the observer be stationed in an unobtrusive position.	Through the acceptance of this request to conduct research, as a manager you agreeing that no information gathered through the survey or observation may be used against the participants which are the employees. As such the participants will be informed that the management has given permission and this will be outlined in the information Leaflet. See Annexures F,G, H	Accepted
4. In the questionnaire the question about the ethnicity of the participants seems irrelevant. We suggest that it be changed to a question about home language if deemed useful, otherwise it can be removed.	Observations will be done by the means of not informing the participants as to what factors of food waste will be observed, however from the information leaflet that they will read they will know that food waste will be observed. The researcher will wait for 20 minutes before commencing with the observation to control the Hawthorne effect. This is to resemble a natural and unchanged setting to minimising the action in which individuals modify an aspect of their behavior in response to their awareness of being observed, no deception is intended. However, management will be aware of the role of the researcher. The researcher will directly observe the participants by occupying one corner of each sections of the kitchen during the observations to minimize disturbance. Collective instances of food waste practices will be observed, not observing participants individually. See Application form and Annexure D	Accepted
5. All letters that have been sent out, e.g. to the ward councillor,	The question on the ethnicity of the participants has been removed from the questionnaire. See Annexure B2	Accepted

also need to be submitted to the FREC for approval.		
6. In the application document, please state that the kitchen SOP's will be adhered to during the observation processes.	New Permission letters to the manager and ward council were sent out and permission was granted by both the three managers and the ward councillors. Refer to Annexures E2, F,G,H	Accepted
7. If any changes to the research methodology are necessitated by the COVID-19 pandemic, the FREC need to be notified.	All the kitchen Standard Operating Procedures will be adhered to by the researcher during the observation processes. Also the Covid-19 safety prevention guidelines of all the organization involved such as and more, social distance, sanitizing and wearing of mask will also be adhered to by the researcher during the collection of data.	Accepted

In all correspondence concerning this research project please use the Ethics Reference Number provided above.

Any revisions to the research documents, as shared in this letter, must reach the FREC by the 14 September 2020.

As the primary researcher you undertake:

➢ To follow only those procedures for which the approval has been given;
➢ To inform the committee should there be significant deviations from that which has been approved;
➢ To report any Adverse Events that might occur, within 14 days of the event (following the Guidelines procedure);
➢ To submit to the committee annual progress reports, where your reporting date is 1 November 2020; and
➢ To inform the committee on the completion of the project, when the findings have entered the public domain.

Lastly, we would like to take this opportunity to you well with your research endeavours.

Sincerely,

Dr A de Klerk
(016 9506870)
Chairperson: Faculty Research Ethics Committee
Faculty of Human Sciences
Vaal University of Technology

ANNEXURE B 1   Ward councillor permission letter

Vaal University of Technology
Your world to a better future

VUT

Department of Hospitality, Tourism &
PR Management]
Tel: +27(0)16 950 9279/9733
Fax: +27(0)16 950 9788

2020-10

Dear Madam/Sir

RESEARCH ON DETERMINING FOOD WASTE KNOWLEDGE AND PRACTICES BY FOOD HANDLERS IN SUPERMARKETS KITCHENS IN SOWETO SOUTH AFRICA

My name is Philisiwe Xaba. I am a student currently enrolled at the Vaal University of Technology (VUT) for an MTech degree in Food and Beverage Management. Food waste as part of the municipal solid waste has negative impact on the environment, society and the economy. I would like to contribute in finding solutions by conducting research study on determining food waste practices in supermarkets kitchens in Johannesburg region. Globally, an excessive amount of food produced for human consumption goes to waste. Food waste has negative impact on the environment, society and the economy. Distribution and retail sectors which include supermarket kitchen contributes about 20% on food waste. Thus, the researcher would like to contribute in finding solutions by conducting research study in supermarket kitchens. The primary objective of this study is to determine knowledge and current practices of food handlers in supermarket kitchens in Soweto regarding food waste in order to provide recommendations and to ultimately create awareness, also design and to develop guidelines for food waste reduction and management for supermarket kitchens. The questionnaire and observation checklist will be used to obtain information. The study will be conducted by visiting some of the supermarkets around Soweto Township.

Procedure of this project

In order to achieve the study aims, the study will be conducted in two phases, namely through survey (questionnaires) and observations. A survey will be conducted by the researcher through the use of the structured questionnaires to obtain information from the food handlers. Each food handler will receive a self-administered questionnaire that will consist of information related to food waste knowledge. The questionnaires will be completed in the presence of the researcher and this require approximately 15 minutes to complete. The food handlers will be allowed to communicate with the researcher if needed for clarity.

The researcher will also observe practices of food handlers on food waste during the working hours, by using an observation checklist, which has theoretical list of relevant factors impacting the generation of food waste during meal production. The researcher will directly observe the participants by occupy one corner of each

sections of the kitchen during the observations to minimize disturbance. Collective instances of food waste practices will be observed, not observing participants individually. All the kitchen Standard Operating Procedures will be adhered to by the researcher during the observation processes. Also the Covid-19 safety prevention guidelines of the organization such as and more, social distance, sanitizing and wearing of mask will also be adhered to by the researcher during the collection of data.

Confidentiality

Your names or the organisation identification information will be confidential. No information will be disclosed using the organistion's or the participants name; privacy for participants will be very important in this study. Instead of respondent's names, codes will be used. There will be no dissemination of findings in an irresponsible and unprofessional manner. All data gathered from respondents during the study will be treated with respect and confidentiality. Through your permission as the ward councilor to conduct this research, manager will be informed about these permissions.

Terms and benefits of this project

Respondents will not be paid for this study as it is voluntary. At the end of the study the organisation (Retail store) will receive food waste reduction guidelines that will help in preventing, managing and reducing food waste in supermarket food sections. Food handlers may be able to understand the impacts of food waste on the organisation, environment, society and the economy.

The Soweto township was selected to form part of the study as it's a home to diverse South African cultures and people and has a big population amongst all townships, therefore it gives a true reflection of South Africa people. In Africa, South Africa has the largest proportion of food waste, yet 24.5% of people go to bed hungry each day. Gauteng have the largest share of the South African population with about 14.3 million people (25.3%). The city of Johannesburg Metropolitan Municipality under Gauteng province is divided into seven regions and the most populated region (24%) is Region D, which is Soweto that covers Doornkop, Diepkloof and Meadowlands. The population growth has led to the increased number of supermarkets located within Soweto Township that sell convenience and grocery items, which are beneficial to the customers.

As a ward councillor, I kindly ask for your permission to conduct this research within Ward 21 and surrounding areas. This study will meet the requirements of the Research Ethics Committee of the VUT. This study has been approved by the **Research Ethics Committee of the Vaal University of Technology, or FREC, Faculty of Human Sciences (Ethics clearance number**: FREC/HS/14/08/2020/6.1.1). Should you have any queries please contact my project supervisors:

Dr K Marumo-Ngwenya (Senior Lecturer): Tel 061 950 9966, Email kudam@vut.ac.za or

Prof J.E Kearney (Associate Professor): Tel 016 950 7591, Email jkearney@vut.ac.za

By signing the below part, you declare that you fully understand and accept the information that has been shared with you.

Please supply with your details below.

Name and surname_____   Position_____

Place_____   Ward name_____

Thank you for taking the time to read this information

Researcher: Philisiwe Xaba (Student)

_____ .

Masters in Food and Beverage management

Cell: 0738482108

ANNEXURE B2   Ward councillor permission letter

TO   : To whom it may concern

FROM   : COUNCILLOR M.I. SESEDINYANE
                   WARD 21

DATE   : 12 October 2020

SUBJECT   : PERMISSION LETTER

Dear Sir/Madam

This communication acknowledges the receipt of communication requesting permission to conduct **Research on Determining Foods Waste Knowledge and practices by Food Handlers in Supermarkets Kitchens in Soweto South Africa. The study will be conducted Philisiwe Xaba, a student in the Vaal University VUT, and more details regarding the study in the attached letter.**

As the Councillor of the Ward, I have no objection against the research and recommend that the student is given everything that she might require.

For any further clarity please do not hesitate to contact the undersigned.

Yours in service delivery.

Councillor M.I. Sesedinyane
Ward 21
072 662 2359

The office of Councillor M.I. Sesedinyane, Entokozweni Community Centre 269 Legwale Street, Moletsane. Tel. 011 932 – 7474 e-mail sesedinyane@yahoo.com

Vaal University of Technology

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VUT

Department of Hospitality, Tourism &
PR Management]
Tel: +27(0)16 950 9279/9733
Fax: +27(0)16 950 9788

2021-04

Dear Madam/Sir

RESEARCH ON DETERMINING FOOD WASTE KNOWLEDGE AND PRACTICES BY FOOD HANDLERS IN SUPERMARKETS KITCHENS IN SOWETO SOUTH AFRICA

My name is Philisiwe Xaba. I am a student currently enrolled at the Vaal University of Technology (VUT) for an MTech degree in Food and Beverage Management. I would like to conduct a research study on food waste knowledge and practices by food handlers in supermarket kitchens in the Johannesburg region to contribute in finding solutions on food waste.

What the study is about

Globally, an excessive amount of food produced for human consumption goes to waste. Food waste has negative impact on the environment, society and the economy. Distribution and retail sectors which include supermarket kitchen contributes about 20% on food waste. Thus, the researcher would like to contribute in finding solutions by conducting research study in supermarket kitchens. The primary objective of this study is to determine knowledge and current practices of food handlers in supermarket kitchens in Soweto regarding food waste in order to provide recommendations and to ultimately create awareness, also design and to develop guidelines for food waste reduction and management for supermarket kitchens. The questionnaire and observation checklist will be used to obtain information.

Procedure of this project

In order to achieve the study aims, the study will be conducted in two phases, namely through survey (questionnaires) and observations. A survey will be conducted by the researcher through the use of the structured questionnaires to obtain information from the food handlers. Each food handler will receive a self-administered questionnaire that will consist of information related to food waste knowledge. The questionnaires will be completed in the presence of the researcher and this require approximately 15 minutes to complete. The food handlers will be allowed to communicate with the researcher if needed for clarity.

The researcher will also observe practices of food handlers on food waste during the working hours, by using an observation checklist, which has theoretical list of relevant factors impacting the generation of food waste during meal production. The researcher will directly observe the participants by occupy one corner of each sections of the kitchen during the observations to minimize disturbance. Collective instances of food waste practices will be observed, not

Your participation in the study will be greatly appreciated, and by signing the below part, you declare that you fully understand and accept the information that has been shared with you."

Please supply with your details below.

Name and surname ████████████████ Position ___Floor Manager____

Company name ████████████████ Location ██████████ onga PnD

████████████████ (Section)

Signature ████████████████ Date __19/04/21__

Researcher: Philisiwe Xaba (Student)

Signature

Cell: 0738482108

ANNEXURE D   Permission letter for Supermarket (Bara City)

Vaal University of Technology
Your world to a better future

VUT

Department of Hospitality, Tourism &
PR Management]
Tel: +27(0)16 950 9279/9733
Fax: +27(0)16 950 9788

2020-10

Dear Madam/Sir

RESEARCH ON DETERMINING FOOD WASTE KNOWLEDGE AND PRACTICES BY FOOD HANDLERS IN SUPERMARKETS KITCHENS IN SOWETO SOUTH AFRICA

My name is Philisiwe Xaba. I am a student currently enrolled at the Vaal University of Technology (VUT) for an MTech degree in Food and Beverage Management. I would like to conduct a research study on food waste knowledge and practices by food handlers in supermarket kitchens in the Johannesburg region to contribute in finding solutions on food waste.

What the study is about

Globally, an excessive amount of food produced for human consumption goes to waste. Food waste has negative impact on the environment, society and the economy. Distribution and retail sectors which include supermarket kitchen contributes about 20% on food waste. Thus, the researcher would like to contribute in finding solutions by conducting research study in supermarket kitchens. The primary objective of this study is to determine knowledge and current practices of food handlers in supermarket kitchens in Soweto regarding food waste in order to provide recommendations and to ultimately create awareness, also design and to develop guidelines for food waste reduction and management for supermarket kitchens. The questionnaire and observation checklist will be used to obtain information.

Procedure of this project

In order to achieve the study aims, the study will be conducted in two phases, namely through survey (questionnaires) and observations. A survey will be conducted by the researcher through the use of the structured questionnaires to obtain information from the food handlers. Each food handler will receive a self-administered questionnaire that will consist of information related to food waste knowledge. The questionnaires will be completed in the presence of the researcher and this require approximately 15 minutes to complete. The food handlers will be allowed to communicate with the researcher if needed for clarity.

The researcher will also observe practices of food handlers on food waste during the working hours, by using an observation checklist, which has theoretical list of relevant factors impacting the generation of food waste during meal production. The researcher will directly observe the participants by occuping one corner of each sections of the kitchen during the observations to minimize disturbance. Collective instances of food waste practices will be observed, not

observing participants individually. All the kitchen Standard Operating Procedures will be adhered to by the researcher during the observation processes. Also the Covid-19 safety prevention guidelines of your organization such as and more, social distance, sanitizing and wearing of mask will also be adhered to by the researcher during the collection of data.

Selection of the organisation

Your organisation has been selected for the study because it is the biggest retail business in the fast moving consumer goods industry on the African continent that believes doing good is good business and the focus of the study is on retail business. If permission is granted the management will be giving permission for the researcher to determine the level of food handlers' knowledge on food waste. Assess their awareness and knowledge in order to identify the gaps they have on food waste. To evaluate current practices and factors associated with food waste in order to improve food handlers' knowledge and awareness in supermarkets food sections. To evaluate food handlers understanding about green practices on food waste in order to develop and recommend guidelines.

Confidentiality

Your names or the organisation identification information will be confidential. No information will be disclosed using the organistion's or the participants name; privacy for participants will be very important in this study. Instead of respondent's names, codes will be used. There will be no dissemination of findings in an irresponsible and unprofessional manner. All data gathered from respondents during the study will be treated with respect and confidentiality. Through the acceptance of this request to conduct research, as a manager you agreeing that no information gathered through the survey or observation may be used against the participants which are the employees. As such the participants will be informed that the management has given permission and this will be outlined in the information Leaflet.

Terms and benefits of this project

Respondents will not be paid for this study as it is voluntary. At the end of the study the organisation will receive food waste reduction guidelines that will help in preventing, managing and reducing food waste in supermarket food sections. Food handlers may be able to understand the impacts of food waste on the organisation, environment, society and the economy.

This study has been approved by the **Research Ethics Committee of the Vaal University of Technology, or FREC, Faculty of Human Sciences (Ethics clearance number:** FREC/HS/14/08/2020/6.1.1). Should you have any queries please contact my project supervisors:

Dr Marumo-Ngwenya (Senior Lecturer): Tel 061 950 9966, Email kudam@vut.ac.za or

Prof J.E Kearney (Associate Professor): Tel 016 950 7591, Email jkearney@vut.ac.za

Your participation in the study will be greatly appreciated, and by signing the below part, you declare that you fully understand and accept the information that has been shared with you."

Please supply with your details below.

Name and surname ~~████████████~~ Position STORE MANAGER

Company name ~~████████████~~ Location ~~████████~~

(Section)

Signature ~~████████████~~ Date 09 - 10 - 2020

Researcher: Philisiwe Xaba (Student)

Signature

Cell: 0738482108

Vaal University of Technology

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VUT

Department of Hospitality, Tourism &
PR Management]
Tel: +27(0)16 950 9279/9733
Fax: +27(0)16 950 9788

2020-10

Dear Madam/Sir

RESEARCH ON DETERMINING FOOD WASTE KNOWLEDGE AND PRACTICES BY FOOD HANDLERS IN SUPERMARKETS
KITCHENS IN SOWETO SOUTH AFRICA

My name is Philisiwe Xaba. I am a student currently enrolled at the Vaal University of Technology (VUT) for an MTech
degree in Food and Beverage Management. I would like to conduct a research study on food waste knowledge and
practices by food handlers in supermarket kitchens in the Johannesburg region to contribute in finding solutions on
food waste.

What the study is about

Globally, an excessive amount of food produced for human consumption goes to waste. Food waste has negative
impact on the environment, society and the economy. Distribution and retail sectors which include supermarket
kitchen contributes about 20% on food waste. Thus, the researcher would like to contribute in finding solutions by
conducting research study in supermarket kitchens. The primary objective of this study is to determine knowledge and
current practices of food handlers in supermarket kitchens in Soweto regarding food waste in order to provide
recommendations and to ultimately create awareness, also design and to develop guidelines for food waste reduction
and management for supermarket kitchens. The questionnaire and observation checklist will be used to obtain
information.

Procedure of this project

In order to achieve the study aims, the study will be conducted in two phases, namely through survey (questionnaires)
and observations. A survey will be conducted by the researcher through the use of the structured questionnaires to
obtain information from the food handlers. Each food handler will receive a self-administered questionnaire that will
consist of information related to food waste knowledge. The questionnaires will be completed in the presence of the
researcher and this require approximately 15 minutes to complete. The food handlers will be allowed to communicate
with the researcher if needed for clarity.

The researcher will also observe practices of food handlers on food waste during the working hours, by using an
observation checklist, which has theoretical list of relevant factors impacting the generation of food waste during meal
production. The researcher will directly observe the participants by occuping one corner of each sections of the kitchen
during the observations to minimize disturbance. Collective instances of food waste practices will be observed, not

observing participants individually. All the kitchen Standard Operating Procedures will be adhered to by the researcher during the observation processes. Also the Covid-19 safety prevention guidelines of your organization such as and more, social distance, sanitizing and wearing of mask will also be adhered to by the researcher during the collection of data.

Selection of the organisation

Your organisation has been selected for the study because it is the biggest retail business in the fast moving consumer goods industry on the African continent that believes doing good is good business and the focus of the study is on retail business. If permission is granted the management will be giving permission for the researcher to determine the level of food handlers' knowledge on food waste. Assess their awareness and knowledge in order to identify the gaps they have on food waste. To evaluate current practices and factors associated with food waste in order to improve food handlers' knowledge and awareness in supermarkets food sections. To evaluate food handlers understanding about green practices on food waste in order to develop and recommend guidelines.

Confidentiality

Your names or the organisation identification information will be confidential. No information will be disclosed using the organistion's or the participants name; privacy for participants will be very important in this study. Instead of respondent's names, codes will be used. There will be no dissemination of findings in an irresponsible and unprofessional manner. All data gathered from respondents during the study will be treated with respect and confidentiality. Through the acceptance of this request to conduct research, as a manager you agreeing that no information gathered through the survey or observation may be used against the participants which are the employees. As such the participants will be informed that the management has given permission and this will be outlined in the information Leaflet.

Terms and benefits of this project

Respondents will not be paid for this study as it is voluntary. At the end of the study the organisation will receive food waste reduction guidelines that will help in preventing, managing and reducing food waste in supermarket food sections. Food handlers may be able to understand the impacts of food waste on the organisation, environment, society and the economy.

This study has been approved by the **Research Ethics Committee of the Vaal University of Technology, or FREC, Faculty of Human Sciences (Ethics clearance number:** FREC/HS/14/08/2020/6.1.1). Should you have any queries please contact my project supervisors:

Dr Marumo-Ngwenya (Senior Lecturer): Tel 061 950 9966, Email kudam@vut.ac.za or

Prof J.E Kearney (Associate Professor): Tel 016 950 7591, Email jkearney@vut.ac.za

Your participation in the study will be greatly appreciated, and by signing the below part, you declare that you fully understand and accept the information that has been shared with you."

Please supply with your details below.

Name and surname ████████████████████   Position Store Manager

Company name ████████████████   Location ██████████
                                                        (Section)

Signat████████████████   Date 12 | 10 | 2020

Researcher: Philisiwe Xaba (Student)

Signature

Cell: 0738482108

ANNEXURE F   Informed leaflet and informed consent letter

Vaal University of Technology
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INFORMATION LEAFLET AND INFORMED CONSENT

FACULTY: HUMAN SCIENCES
DEPARTMENT: HOSPITALITY, TOURISM & PR MANAGEMENT

Project title: Determining food waste knowledge and practices by food handlers in supermarket kitchens in Soweto South Africa.
Primary investigator: Ms Philisiwe Happy Xaba, BTech in Food and Beverage Management.
Study leader: *Dr K Marumo-Ngwenya, DTech, Department of Hospitality, Vaal University of Technology, Vanderbijlpark.*

Dear Potential Research Participant
You are invited to complete a survey questionnaire that forms part of my formal study (MTech in Food and Beverage Management). Please use some time to read the information described here, which will explain the details of this project. This study has been approved by the **Research Ethics Committee of the Vaal University of Technology, or FREC, Faculty of Human Sciences (Ethics clearance number FREC/HS/14/08/2020/6.1.1).** Permission to conduct the study was also granted by the management of Pick n Pay Company. All parts of the study will be conducted according to internationally accepted ethical principles.

Globally, an excessive amount of food produced for human consumption goes to waste. Food waste has negative impact on the environment, society and the economy. Distribution and retail sectors which include supermarket kitchen contributes about 20% on food waste. Thus, the researcher would like to contribute in finding solutions by conducting research study in supermarket kitchens. The primary objective of this study is to determine knowledge and current practices of food handlers in supermarket kitchens in Soweto regarding food waste in order to provide recommendations and to ultimately create awareness, also design and to develop guidelines for food waste reduction and management for supermarket kitchens. The questionnaire and observation checklist will be used to obtain information.

As a food handler within the supermarket kitchen you are considered relevant to be a participant in this study owing to the fact that knowledge on food waste and good practices has been identified as factor that can contribute towards the prevention of food waste. As a participant your role will be to

complete a questionnaire regarding food handlers' knowledge on food waste in order to identify the level of knowledge. A questionnaire will require approximately 15 minutes of your time to complete. The researcher will also observe practices of food handlers on food waste during the working hours of the participants, by using an observation checklist in order to develop food handler guidelines for food waste and green practice. The researcher will directly observe the participants by occupying one corner of each sections of the kitchen during the observations to minimize disturbance. Collective instances of food waste practices will be observed, not observing participants individually.

The study does not pose any risk towards you as the participant and the company. Participants will not be paid for this study as it is voluntary. As the participants you have the right to withdraw from the study at any stage if you wish to do so. All information provided to the research will be treated as confidential and the study will be conducted respectfully. No information will be disclosed using the respondent's name; privacy for respondents will be very important in this study. Your names or the organisation information will be confidential. Instead of respondent's names, codes will be used. Your anonymity is therefore ensured.

Should you have any enquires please do not hesitate to contact the researcher and the study leaders on the following contacts:

Researcher
Miss P.H Xaba (M-Tech student) Cell: 0738482108 / 0727939441

Project supervisors
Dr Marumo-Ngwenya (Senior Lecturer): Tel 061 950 9966, Email kudam@vut.ac.za or Prof J.E Kearney (Associate Professor): Tel 016 950 7591, Email jkearney@vut.ac.za

Your participation in the study will be greatly appreciated. By agreeing to answer the questions and to be observed you declare that you fully understand and accept the information that has been shared with you.

Signature of respondent…………………………….signed at………………..……………………on…………………………………….

ANNEXURE G　　Food waste knowledge questionnaire

Food waste knowledge questionnaire for food handlers in Supermarket kitchen

SUBJECT NR: 610004　　　　　**Supermarket:** __A__　　__B__　　__C__

DATE: _____

SECTION A: DEMOGRAPHIC PROFILE

Please select the most appropriate response by putting X in the appropriate box

A 1. Gender:　　　　Female ☐　　　Male ☐

A 2. Please write your age: _____

A 3. Please write your position at work_____

A 4. Highest standard/grade completed in school

a. None	
b. Primary school	
c. Secondary school	
d. Diploma	
e. Degree	
f. Masters	
g. Others (please name them)	

A 5. The number of years/ months working in the supermarket kitchen

a. 3-6 moths	
b. 6-12 months	
c. 12 months – 3 years	
d. More than 3 years	

A 6. Do you have written job descriptions?　　　　　　　　　YES ☐　　NO ☐

A 7. Do you have the technical expertise to perform specific tasks?　YES ☐　　NO ☐

A 8. Have you ever been sent for practical training by your employer?　YES ☐　　NO ☐

A 9. Have you ever been sent for theoretical training by your employer?　YES ☐　　NO ☐

A 10. Is the interval between training sessions less than six months?　YES ☐　　NO ☐

SECTION B1: KNOWLEDGE ABOUT PROFILE OF THE CUSTOMERS

B1 1. Who are your major customers? _____.

Please select the most appropriate response by putting X in the appropriate box

B1 2. Do you know the estimated number of customers to be served on any given day? YES ☐ NO ☐

B1 3. Do you know the gender distribution of the customers? YES ☐ NO ☐

B1 4. Do you know the food habits of and preferences of the customers? YES ☐ NO ☐

B1 5. Do you know the age range of the customers? YES ☐ NO ☐

B1 6. Do you know the educational level of the customers? YES ☐ NO ☐

B1 7. Do you know the socioeconomic status of the customers? YES ☐ NO ☐

B1 8. Do you know the level of physical activities the patrons engage in? YES ☐ NO ☐

B1 9. Do you know the religion of most of the customers? YES ☐ NO ☐

SECTION B2: KNOWLEDGE ABOUT FOOD WASTE

General knowledge

Please indicate your answer by **X** in the appropriate box	Strongly Agree	Agree	Not sure	Disagree	Strongly Disagree
B2 1. Food waste has environmental damages.					
B2 2. I know food waste affect the economy.					
B2 3. Food waste has food security implications.					
B2 4. Being environmentally conscious is part of my daily life.					
B2 5. I am aware that reducing food waste could be a solution to waste management problems.					
B2 6. I am responsible for preventing food waste.					
B2 7. I have been taught / attended training / informed about food waste reduction before.					
B2 8. Careful menu planning contributes towards preventing food waste.					

SECTION B1: KNOWLEDGE ABOUT PROFILE OF THE CUSTOMERS

B1 1. Who are your major customers? _____.

Please select the most appropriate response by putting X in the appropriate box

B1 2. Do you know the estimated number of customers to be served on any given day? YES ☐ NO ☐

B1 3. Do you know the gender distribution of the customers? YES ☐ NO ☐

B1 4. Do you know the food habits of and preferences of the customers? YES ☐ NO ☐

B1 5. Do you know the age range of the customers? YES ☐ NO ☐

B1 6. Do you know the educational level of the customers? YES ☐ NO ☐

B1 7. Do you know the socioeconomic status of the customers? YES ☐ NO ☐

B1 8. Do you know the level of physical activities the patrons engage in? YES ☐ NO ☐

B1 9. Do you know the religion of most of the customers? YES ☐ NO ☐

SECTION B2: KNOWLEDGE ABOUT FOOD WASTE

General knowledge

Please indicate your answer by **X** in the appropriate box	Strongly Agree	Agree	Not sure	Disagree	Strongly Disagree
B2 1. Food waste has environmental damages.					
B2 2. I know food waste affect the economy.					
B2 3. Food waste has food security implications.					
B2 4. Being environmentally conscious is part of my daily life.					
B2 5. I am aware that reducing food waste could be a solution to waste management problems.					
B2 6. I am responsible for preventing food waste.					
B2 7. I have been taught / attended training / informed about food waste reduction before.					
B2 8. Careful menu planning contributes towards preventing food waste.					

Food storage

Please indicate your answer by **X** in the appropriate box	Strongly Agree	Agree	Not sure	Disagree	Strongly Disagree
B2 9. Improper food storage can cause food cross contamination and fast food spoilage.					
B2 10. High risk cooked and raw food stored between 5°C-60°C can lead to food spoilage.					
B2 11. Food rotation label is used to mark / indicate food expiry date before storing.					
B2 12. First-in, first-out (FIFO) is used to properly rotate stock.					
B2 13. Food that has reached sell-by date should be thrown away.					

Food preparation

Please indicate your answer by **X** in the appropriate box	Never	Sometimes	Always
B2 14. I peel all vegetables skin before cooking.			
B2 15. I boil all vegetable as a cooking method			
B2 16. I know the estimated number of customers when preparing food			
B2 17. I use the leftover quality food for the preparation of other meals			
B2 18. I display piles of food in the food display to attract customers			
B2 19. I use food garnishes e.g. with parsley for food presentation.			
B2 20. I use / follow standardized recipe when preparing food			

SECTION C: GREEN PRACTICES ON FOOD WASTE

Knowledge

Please indicate your answer by **X** in the appropriate box	Yes	No	Not sure
C1. I am well informed about green practices / eco-friendly practices			
C2. I know about food waste recycling methods			
C3. I don't think green practices can prevent / reduce food waste			
C4. I need training about green practices on food waste			
C5. I am confident that my company have initiated green practices on food waste to protect the environment.			

Waste separation

Please indicate your answer by **X** in the appropriate box	Yes	No	Not sure
C6. I know about waste separation.			
C7. There is a difference between dry and wet waste.			
C8. All types of food waste are recyclable			
C9. Food waste can be disposed in the same bin with other waste types.			

Managing food waste

C10. Please indicate any method used to manage food waste in your facility by X in the appropriate box

a. Composting ☐   b. Disposal ☐   c. Food Sharing Scheme ☐   d. Donate to a Food charity ☐

e. None ☐   f. Other_____.

Types of food waste
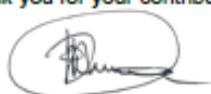
C11. Indicate which food items are mostly wasted in your facility with an X in the appropriate box

Vegetables	Fruits	Bread	Meat	Fish	Dairy Products	Drinks	Cooked food
a.	b.	c.	d.	e.	e.	f.	g.

C12. Indicate the amount of food wasted in your facility in a day by X in the appropriate box

large amount	An average amount	Very little
a.	b.	c.

Thank you for your contribution to this study.

....
Signature (P.H XABA)

ANNEXURE H   Observational checklist on food waste practices

OBSERVATION CHECKLIST FOR DETERMINING CURRENT PRACTICES OF FOOD HANDLERS ON FOOD WASTE IN SUPERMARKET KITCHENS

SUBJECT NR: 610004

DATE: _____   Supermarket: A   B   C

ACTIONS AND THE FACTORS OBSERVED		
Actions for the factor *"careful menu planning contributes towards preventing food waste"*	**Yes**	**No**
1. Does food handlers follow a standardized recipe?		
2. Does the food handler take into account the yield of all food? (Vegetables, fruits, meat)		
3. Does the food handler take into account the food seasonality?		
4. Does the food handler take into account the food regional climate?		
5. Are the meals planned to show pleasing food colour combinations?		
6. Are the meals planned to show pleasing food taste combinations?		
7. Are the meals planned to show pleasing food texture combinations?		
8. Are the resources sufficient for a varied menu?		
9. Does the menu items (meat, vegetables, and fruit) have cutting specifications?		
10. Are the cooking techniques specified for the food handlers?		
Actions for the factor *"careful menu execution contributes towards preventing food waste"*	**Yes**	**No**
11. Does the storage clerk comply with the food item quantities ordered by the kitchen staff?		
12. Does food handlers use a scale to weigh ingredients?		
13. Does food handlers prepare food in separate sections?		
14. Do food handlers use separate colour coded chopping boards?		
15. Does food handlers peel all vegetable skin when preparation food?		

	Yes	No
16. Does food handlers comply with cutting specifications of meat, vegetables and fruit?		
17. Do the staff members in charge of cooking comply with the specified cooking techniques?		
18. Does food handlers prepare food in different color?		
19. Does food handlers prepare food in different texture?		
20. Do the staff members comply with applying standardized recipes according to the number of customers?		
21. Does the quality of food ingredients used for food preparation looks fresh?		
22. Do food handlers make use of misshapen fruits and veggies to prepare food?		
23. Does food handlers use different techniques to prepare foods?		
24. Does food handlers cut uniform sizes of foods as per the specifications on the menu?		
25. Do the staff members comply with maintaining the required holding temperature between food preparation and service?		
Actions for the factor "*Proper practices during the distribution of meals contribute towards preventing food waste*"	**Yes**	**No**
26. Does the staff monitor food holding temperatures in the steam tables and salad buffets?		
27. Are standardized food service utensils used?		
28. Does deli food display piled up with lot of food?		
29. Do the food handlers serve the customers with agility and speed?		
30. Does food garnishes used for food presentations?		
31. Does the overall food display looks attractive?		
Actions for the factor "*Having a waste management plan contributes towards preventing food waste*"	**Yes**	**No**
32. Does food handlers use different bins to dispose different types of waste?		
33. Does food handlers dispose organic and non-organic food waste separately?		
34. Does food handlers close the bin after use to prevent flies attraction?		
35. Does food handlers throw a significant amount of food waste in the bin?		
36. Is the waste management plan implemented in the food service unit?		

Actions for the factor "*Good management practices during storage and in the inventory control of foods contribute towards preventing food waste*"	Yes	No
37. Does food items labelled/ dated in the refrigerator?		
38. Does potentially hazardous foods such as uncooked meat, poultry etc. stored separately from other foods?		
39. Does food in the refrigerator/freezer covered and shelved to allow circulation?		
40. Is there a cleaning schedule for the storage areas?		
Actions for the factor "*Applying good food handling practices contribute towards preventing food waste by spoilage*"	Yes	No
41. Do food handlers wash hands thoroughly and frequently?		
42. Do food handlers avoid touching of nose, ears, face and mouth while handling food?		
43. Do food handlers remove jewellery prior to working with food?		
44. Do food handlers make use of hair net/caps before handling food?		
45. Do food handlers keep their hair tied back before wearing a head net/cap?		
Actions for the factor "*Proper working conditions prevent errors and accidents, contributing towards minimizing food waste* "		
46. Is personal protective Equipment (PPE) available to workers?		
47. Do the workers wear PPE?		
48. Is the PPE clean every day?		

MENU PLANNING AS FOOD WASTE PREVENTING PRACTICE

A guideline for food handlers in supermarket kitchens

Contents

INTRODUCTION

Globally, an excessive amount of food produced for human consumption goes to waste (World Wild Fund [WWF] (2017). Food waste is an environmental, social and economic problem.

The largest amount of food waste and loss in South Africa is produced by agricultural/ post stage (50%) followed by processing and packaging (25%), distribution and retail at 20% with consumer level at 5% (WWF 2017). To realise the vision of a truly sustainable world, we all need to change the way we produce and consume our natural resources.

All sectors that contribute to the usage of natural resources and food waste are entitled to take initiatives at all levels, including the supermarkets as part of the food supply chain. Managing food waste leads to reduced costs for the organisation and for the environment (Mabaso & Hewson 2018:2).

PURPOSE OF THIS GUIDE

T he The purpose of this guide is to provide food waste guidelines and recommendations for kitchens in food service units, including supermarkets. The guide provides tools and techniques for reducing overall waste generation in food service unit kitchens and keeping recyclable and organic food out of waste destined for landfill. Factors that contribute to food waste are discussed, as well as proper food waste reduction practices. Every food service unit is hoped to be committed to reducing the amount of food waste generated for disposal. The cost of collecting and disposing of unnecessary food waste to the landfills is going up, and the landfill sites are progressively being filled up. This guide can be a customised plan to suit your business needs. We all have a duty to find alternative ways to deal with food waste.

> The following factors discussed below contributes to food waste in food service units' kitchens if not followed accordingly. Proper knowledge and practices are provided.

1. CAREFUL MENU PLANNING

According to Egan (2015:62) menu planning principles should include the following;

1.1 Customer satisfaction

- Knowing your customers (and potential customers) is obviously important when it comes to menu planning and design. Consider yourself as the customer. What are some of the factors that influence your liking or disliking of a menu?
- Gathering market research on our customers and researching food and menu trends can assist menu planners in keeping the menu fresh and satisfying for our customers.

1.2 Nutritional quality

- Consider dietary guidelines that specify how people should eat, and be aware that nutrition knowledge influences how we eat.
- Consider how nutrition trends such as smaller serving sizes, ethnic foods, and gluten-free diets influence menu planning. Consider the new food products and dishes.
- Customers may be misinformed about nutrition at times, and we must educate them while also attempting to feed them a well-balanced, healthy diet.
- In some cases, the menu also serves as a tool for nutrition education.
- The addition of unusual or unfamiliar foods may cause a customer to lose interest in eating entirely.

1.3 Aesthetics

The issue of aesthetics should not be overlooked. You've probably heard it before: we eat with our eyes. The presentation of our food, as well as texture, consistency, colour, shape, and preparation method, influences how we feel and think about a menu. It can even affect our appetite and desire to eat.

Figure 1 Colourful food example (Colourful plates 2024)

1.4 Management decision

When the menu is viewed as a management tool, a number of other menu-related factors enter the picture. Consider the following factors when creating a menu:

- Food costs and the foodservice operation's budgetary objectives.
- Capacity for production, including available equipment and personnel.
- Service type and food delivery system.
- Food availability.
- The business and foodservice philosophy

2. PROPER FOOD STORAGE AND INVENTORY CONTROL

The following section discusses food storage types, storage access control, food storage rules, labelling and dating of food items in storage areas, as well as sanitising and cleaning schedules of storage areas as factors that contribute to food waste.

2.1 Types of food storages

2.1.1 Dry Storage

- Non-perishables are foods that are shelf stable at room temperature and are stored in dry storage, such as grains, pulses, and dehydrated foods with low moisture content (Shukla 2018:55). The storage area should be dry and the temperature should not be higher than 70ºC. Certain organisms, such as moulds, thrive in a dark, moist environment. One of the most important aspects of dry storage is ventilation (Payne-Palacio and Theis 2016:206).

- Dry food should be stored at least 15cm above the deck, away from bulkheads, and away from direct sunlight.

- Foods must be stored in their original packaging and, once opened, in tightly sealed containers. This will keep insects, rodents, and microorganisms out of the food (Fernandes 2018:63).

- Storage facilities should provide adequate space as well as appropriate dust, insect, rodent, and other extraneous matter control and protection (Marriott et al. 2018:4).

- Bulk food products, such as sugar and flour, should be properly labelled before being emptied into storage containers (Atia & Abdelgawad 2018:21).

2.1.2 Refrigerated and freezer storages

- Non-perishable and semi-perishable foods are stored in refrigerators and freezers.

- Refrigerated food items are perishables and must be kept at a constant low temperature and at chilled/frozen temperatures, such as meat, dairy products, fruits, and vegetables.

- Perishables can be kept under normal refrigeration for 5-8 days, but deep freezing is required for longer storage. Semi-perishables, such as cheeses and eggs, can be kept at room temperature for a short period of time. Under refrigeration, the shelf life can be extended to about 30-90 days (Shukla 2018:55).

2.1 Food storage food rules

- All foods prepared ahead of time must be promptly stored in a refrigerator at or below 50 degrees Celsius.
- Cooked or ready-to-eat foods, as well as raw poultry, meat, or seafood, should be stored in separate sections of the refrigerator or freezer in the proper order. All food should be tightly wrapped or covered (Fernandes 2018:63).
- To avoid cross contamination, raw meat should be stored below cooked food (Atia & Abdelgawad 2018:22), and dripping liquids of raw uncooked foods in cooked or ready-to-eat foods should be avoided (Fernandes 2018:59).

2.1 Storage access control

Storeroom control not only prevents theft and pilferage, but also food spoilage, which can result in food waste of stock if not handled properly. As a result, store room rules that specify who is permitted to enter stores are required. After obtaining requisitions signed by authorised individuals, the item should be issued in accordance with the prescribed procedure (Shukla 2018:54).

2.2 Labelling and dating of food items in storage areas

- Proper storage techniques include making sure that food products are well organised so that employees can easily use older products first, find products when they are needed, and monitor inventory levels, as well as making sure that food does not spoil before use (EPA 2014:8).
- The first-in-first-out (FIFO) approach for stock rotation is commonly used to ensure that food is consumed before it expires (Betz, Buchli, Gobel, & Müller 2015:225).
- Food products with the most recent expiration dates should be used first. Furthermore, not only should the temperature and quality of food products be checked during the receiving stage, but the expiry date or shelf-life should be

checked as well to avoid storing food with a closer expiry date, which leads to food spoilage before use (Shukla 2018:55).

- Food, whether raw or cooked, must be stored in a clean, covered container with a label sticker after being removed from the container or package in which it arrived (Fernandes 2818:62).

- Labeling food items before storing them informs a food handler of when the food must be consumed. Use by dates should be included on highly perishable packaged foods such as cooked meat, fish, and dairy products. All ready-to-eat foods must bear a label that includes the food's name as well as a use by or expiration date. Items that are less perishable, such as dried fruits, flour, chips, and canned food, should have a best before date (Always food safe 2018).

Figure 2 Food storage label example (Morgan 2019)

2.3   Sanitising and cleaning of food storage areas

Sanitation refers to practices that aim to keep a clean and healthy environment for food production, processing, preparation, and storage. Sanitation is more than just cleanliness, and when done correctly, it can improve the aesthetic qualities and conditions of food preparation areas. Organised storage layouts with proper stock rotation can frequently reduce contamination, make cleaning easier, and contribute to a cleaner operation. Storage area floors should be swept or scrubbed, and shelves and/or racks should be cleaned and sanitised using appropriate cleaning compounds (Marriott, Schilling & Gravani 2018:90). Cleaning with soap and other detergents is the first step

in the cleaning process. Sanitation is also required. Cleaning removes dirt and grease but does not necessarily kill bacteria or other pathogens. Only a sanitiser will kill bacteria and make the area safe for food preparation. In any food service preparation area, a sanitation plan is essential. A cleaning schedule that specifies how each item should be cleaned, who is responsible for it, and how frequently it occurs (BC cook articulation committee 2015:43).

Figure 3 food preparation (Jonathan 2018)

3. PROPER FOOD PREPARATION

The complexities of food presentation, the ingredients used in cooking, and the need to know the exact temperatures at which foods come together best are all factors that kitchen staff must be intimately familiar with in order to prepare food at its best.

Most foods and ingredients are highly sensitive to overcooking and poor preparation techniques; for example, fresh fish will become rubbery and unappealing if cooked for even a few minutes too long. As a result, it is critical that the menu be created with an understanding of how skilled the kitchen staff will need to be in order to properly prepare the foods (Taylor *at el.* 2016:26).

3.1 Standardised recipe

A standardised recipe is a set of written instructions used to consistently prepare a known quantity and quality of food. A standardised recipe will produce a product that

is close to identical in taste and yield every time it is made, no matter who follows the directions. A good standardised recipe will include the following (Egan 2015:97);

- Menu item name – the name of the given recipe that should be consistent with the name on the menu.
- Total Yield – number of servings, or portions that a recipe produces, and often the total weight or volume of the recipe.
- Portion size – amount or size of the individual portion.
- Ingredient list/quantity – exact quantities of each ingredient (with the exception of spices that may be added to taste).
- Preparation procedures – Specific directions for the order of operations and types of operations (e.g., blend, fold, mix, sauté).
- Cooking temperatures and times, including HACCP critical control points and limits to ensure the dish is cooked properly and safely.
- Special instructions, according to the standard format used in an operation.
- Mise en place – a list of small equipment and individual ingredient preparation.
- Service instructions, including hot/cold storage.
- Plating/garnishing'

3.2 Benefits of using a standardised recipe include;

- Waste reduction.
- A consistent level of quality and quantity.
- Standard serving size/price.
- Ensuring nutritional content and dietary considerations, such as special diets or food allergies.
- Assisting in ensuring compliance with the "Truth in Menu" requirements.
- Assisting with purchasing and forecasting.
- Fewer food order mistakes.
- Incorporating work simplification principles and aiding in cross-training.
- Assisting in the training of new employees.

3.3 Avoid cross-contamination.

Proper guidelines to avoid cross-contamination in food preparation stage are as follows (Garden-Robinson 2017);

- Hands should be washed before beginning a task and after any interruption that could contaminate hands. It is preferable to use the hand washing sink rather than the prep sink.

- When harmful bacteria are transferred from one food to another via a nonfood surface, such as utensils, equipment, or human hands, this is referred to as cross contamination.

- Cross contamination can also happen from food to food, such as when thawed meat drips on ready-to-eat vegetables.

- Prevent cross contamination by observing the following recommendations:

- Use proper hand-washing techniques. Hands should be washed before putting on plastic gloves if they are to be worn. When changing tasks that could cause contamination, plastic gloves should be changed. Plastic gloves that are improperly used can contaminate foods just as easily as bare hands.

- When preparing food, use clean and sanitised utensils and cutting boards. After using, thoroughly clean cutting boards with hot soapy water, followed by a hot water rinse and a final sanitising step (1 tablespoon bleach per gallon of water).

- Cooked and raw foods should be stored separately.

- Wash all fresh fruits and vegetables in a produce sink with clear running water.
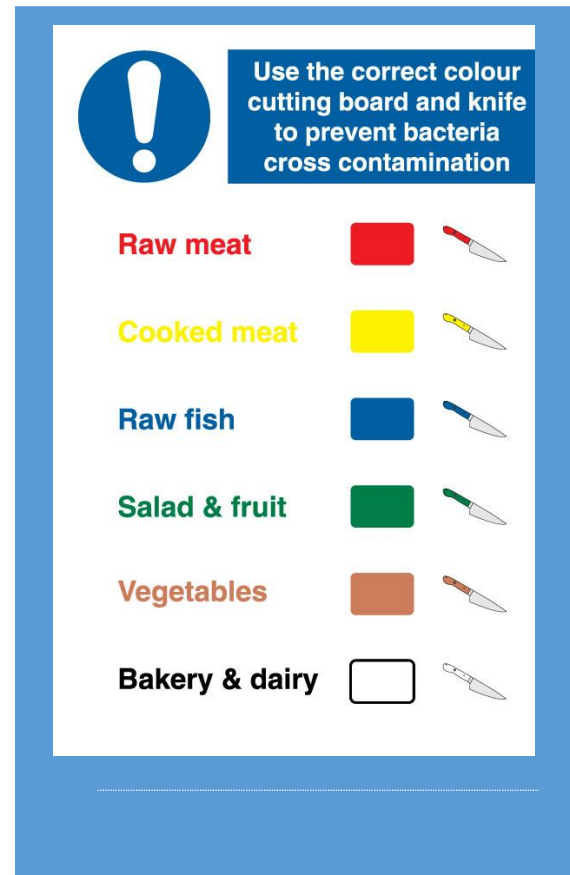
4. COOKING METHODS TECHNIQUES

Knowledge of cooking methods and techniques, as well as food component arrangement, is essential for reducing kitchen waste (Hennchen 2019:679). Food handlers should be familiar with the different types of cooking methods, such as dry heat and moist heat. Different types of cooking methods are discussed on the table below.

Table 1   Main cooking methods (Cousins 2014:101)

Cooking method	Procedure
Baking	Cooking in either a conventional or a fan oven. Dry cooking is a term that is frequently used.
Boiling	Cooking food in a simmering liquid.
Braising	Slow cooking in minimum liquid in a casserole dish with a lid.
Deep frying	Cooking by placing into deep fat held at a temperature of about 175–190 °C/ (350–375 °F).
Grilling	Quick and dry method of cooking food by radiant heat, either over heated charcoal Or under electric or gas salamanders.
Microwave	cooking or re-heating food using high frequency power in a microwave oven Powered by electricity.
Poaching	Cooking in a minimum amount of liquid held at simmering point.
Roasting	Cooking with dry heat in the oven.
Shallow frying	Cooking in the minimum amount of heated fat or oil.
Steaming	Cooking heat is transferred from the water vapor (steam) to the food being cooked.
Stewing	Very slow cooking of food items in their own juices and using the minimum amount of liquid, such as stock, in the process.
Water bath:	Technique of vacuum packing ingredients and cooking them at low temperatures in a water bath. This is a slow and gentle process where moisture is not expelled and flavour is retained.

5. TIME AND TEMPERATURE CONTROL

Food temperature and time control during the preparation, thawing, cooking, cooling, reheating, and serving food stages should be followed as specified by the Food and Drug Administration [FDA] (2017) food code to protect public health and ensure food is pure and accurately presented when offered to the consumer. Every food service unit establishment, including supermarket kitchens, should have a written plan regarding temperature and time for food preparation that states what will be monitored by when and by whom (Brown 2014:89). Some of the time and holding temperature control stages in food safe handling are as follows:

- **Hot and Cold Holding**

  Hot food should be kept at a temperature of 54°C or higher, while cold food should be kept at a temperature of 5°C or lower (FDA 2017:96).

- **Cooling**

  Food must be cooled within 2 hours between 57°C to 21°C and within 6 hours between 57°C to 5°C or less. Food, on the other hand, must be cooled within 4 hours to 5°C or less if made from ingredients at room temperature, such as reconstituted foods and canned tuna (FDA 2017:94).

- **Reheating**

  Controlling time and temperature for safety food that has been cooked, cooled, and reheated for hot holding must be reheated for 15 seconds so that all parts of the food
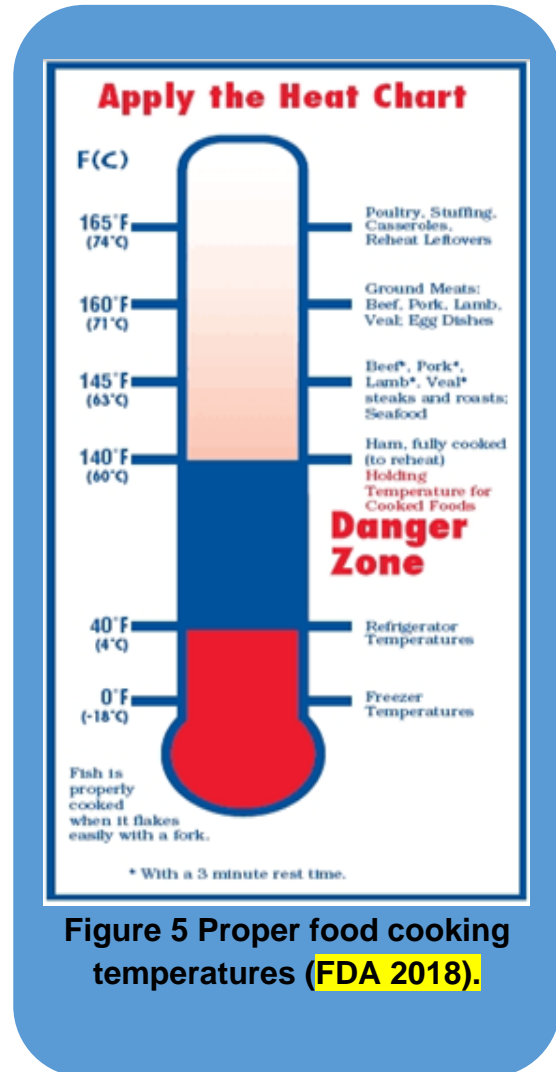
Figure 5 Proper food cooking temperatures (FDA 2018).

reach a temperature of at least 74ºC. Food must be kept between 5ºC and 2 hours (FDA 2017:91).

6. PROPER PRACTICES DURING THE DISTRIBUTION OF MEALS

One of the most significant causes of food deterioration in delicatessen cabinet displays is improper temperature control, which affects food quality, drying rate of food, and display shelf life in food service units during food distribution and serving (Hadawey, Tassou, Haddowe & Sundararajan 2018:324). If the proper temperature is not maintained in a hot or cold display, or if food is handled incorrectly, the chances of contamination increase. To avoid food display contamination, raw and cooked or ready-to-eat food should be displayed in separate units, separate serving utensils should be used for each food, and most importantly, food displays and utensils must be cleaned before use (Catering wholesalers 2019). The following guidelines illustrate safe food handling in food holding stage (Garden-Robinson 2017:6);

- Hot foods should be kept hot, and cold foods should be kept cold. Hot foods should be kept at 60ºC F or higher, and cold foods at 5oC or lower. Temperatures near the top surface should be measured on a regular basis before stirring; stir with a clean, sanitised utensil, then measure and record the temperature.
- Holding units, such as steam tables or chafing dishes, should not be used to cook or reheat foods.
- Hold cold foods in ice-filled serving containers; the food should not come into contact with the ice.
- Do not pile previously stored food on top of freshly prepared food. First, finish the food that was previously stored.
- Handling ready-to-eat foods such as lettuce, ham, and cheese with bare hands is not recommended. To handle food, use spatulas, tongs, clean plastic gloves, or deli tissue.

- Foods that have been out of temperature control for more than four hours should be discarded. Food variety and menu, food presentation, and overall food display appearance all have a significant impact on customer satisfaction and as well as staff service efficiency (Anu & Manorselvi 2021:1117).

7. PERSONAL HYGIENE GUIDELINES FOR EMPLOYEES

Personal hygiene is extremely important for foodservice workers. Personal hygiene policies should be reviewed with employees and posted as a reminder. Workers who have a cold, the flu, or another communicable illness, for example, should notify their supervisor and refrain from handling food. The following guidelines should be stressed to any worker dealing with food (Garden-Robinson 2017);

- Maintain your cleanliness by bathing daily, using deodorant, and washing your hair on a regular basis.
- Wear a hair restraint to keep your hair under control. Wear clean clothing/uniform and/or an apron.
- Avoid wearing jewellery, which can harbor bacteria and pose a physical hazard if pieces fall into food. Jewelry can also pose a personal safety risk if it becomes entangled in the equipment.
- Keep your fingernails clean, unpolished, and short.
- If you have open cuts or sores, use a bandage and plastic gloves. Employees may be required to perform non-food-related tasks until the wound heals in some cases.
- While on duty, do not chew gum.
- Do not smoke cigarettes while doing any part of the food preparation process.
- Avoid unprotected coughing or sneezing.
- After coughing or sneezing, wash your hands.

Wash hands thoroughly:

- Before beginning work.
- During food preparation, change tasks as often as necessary to avoid cross contamination when transitioning from raw to cooked foods.

After:

- Coughing, sneezing,
- Using a tissue or a handkerchief.
- Getting in contact with bare human body parts.
- Eating, drinking, or smoking
- Working with raw meats, poultry, and fish.
- Taking care of garbage, sweeping, or picking up items from the floor.
- Using cleaning products and other chemicals.
- Using the restroom.
- Handling soiled utensils and equipment.
- Alternating between raw and ready-to-eat foods.

8. GUIDELINES FOR ENSURING FOOD SAFETY

Table 2 Food safety guidelines (Environmental health in emergencies and disaster 2003:150).

Step	Danger	Measure
Storage	Contamination	Keep foods in wrapped or closed containers. Perform pest control.
	Reproduction of bacteria .	Monitor the time and temperature of storage. Follow the FIFO principle
Preparation	Contamination resulting from personal hygiene	Wash hands before touching the food. Prevent cross-contamination by surfaces and containers. Separate cooked foods from raw foods. Use boiling water, especially if the food will not undergo additionally cooking
	Reproduction of bacteria	Pay close attention to the amount of time foods remain at room temperature
Cooking	Survival of the pathogen	Make sure that the food is cooked well (the food in its entirety should have a temperature of 70°C)
Cooling and keeping at cool temperatures	Reproduction of the bacteria and spores which did not die in high temperature; toxin production	Make sure that the temperature of the food drops below 5°C as soon as possible when cooling it. Do not let foods remain at room temperature longer than two hours. Avoid storing too much food in the refrigerator or in the cool spaces in it. Beware of the thermal agitations in long-term cold storage.
	Contamination by various Sources	Wrap the foods appropriately and prevent their direct or indirect contact with raw foods Make sure that the food containers are clean when storing the cooked foods.
Waiting in high temperature	Reproduction of the bacteria and spores which did not die in high temperature; toxin production	Keep temperature of the food above 60°C.
Re-heating	Survival of the bacteria	Re-heat the food properly.
Service	Reproduction of bacteria, production of spores, and toxins	Re-heat the food properly.
	Contamination	Do not touch the food with hands. Serve the food hot. Prevent contact between uncooked foods and unclean containers.
HACCP: Hazard Analysis Critical Control Point		Follow all steps of HACCP accordingly.

9. GREEN PRACTICES

Green initiatives, in essence, optimise eco-friendly products that may be organic or manufactured with fewer natural resources and with social and ethical respect for the labor force, require less energy during usage, and can be recycled (Guyader, Ottosson & Witell 2016:319). According to DiPietro & Gregory (2013:2) Green practices are those used by organisations to reduce their carbon footprint and harm to the environment, such as excessive resource use, the use of non-recyclable products, ineffective recycling processes, and harmful chemical products. Below are some of the tips to reduce food waste.

Some of the kitchen tips that help in food waste reduction are indicated in Figure 3 below.

Prep and Storage Tips

☐ **Use leftovers from the day before.** Steak one day can be used for beef stew the next day.

☐ **Train staff on knife skills to make more efficient knife cuts** to use more of the food being prepared.

☐ **Use as much of the food as possible.** Cook up carrot greens and don't peel cucumbers or potatoes.

☐ **Reconstitute stalky vegetables that have wilted** by immersing them in warm water (100˚F) for 15 minutes.

☐ **Marinate meats** to extend their shelf life for a few more days.

☐ **Different foods like different storage conditions.** Refresh staff on storage techniques for different foods (e.g., don't store tomatoes and lettuce in the same container or near each other).

☐ **Use see-through storage containers.** Easily see what is available and keep an eye on freshness.

☐ **Cook, freeze, juice, or otherwise process foods** that are approaching the end of their peak freshness to prolong their useful life.

Store Set Up and Display Tips

☐ **Set up a discount shelf for ripe, near-to-expire, discontinued, or slightly damaged food.** Provide clear communication about this reduced price section.

☐ **Redesign product displays with less excess.** For example, instead of a pile of produce, have a back support that makes it look like a pile to keep produce fresher.

☐ **Allow prepared foods to run out near store closing.** Track these items and only make as much as you can sell.

Engaging with Customers Tips

☐ **Provide taste samples.** Train staff to remind customers that they can try a sample to see if they like a product before they buy it.

☐ **Have best storage practices information available** in appropriate departments for certain foods, including how long food should last when stored properly.

☐ **Offer various options to your customers on produce** (e.g., whole, sliced, and mixed fruit). This will assist them in eliminating food loss in their own homes.

Figure 3Food waste preparation tips. Adapted from EPA (2019).

10. PROPER FOOD WASTE MANAGEMENT PLAN

10.1 Food recovery waste hierarchy

The food recovery hierarchy Figure below indicates the most and least preferred solutions of managing food waste (EPA 2019). The first step is the source reduction, followed by the second option which is to feed hungry people, thirdly is to feed animals, the forth one is the industrial use, lastly is landfilling. These are the steps that can be adopted by food service units to manage food waste.
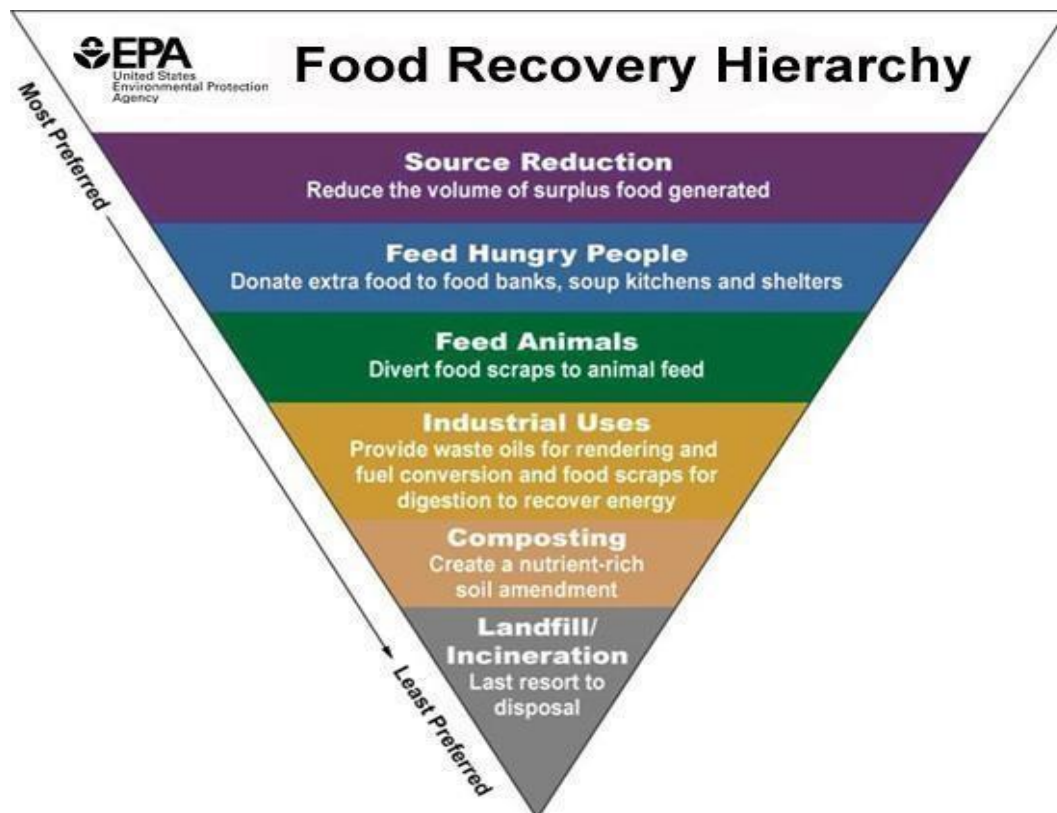
Figure 6 The food waste recovery pyramid (EPA 2019).

The following food waste management guidelines are recommended by the Association of Whistler Area Residents for the Environment [AWARE] (2016). The first

step is to evaluate current waste practices and identify areas for improvement, followed by understanding options for waste segregation infrastructure, training staff, and establishing continuous monitoring.

10.2 Evaluating existing waste practices and identifying areas for Improvement

- The first step in identifying opportunities for improvement is to understand where and how waste is generated.
- The depth and scope of an initial waste review and ongoing waste monitoring will be determined by available budgets, waste flow, and staff support.
- Waste audits can be as simple as routinely observing the amount and variety of materials that end up in garbage, compost, and recycling bins.
- Understanding the amount and type of waste generated will aid in identifying necessary changes to existing waste management policies and operating practices.
- You can't manage something if you don't measure it. Continuous waste monitoring enables businesses to save money while improving recycling performance.
- Engaging supervisors and employees early on will aid in the identification and understanding of existing waste practices, as well as the development of shared responsibility, which increases the likelihood of success when implementing future changes.
- Invite employees to become "champions" of waste management and involve them in monitoring reduction efforts.

Methods for monitoring waste

- Do visual observations.
- Discuss waste data with waste collectors.
- Conduct a thorough waste audit.

10.3 Understanding options for waste segregation infrastructure

- To maximise recycling and minimise contamination, waste sorting areas should be convenient, easy to use, and intuitive.
- Consider how employees and customers 'flow' through the company.
- Ensure that waste-sorting stations are visible, easily accessible, and correctly used.

Install clear signage

- Clear, image-based signs in a variety of formats have been created, which can be used to create signage, posters, or bin labels.
- Using standard signage will assist people in correctly sorting waste.
- They will become accustomed to seeing the same images and colors on signage.

Consider using color coded bins

- When choosing bins or bin lids, consider using three different colors of bin to represent the three streams of collection.

- This would imply that green would be used for organics, black for garbage to landfill, and blue for all other recycling.

- Signage or labels can then be used to distinguish between blue bins.

In the garbage room

- Organic waste and recyclable materials are collected in bins provided by waste hauling companies in the main garbage area.

Figure 7: Color coded waste bins (Conrad 2021)

- The containers used to collect organics within the business will be chosen based on the layout of the business spaces.
- Consider the path waste takes from daily business operations to the garbage room.
- Is there a staircase? How far must employees transport waste?
- How should waste be moved from the business to the garbage room?
- Is it better to collect food scraps in the provided service bins and wheel them to the garbage room, or to collect in smaller bins and then empty them into the garbage room's service bins?
- Keep in mind that organic waste can be bulky.
- Bins must be kept in good condition in both indoor and outdoor areas so that they can be easily and safely accessed.
- Keeping garbage rooms clean, tidy, and well-lit ensures that employees are comfortable taking the time to sort waste correctly and establishes the expectation that waste should be disposed of responsibly.
- Waste collectors can assist in keeping garbage rooms clean by replacing or cleaning dirty bins, and they frequently offer services to power wash garbage rooms.
- Do not leave trash on the floor or on top of waste bins.

Setting up for success:

- To encourage full separation, pair food waste bins with garbage and recycling bins.
- Identify waste collection points, such as food prep stations, the line, dish pits, and front of house stations.
- By providing centralised waste collection points, supervisors can more easily monitor and review waste levels and contamination.
- Use clear, color-coded labels to help users identify where waste should go.
- Post waste sorting information in high traffic areas such as the kitchen, staff information boards, or the employee break room, such as educational posters or updates on new products and their disposal.

Points to consider when reviewing collection stations:

- determining bin locations and the number of bins required.

- The use of bin liners and the leads.

- Bins must be emptied.

- Keeping waste bins clean.

- Maintaining system consistency.

10.4 Training staff and building in monitoring

Monitoring and quality control are the most important aspects of maintaining a business waste management programme once food waste collection processes are established. A long-term commitment to continuous improvement is required.

10.4.1 Involve Staff

- Helping employees understand why food waste is separated can often result in increased vigilance.

- Include a description of food waste and recycling systems during new employee orientation.

- During staff briefings, provide regular feedback updates to the team.

- To achieve better results, demonstrate the system in action or discuss problem areas.

- Help staff understand the importance of correct waste segregation

- When waste is contaminated, recycling facilities find it extremely difficult to process it, which can result in batches of recyclable materials being sent to landfill. The level of contamination that is acceptable in waste varies depending on the equipment at facilities. Staff buy-in can be increased by helping them understand why contamination affects recycling.

10.4.2 Keep it Simple

- Allow employees to customise the system to their needs. For example, a staff member may need a container on or near their workspace to complete a task, with the understanding that the container will be emptied into the main organics bin once completed.

- Ensure that no changes are made that will impact or confuse other members of the team who are also attempting to segregate waste (for example, if one employee wheels the main organics bin next to their workstation the rest of the team may simply start putting food scraps in the garbage as a result of being unable to quickly locate the organics bin).

10.4.3 Plan for continued education

- Plan to engage and educate staff on a regular basis once the organics collection system is in place.

- Continuously reinforcing the importance of following waste management systems will increase the likelihood of success, especially in high-turnover teams.

- Include waste information in training, staff briefings, staff areas, and via e-mail.

- Focus on information that provides practical guidance (for example, what goes where), generates interest (for example, why waste reduction is important to the business), and shares success tips.

- To assist with waste separation, provide posters, information, appropriate equipment, and appropriately sized containers. Posters can also be used to educate staff and customers about the environmental benefits of organics collection and recycling.

11. PARTNERSHIP

- Partner with public and private food waste reduction organisations such as non-governmental organisations (NGOs) to promote food waste awareness (Food Wise Hong Kong 2013).

- Partner with organic food waste recycling organisations to collect recyclable food waste.

Figure 8: Organic recyclable food waste (Jennie 2018)

- Partner with different local food banks and charities.

- Make use of latest technology such as smartphones and social media platforms to communicate with different food banks and charities for food surplus collection (WWF 2018).

12. BUILD IN MONITORING

- Check on a regular basis to ensure that staff members understand how to use the food scraps and recycling bins.

- Check in at staff meetings if you have any waste-related questions or issues. Plan to review how much food waste is produced on a regular basis and which processes are causing waste.

- Consider incorporating monitoring into daily staff checklists; this will allow contaminants to be easily identified and avoided.

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ANNEXURE J   Turnitin report

Dissertation

by Philisiwe Xaba

Dissertation

ANNEXURE K Declaration of language editing

Linda Scott
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To whom it may concern

This is to confirm that I, the undersigned, have language edited the **dissertation** of

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for the degree

Magister Technologiae in Food and Beverage Management

entitled:

*DETERMINING FOOD WASTE KNOWLEDGE AND PRACTICES BY
FOOD HANDLERS IN SUPERMARKET KITCHENS IN SOWETO SOUTH
AFRICA*

The responsibility of implementing the recommended language changes rests with the author of the document.

Yours truly,

Linda Scott