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Consumers' understanding of food waste and their attribution of blame

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Verbruikers se begrip van voedselafval en hul toeskrywing van skuld

deur

Shandré Candiotes

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Declaration

I, Shandré Candiotes, declare that this dissertation submitted for the degree of Masters in Consumer Science Food Management at the University of Pretoria, is my own work and has not been submitted to any other tertiary institution for a degree. In all cases where secondary work was used, the original authors have been acknowledged according to the University's requirements and guidelines.

SHANDRÉ CANDIOTES

November 2019

Abstract

Consumers' understanding of
food waste and their attribution of blame for household food waste in South Africa

by

Shandré Candiotes

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Department: Consumer and Food Sciences

Degree: Masters in Consumer Science Food Management

Reflecting on the emergence of a past civilisation, evidence suggests that the supply and availability of food has played a significant role. For the last few decades, food has been appraised as being relatively cheap, readily available and more accessible than any other time in history. This could partly explain why food is often so easily wasted across the food supply chain and beyond. In South Africa alone, an average of 11 million people are deemed food insecure. The country has the highest proportion of food wastage in Africa. The latest figures present that South Africa disposes of approximately one third (10.2 million tonnes) of food produced which costs the country R61.5 billion (Current exchange rate R14.39 = $1) (2.1% of national GDP) annually. Because the mitigation of food waste is an essential element of ensuring South Africa's sustainability, one would expect heightened awareness of food waste from farm to fork. Unfortunately, this is not yet a reality and the primary reason for this can be attributed to the lack of a proper definition of food waste. The reviewing of literature on food waste poses a scenario where one is not only confronted with but also confused by the myriad definitions presented.

The principal aims of this study were to investigate and describe consumers' definition of food waste, to investigate their self-reported food waste practices and lastly, to identify who they think

is best equipped to address food waste concerns in South Africa. A structured, self-administered electronic questionnaire was used to collect quantifiable data from respondents recruited across Gauteng, South Africa. The data analysis included both descriptive and inferential statistics. Regarding inferential statistics, analysis of variances (ANOVA) were used to test for possible, significant differences between demographic groups.

Results revealed that respondents, unfortunately, do not acknowledge food wasted during production, processing, or distribution (pre-consumer stages). Respondents mostly did not view industry food waste as a concerning issue, which indicated that consumers were more likely to define food waste as a household problem. In terms of self-reported food waste, respondents indicated that they waste (percentage per commodity) mostly vegetables (21,10%), fruit (20,14%), bread (19,22%) and dairy (14,22%). When prompted to indicate whom they felt is best equipped to address the food waste problem in South Africa, respondents revealed that food retailers and the government should take the lead.

Going forward, South Africa, as an emerging economy that is facing food insecurity, needs to address current food waste practices and act to reduce food waste to ensure a sustainable supply of food for future generations.

Keywords: food waste, consumers' understanding, attribution of blame, sustainability

Opsomming

Verbruikers se begrip van
voedselafval en hul toeskrywing van skuld vir huishoudelike voedselafval in Suid-Afrika

deur

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Graad: Meesters in Verbruikerswetenskap Voedselbestuur

As 'n mens nadink oor die ontstaan van 'n beskawing uit die verlede, dui dit daarop dat voedsel en beskikbaarheid van voedsel 'n belangrike rol gespeel het. Die afgelope paar dekades is kos gesien as relatief goedkoop, geredelik beskikbaar en toegankliker as ooit van te vore. Dit kan deels verklaar waarom voedsel dikwels so maklik deur die voedsel voorsienings ketting en selfs daarna vermors word. In Suid-Afrika word gemiddeld 11 miljoen mense beskou as voedsel onsekuur. Tog het die land die grootste hoeveelheid vermorsing in Afrika. Die jongste syfers toon dat Suid-Afrika jaarliks ongeveer een derde (10,2 miljoen ton) van alle geproduseerde voedsel oor die land vermors, 'n geskatte waarde van R61,5 miljard (huidige wisselkoers R14,39 = $ 1) (2,1% van die nasionale BBP). Omdat vermindering van voedselafval 'n wesenlike element is om Suid-Afrika se volhoubaarheid te verseker, sou 'n mens 'n groter bewustheid reg deur, van plaas tot vurk, verwag. Ongelukkig is dit nog nie 'n werklikheid nie, en die primêre rede kan toegeskryf word aan die gebrek aan 'n behoorlike definisie vir voedsel vermorsing. 'n Studie van literatuur oor voedsel vermorsing skep 'n scenario waar 'n mens nie net oorweldig word nie, maar dikwels ook verwar word deur die magdom definisies wat voorgestel word.

Die hoof fokus van hierdie studie was eerstens om verbruikers se definisie van voedselafval te ondersoek en te beskryf. Tweedens, om verbruikers se self gerapporteerde praktyke van voedsel vermorsing te ondersoek. Laastens, om vas te stel wie verbruikers dink die beste toegerus is om probleme aangaande voedsel vermorsing in Suid-Afrika aan te spreek. 'n Gestruktureerde, self-geadministreerde elektroniese vraelys is gebruik om meetbare data in te samel van respondente in Gauteng, Suid-Afrika. Die data-analise het sowel beskrywende statistieke as afleidende statistieke ingesluit. Wat afleidings statistieke betref, is ’n variansie analise (ANOVA) gebruik om te toets vir moontlike beduidende verskille tussen demografiese groepe.

Die resultate het dit aan die lig gebring dat respondente ongelukkig nie voedsel wat vermors is tydens die produksie, verwerking en verspreiding fases (voor verbruikers fases) erken nie. Respondente het meestal nie dié vermorsing van voedsel as 'n aangeleentheid beskou nie, wat aangedui het dat verbruikers meer geneig was om voedselafval as 'n huishoudelike probleem te identifiseer. In terme van self-gerapporteerde voedsel vermorsing het respondente aangedui dat hulle (persentasie per kommoditeit) meestal groente (21,10%), vrugte (20,14%), brood (19,22%) en suiwel (14,22%) vermors. Op aanvraag om aan te dui wie die respondente voel die beste toegerus is om die probleem van voedsel vermorsing in Suid-Afrika aan te spreek, het die hulle dit laat blyk dat voedsel handelaars en die regering die leiding moet neem.

‘n Ontluikende Suid-Afrikaanse ekonomie wat voedsel onsekerheid in die gesig staar, moet dus die huidige voedselvermosingspraktyke aanspreek en, dus, voedsel vermorsing verminder om 'n volhoubare voedselvoorraad vir toekomstige geslagte te verseker.

Sleutelwoorde: voedselvermorsing, begrip van die verbruiker, die erkenning van skuld, volhoubaarheid

Dedication

Dedicated to God and my family.

I would like to thank above all God almighty for giving me the strength to complete this journey. I praise you Lord for all my blessings throughout this journey.

Mom (Elria Jongbloed), thank you for always pushing me in such a manner that I am self-motivated and competing to be a better me. Thank you to my second dad (Auwke Jongbloed) for always listening and at time pretend to understand what I was trying to say.

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List of Abbreviations

CSIR	Council for Scientific and Industrial Research
DEA	Department of Environmental Affairs
DEAT	Department of Environmental Affairs and Tourism
EU	European Union
FAO	Food and Agricultural Organisation of the United Nations
FSC	Food supply chain
GDP	Gross Domestic Product
NWMS	National Waste Management Strategy
SA	South Africa
SDG	Sustainable Development Goals
UK	United Kingdom
WRAP	Waste & Resources Action Programme
WWF	Worldwide Fund for nature

Chapter 1

INTRODUCTION

This chapter presents the background of the research, introduces the problem statement, justifies the research and gives a brief overview of the research design, aim and objectives of this study.

1.1 INTRODUCTION

Food waste is a major global concern as 1.3 billion tonnes of food are wasted annually (Gustavsson, Cederberg, Sonesson, Van Otterdijk & Meybeck, 2011). This is approximately a third of all edible parts of food produced for human consumption (FAO, 2010). Food waste impacts three environments, namely: the economy, nature and society. Economically, food waste costs billions of Rands each year (D'Oliveira, 2013). In SA, recent estimates indicate 9.04 million tonnes of annual food waste (Blaine, 2013) which costs the country R75 billion each year (De Lange & Nahman, 2015). In the natural environment, valuable resources like water and energy may be lost when food is wasted, because these resources cannot be reused once they've been absorbed (Blaine, 2013). Socially, food waste contributes to food insecurity; one in seven consumers globally do not have access to sufficient nutritious food, resulting in malnutrition (Godfray, Beddington, Crute, Haddad, Lawrence, Muir, Pretty, Robinson, Thomas & Toulmin, 2012). This issue is exacerbated in many African countries such as SA where many households struggle to access sufficient nutritious food (Godfray, Beddington, Crute, Haddad, Lawrence, Muir, Pretty, Robinson, Thomas & Toulmin, 2012). Recent literature explains that whilst 14 million people in SA go to bed hungry most nights, estimates indicate that the average South African consumer still wastes approximately 7 kg per annum (Oelofse & Nahman, 2012). This is an issue that warrants urgent attention.

Gustavsson *et al*. (2011) state that in contrast to high-income countries, such as North America where food is mostly wasted at household level, many countries with emerging economies tend to waste food in the early stages of the food supply chain. This implies that most food is wasted before it reaches the consumer's table. The food supply chain includes many sectors where food is wasted. The four main sectors are: farmer, food manufacturer, food retailer and consumer (Gustavsson *et al*., 2011). In 1997, the Kyoto protocol was implemented to fight drastic climate

changes and, more specifically, address food waste in the early stages of the food supply chain. The protocol stipulated that countries must reduce their overall greenhouse gas emissions, including CO^2 gas emissions that are derived from food waste, by 5.2% by 2012 (MacCracken, Edmonds, Kim & Sands, 1999). As a result, the South African government encouraged a greater awareness in the food industry and implemented strict waste management principles such as donating expired food that is still safe for consumption (Nahman & De Lange, 2013). Unfortunately, many retailers are still driven by unrealistic consumer demands that often result in unnecessary food waste (Parfitt, Barthel & Macnaughton, 2010). Compared to many first world countries like the UK that committed to the Kyoto protocol, SA, as an emerging economy, managed to only recently commit to any ratification in terms of food waste management regulations and/or penalties (Ten Doeschate, 2016). This resulted in many food industries and households disregarding the problem of food waste. Consumers often feel powerless in terms of addressing their household food waste. This has not only led to ignorance about food waste, but it has also caused customers to feel contempt for/revert blame to the government and food retailers (Krzywoszynska, 2011). Current food waste estimates present that SA's food waste is on par with that of developed countries such as the USA (Parfitt *et al*., 2010). To date, household food demands and their contribution to food waste have received little attention. In most South African households, sustainable waste management is not part of their daily routine (Oelofse & Nahman, 2012; Parfitt *et al*., 2010).

Recent research indicates that consumers are initially reluctant to notice unsustainable waste practices. This is the result of consumers lacking understanding of possible sustainable alternatives (Parfitt *et al*., 2010). SA is recognised as one of the leading countries in Africa and thus could be an inspiration to the rest of the continent, which means that it is essential that food waste management is encouraged at all levels, especially at consumer level (Parfitt *et al*., 2010). To do this, one must address consumers' understanding of and possible reasons for food waste. Consumers assign locus (judgement of who is responsible for food waste) to either themselves (internal attribution) or to external parties (external attribution like a food retailer) (Weiner, 1985). Consumers' wasteful behaviour can either be attributed to controllable (e.g. the amount of food prepared) or uncontrollable reasons (e.g. use-by-date markings and food items that can only be purchased in bulk and not in single servings) (Williams, Wikström, Otterbring, Löfgren & Gustafsson, 2012). Parfitt *et al*. (2010) state that neglecting to address consumers' understanding will result in little to no behavioural change, which will have direct consequences for the future.

It is postulated that consumers can be empowered through addressing their current understanding of food waste. According to Vermeir and Verbeke (2006), consumers are keen to mitigate unsustainable food waste practices, but many fail due to a lack of understanding. This study therefor aims to provide empirical evidence regarding consumers' current understanding of

and possible reasons for food waste. Furthermore, it aims to investigate consumers' attribution of blame regarding food waste.

1.2 PROBLEM STATEMENT

Food waste is not only an issue in SA, but also globally (FAO, 2010). Food waste contributes to food insecurity, costs billions annually and uses valuable resources including energy, water and land (D'Oliveira, 2013; Blaine, 2013). Only a few countries have acted to reduce food waste by implementing waste management strategies and through reducing carbon emissions (Kortland, 2007). In the last twenty years, both the UK and Germany have implemented systems in line with the Kyoto Protocol of 1997 to successfully reduce their waste and carbon emissions. These systems include managing waste through source separation and regulating the amounts sent to landfills. Germany is close to reaching a sustainable and environmentally friendly system to deal with food waste and already produces five times fewer carbon emissions than the UK (Mühle, Balsam & Cheeseman, 2009).

Contrarily, SA has a growing economy but has not implemented any food waste management strategies, which has resulted in an annual financial loss of R61.5 billion (D'Oliveira, 2013). Due to SA's financial loss and status as a food insecure country, food waste can no longer be ignored (Crush & Caesar, 2014). The problem in SA is that current estimates regarding food waste losses are mostly based on the early stages of the food supply chain (Oelofse & Nahman 2012) and do not consider the contribution of food waste by South African households. According to Vermeir and Verbeke (2006), consumers' understanding of a concept such as food waste can have a direct influence not only on their food waste management practices, but also on their ultimate attribution of blame. SA, with its emerging economy and vast numbers of food insecure/vulnerable citizens, can no longer turn a blind eye when it comes to food waste. Therefore, this study aims to explore consumers' understanding of food waste, their current food waste practices and possible reasons for food waste. Finally, the study focuses on exploring and describing consumers' attribution of blame in order to reveal possible role players who could be held accountable and who could assist in taking charge in terms of future mitigation.

1.3 JUSTIFICATION OF RESEARCH STUDY

Currently, South African consumers seldom manage food waste proactively in their households (Parfitt *et al*., 2010). This could be attributed to customers' sense of responsibility and/or attribution of blame (Cicatiello, Franco, Pancino & Blasi, 2016). From the consumers' perspective, the blame is either attributed to themselves (internal locus of control) or external parties.

According to Blaine (2013), consumers who lack understanding of food waste and the impact thereof do not limit their household food waste. To mitigate current behaviour, it is therefore essential to address not only consumers' understanding of food waste but also their sense of responsibility (Daniels *et al*., 2011). This research could present the following contributions:

Academic contribution: This study will aid in understanding the concept of food waste from a South African household perspective. As stated by Parfitt *et al*. (2010), consumers' understanding has a direct impact on their daily food waste practices and the amount of food waste.

This study will contribute to the Department of Consumer and Food Sciences and towards food wastage research projects. It will also aid research in sustainable food practices and behaviour. The relationship between the Department of Consumer and Food Sciences and Council for Scientific and Industrial Research (CSIR) as part of the CEO project will be supported by this study.

Consumer contribution: Investigating the reasons why consumers waste food could help implement solutions to manage their household food waste more proactively. This study could help consumers understand how their household food waste practices impact the social, economic and natural environments and therefore highlight their contribution and responsibility in order to influence other consumers to lessen the amount of food they waste.

Government-related: According to Nahman and De Lange (2013), it is essential for the South African government to investigate consumers' understanding of food waste to address related issues such as greenhouse gas emissions and food insecurity. D'Oliveira (2013) states that the government should start addressing household food waste and have legislation in place to reduce this on-going global issue. This study's findings could present recommendations that could assist in improving legislation regarding the management of food waste and related issues.

1.4 RESEARCH AIM AND OBJECTIVES

The principal aim of this study is to investigate and describe consumers' understanding of food waste and how it is reflected in their attribution of blame and current food waste practices.

The following objectives were identified to ensure that the applicable data was obtained to formulate an appropriate conclusion.

Objective 1: To investigate consumers' understanding of food waste and current food waste practices.

The following objectives were formulated to investigate and describe consumers' understanding of household food waste and current food waste practices. The main aim was to describe consumers' understanding of household food waste and secondly to present consumers' self-reported food waste figures.

- **Objective 1.1:** To investigate and describe consumers' understanding of food waste.
- **Objective 1.2:** To investigate and present consumers' self-reported food waste figures.

Objective 2: To investigate possible reasons for household food waste.

The following objective was formulated to identify and describe possible reasons for consumers' household food waste. The aim was to explore possible reasons for food waste and identify significant differences between demographic groups.

- **Objective 2:** To identify and describe possible reasons for household food waste and identify its controllability (controllable or uncontrollable by the consumer).

Objective 3: To investigate consumers' attribution of blame

The following objectives were formulated to explore and describe consumers' attribution of blame. The aim was to explore whom consumers perceive as the most responsible party and to explain who consumers believe is best equipped to address food waste in South Africa.

- **Objective 3.1:** To explore and describe consumers' perception of who is responsible (internal or external locus of control) for food waste.

- **Objective 3.2:** To explore and describe consumers' perception of who is best equipped to address food waste in South Africa.

1.5 STUDY AREA

The geographic area for this study is Gauteng, South Africa. Gauteng (map provided below) is the smallest province with the largest number of people in South Africa (approximately 13 million people) (STATS SA, 2016). Gauteng consists of three metropolitan and two district municipalities (SA Venues, 2017).

FIGURE 1.1: MAP OF GAUTENG (SA VENUES, 2017)

This province, thanks to its economic growth, not only makes it possible for consumers to have easy access to food, but it also possesses the capital to establish a system in line with the Kyoto Protocol to reduce food waste.

1.6 RESEARCH DESIGN AND METHODOLOGY

The research included both exploratory and descriptive investigations. The exploratory investigation entailed exploring consumers' current waste practices, understanding of and possible reasons for food waste. The descriptive investigation that followed aimed at gaining insight into consumers' attribution of blame and ultimate ability to mitigate unsustainable food waste practices.

This study followed a quantitative approach. Primary data was collected in a single phase using a structured questionnaire to achieve the aim and objectives set for this study. The electronic questionnaire (via an e-mail link) commenced by collecting responses regarding consumers' understanding of food waste and food waste management practices. Data collected for consumers' attribution of blame focused on whom consumers blame for food waste and who is best equipped to address food waste in South Africa.

The structured questionnaire formed part of a more extensive investigation titled *Food wastage, sustainability and triple bottom line – A case study of urban households in Gauteng, South Africa.* Only relevant sections of the main questionnaire for data collection were indicated to ensure the relevance, accuracy and validity of this study. The relevant sections are discussed in Chapter 3.

1.6.1 The unit of analysis

The unit of analysis was female and male consumers aged 21 and older. The study area was Gauteng, South Africa. The only prerequisites for the respondents were that they had that to be responsible for food purchasing, main preparation of food and waste management skills in their household.

The respondents' income, population group and educational were not considered restrictions in their participation in the study.

1.6.2 Sampling technique and size

Convenience sampling was used for this study. It is preferred since it is fast, inexpensive, easy and respondents are readily available (Salkind, 2012). The online survey was distributed through snowball sampling. The researcher could collect a large amount of data in a shorter period. The disadvantage of this type of sampling is that the researcher cannot always control who the respondents are and whether they meet the minimum requirements. The researchers can also

not interpret the respondent's mood that might influence the reliability of their answers (Areni, 2003; Salkind, 2012).

The online survey (Addendum A) was distributed by thirty fieldworkers, including the primary investigator. A total of 1767 questionnaires were distributed, of which 1143 were completed and returned.

1.7 THEORETICAL PERSPECTIVE

Weiner's (1986) attribution theory was appropriate for this study and was used as a guideline for the discussion of the results. This theory has two primary dimensions which are used in this study, namely: locus of control and controllability. This theory aided understanding of who consumers blame for food waste through locus of control. This dimension is influenced by consumers' opinion on who is "to blame" when it comes to food waste (Weiner, 1986). Thus, consumers either blame themselves or an external role player (e.g. food manufacturer) for current food waste figures in South Africa.

The second-dimension, controllability, aided the investigation of possible reasons for household food waste. Consumers thus evaluate whether the reason for food waste is **controllable** or **uncontrollable**. Consumers can control factors such as the amount of food that is prepared for their family, but they cannot neccesarily control the date labelling on packaging.

1.8 ETHICS

The University of Pretoria has a formal code of conduct where all potential research proposals are first evaluated. The Ethics Committee of the Faculty of Natural and Agricultural Sciences must approve the proposal, including its measuring instrument, before a research study can continue (reference number, EC150518-011 – reflected in Addendum B).

The questionnaire for this study had a cover letter stating the aim of the study and ensured confidentiality to potential respondents. Respondents were guaranteed that all the information gathered for this study would be handled with care and confidentiality. De Vos, Strydom, Fouché and Delport (2011) emphasise the importance of respondents participating willingly to ensure that

this study is valid and reliable. Thus, only respondents that were willing to participate were identified for this study.

It was essential for the researcher to ensure that concepts and ideas were referenced accordingly to avoid plagiarism. The results for this study were also carefully evaluated through a statistical program to ensure that data collected was not abused.

1.9 STRUCTURE OF THE STUDY

This dissertation is presented in five chapters.

Chapter 1: Introduction

This chapter presents the background of the research, introduces the problem statement, justifies the research and gives a brief overview of the research design, aim and objectives for this study.

Chapter 2: Supporting literature and the theoretical perspective

Chapter 2 commences with a comprehensive literature review which presents the main themes of the study, which are: the definition and discussion of food wastage and the importance and role of the current food supply chain. This is followed by an introduction and explication relating to the theoretical perspective chosen for this study (Weiner's attribution theory). This order was implemented because the theoretical perspective not only guides the investigation from the onset but ultimately also allows for a more in-depth insight and discussion of the literature reviewed. This chapter concludes by presenting the conceptual framework and objectives set for this study.

Chapter 3: Research design and methodology

Chapter 3 presents the research design and methodology that served as the background for the collection and analysis of data for this the study.

Chapter 4: Results and discussion

Chapter 4 presents the results as well as a discussion regarding the objectives set for this study. It also follows the outline of the conceptual framework.

Chapter 5: Conclusion

This chapter presents the conclusions of the research regarding the main objectives set for the study. Recommendations are based on the interpretation of the findings with specific attention to how the intricate issue of food waste could be better managed and/or mitigated through acknowledging and understanding consumer attribution of blame. Shortcomings of the study are highlighted and assisted in the idea formulation for future research.

1.10 DEFINITIONS

TABLE 1.1: TERMS AND CONCEPTS

TERMS AND CONCEPTS		
TERM OF CONCEPT	**DEFINITION**	**REFERENCE**
Avoidable food waste	Avoidable food waste includes all food items that were meant for human consumption before being discarded.	(Parfitt *et al.*, 2010)
Controllability	Controllability refers to the extent to which an outcome was controllable or not.	(Weiner, 1986)
Developed country	A country with advanced infrastructure, standards of living, industrialisation and income per capita.	(Aschemann-Witzel, Giménez & Ares, 2019; Buzby & Hyman, 2013)
Developing country	A country with poor agricultural practices which is striving to advance its economic and social status.	(Buzby & Hyman, 2013; Godfray *et al.*, 2012)
Food supply chain	Food supply chain consists of multiple role players who ensure food is taken from raw material to the consumers' plate through a series of processes and operations.	(Samir, 2015)
Locus of control	Locus of control refers to judgments of who is responsible for an outcome.	(Spector, 1988)
Unavoidable food waste	Unavoidable food waste includes parts of food that, during food processing, are not consumed under normal circumstances (e.g. pips of fruit).	(Parfitt *et al.*, 2010)

1.11 CONCLUSION

This chapter introduced the research topic, gave relevant background information and justified the study regarding the research problem that was provided. Concepts and theories were introduced in line with the objectives set for this study.

Chapter 2

LITERATURE REVIEW AND THEORETICAL PERSPECTIVE

This chapter commences with a comprehensive literature review that presents the main themes of the study, which are: the definition and discussion of food wastage as a global issue and the importance and role of the current food supply chain. This is followed by an introduction and explication of the theoretical perspective chosen for this study (Weiner's attribution theory). This order was implemented because the theoretical perspective not only guided the investigation from the onset, but ultimately allowed for a deeper insight into and a discussion of the literature reviewed. This chapter concludes by presenting the conceptual framework and objectives set for this study.

2.1 INTRODUCTION

According to Clay (2011), by the year 2050, Earth will be home to 2 to 3 billion more human beings who all consume a minimum level of food, water and energy. Numerous studies have emphasised the fact that current consumption practices (excessive consumption) of modern-day societies have detrimental consequences for future societies' particular resources, like water and food security (FAO, 2009; Melikoglu, Lin & Webb, 2013). It is estimated that we would need three more planets to produce enough food for future generations if we continue with this course of action (Clay, 2011). Ironically, while awareness about current and future food security is highlighted on many agendas, food is still wasted globally at an alarming rate. Addressing the current issue of food waste is an essential task as it not only impacts food security, but also sustainable food production (Gustavsson *et al*., 2011).

2.2 FOOD WASTE – MORE THAN JUST A GLOBAL CONCERN

Reflecting on the emergences of past civilisations, evidence suggests that the supply and availability of food have played significant roles (Kummu, Ward, De Moel & Varis, 2010). For the last few decades, food has been appraised as being relatively inexpensive, readily available and more accessible than it was at any other time in history (Aarnio & Hämäläinen, 2008). This could

partly explain why food is often so easily wasted across the food supply chain and beyond (Marx-Pienaar, Du Rand, Viljoen & Fisher, 2018). In South Africa alone, an average of 6.8 million people experienced severe hunger in 2017 (STATS SA, 2017).

South Africa has the highest proportion of wastage in Africa (FAO, 2009). Latest figures present that South Africa disposes of approximately one third of food produced (Nahman & De Lange, 2013). One would expect heightened awareness from farm to fork because the mitigation of food waste is such an essential element for ensuring South Africa's sustainability. Unfortunately, this is not yet a reality and the primary reason can be attributed to the lack of proper understanding of food waste (Evans, 2011).

Understanding food waste and the impact thereof is therefore essential as it impedes on the sustainability of South Africa's social, economic & natural environments (Parfitt *et al*., 2010).

2.2.1 Food waste and the social environment

Food security goes hand in hand with food waste (Cicatiello *et al*., 2016). Food security is not only achieved by the availability of food, but also through the efficient and appropriate distribution of food (Du Toit, 2011). The researcher (Du Toit, 2011) futher emphasises the fact that increasing supply to meet demand will not necessarily solve food insecurity if we do not address food waste throughout the food supply chain. Globally, it is estimated that 842 million consumers do not have sufficient food and suffer from chronic hunger, while one-third of all food produced is wasted through the food supply chain (FAO, 2015). These figures further estimate that one in seven consumers do not have access to sufficient nutritious food, which leads to malnutrition (Godfray *et al*., 2012). Lost food has valuable nutrients, like Vitamin A, which are essential for healthy immune systems. In South Africa, nearly 44% of children are Vitamin A deficient owing to the lack of proper access to food (FAO, 2009).

If food waste decreases to half the current amount, it would lead to enough food for 1740 million hungry consumers (Gustavsson *et al*., 2011). According to Du Toit (2011), one of South Africa's priorities is addressing food security. Despite the last few years' efforts to fight hunger, it is still estimated that nearly 20% of Africa is facing malnutrition (FAO, 2015). This is a cause for concern as it is double the world average of 10% (FAO, 2015). According to South African Food Sovereignty Campaign, 53% of the country is food insecure while almost 14 million consumers go to sleep hungry every night (SAFSC, 2016). For these reasons, South Africa as a developing country can no longer afford to waste as much as developed countries like the USA (Parfitt *et al*., 2010).

Only certain countries have acted to fight food insecurity by implementing legislation aimed at reducing food waste. Australia was the first country to announce in 2017 that their goal for 2030 is to reduce food waste by half through investing in different charity organisations (Lemos, 2018). In 2016, the French government banned food retailers from disposing of all their unsold food items and encouraged them to donate to charity (Lemos, 2018). In Denmark, the government invested in educational campaigns to reduce food waste by helping consumers understand “Best-Before” and “Use-by” labels on packaging (Lemos, 2018). Dubai encourages the hospitality industry to use Winnow’s technology to reduce food waste. This technology is a tool that helps businesses monitor and measure their food waste in their establishment and gives information to managers to implement better waste management (Lemos, 2018). One of the main problems in South Africa is that no policies, regulations or legislation exclusively focus on food waste, but rather regulate general waste. The National Waste Management Strategy (NWMS) focusses on reducing the total amount of general waste in landfills by 25% and reducing the food (wet waste) that ends up on landfills (DEA, 2013). Despite South Africa’s constitution (Section 27(1)(b)) stating that it is each South African’s human right to have access to sufficient food and water (Lawrence Mushwana, 2013), little action has been taken to reduce food waste in South Africa. Food waste goes further than food insecurity because the financial losses of food waste have a significant impact on a country’s economy.

2.2.2 Food waste and the economic environment

When reviewing the economic environment, Gustavsson *et al*. (2011) state that globally nearly one third of food produced for human consumption is wasted annually throughout the food supply chain (farm to consumer) which adds up to approximately 1.3 billion tonnes annually. To date, the resulting global economic loss is estimated to be between 780 billion and 1 trillion dollars a year ($1 = R14.42) (Thyberg & Tonjes, 2016). Ironically, this amount of money (or even less) could easily feed the eight million people who are going hungry every day (FAO, 2015).

The European Union (EU) in particular has acted to reduce food waste throughout the food supply chain due to the economic impact of avoidable food waste (Corrado & Sala, 2018). The EU measures the economic impact of food waste through the total output, gross domestic product (GDP) and employment of a country. Germany was the most successful at reducing avoidable food waste through mechanising the food supply chain, saving the country €29 968 million (€1 = R16.36) (Campoy-Muñoz, Cardenete & Delgado, 2017). Unfortunately, this simultaneously resulted in a negative impact of 600 000 job losses (Campoy-Muñoz *et al*., 2017). Reducing food waste solely based on the monetary value is thus a complicated task and may have several repercussions. Currently, South Africa has an unemployment rate of 27.6% (StatsSA, 2019) and

therefore a strategy that purely focuses on economic returns (that are derived from the reduction of food waste) without consideration of the potential job losses would not be feasible.

South Africa as a developing country is disposing of approximately one third (10 million tonnes) of food that was produced for human consumption (WWF, 2017) which costs the country R61.5 billion (2.1% of national GDP) annually (D'Oliveira, 2013). Food waste at household level in South Africa is a concerning issue as it is estimated that each year 1.4 million tonnes of food with an economic value of R21.7 billion is wasted (0.8% of national GDP) (Nahman, de Lange, Oelofse & Godfrey, 2012). Food is produced and supplied through using specific resources for processing, storage and transportation. These resources undergo a major financial loss when food is discarded. (Campoy-Munoz *et al*., 2017). According to Notten *et al*. (2014), in South Africa alone the cost of the diesel and electricity lost due to food waste roughly adds up to R1 billion per annum. These resources, including all natural resources, are valuable and crucial for future generations (FAO, 2013).

2.2.3 Food waste and the natural environment

Food waste causes the loss of scarce resources like energy, water, fossil fuel and soil (cropland), which are all employed in the production of food (FAO, 2013; Stancu, Haugaard & Lähteenmäki, 2016). Reducing these losses should be a priority as some of these resources are non-renewable (Cordell, Drangert & White, 2009). Investigating the impact of food waste on the natural environment is a complicated business. Not only are the resources that are lost difficult to quantify, but measuring the resulting impact of greenhouse gasses is also exceedingly complex (FAO, 2013). Natural resources play an essential role during agricultural production in the food supply chain (Samir, 2015). It is estimated that approximately one quarter of crops is wasted during farming. This amount of crops wasted can feed nearly 1.9 billion consumers (Kummu, De Moel, Porkka, Siebert, Varis & Ward). Thus, Du Toit's (2011) argument carries value in emphasising that increasing supply to meet demand without proper food waste management strategies would be futile.

In South Africa, 90% of all waste ends up on landfills and this food waste is the leading cause for the production of greenhouse gasses such as methane and carbon dioxide (Quested & Johnson, 2009). According to Graham-Rowe, Jessop and Sparks (2014), methane has thirty-four more times the potential than carbon dioxide (CO_2) to increase climate change. If global food waste were a country, it would be the third largest CO_2 emitting country with 4.4 $GtCO^2$ (1 metric gigaton = 1,000,000,000 metric ton) after China (10.5 $GtCO^2$) and the United States (6.2 $GtCO^2$) (FAO, 2013). In South Africa, the research on the impact of food waste on the natural environment lacks

up-to-date and accurate information, making it an impossible task to quantify the issue in this country.

Another valuable resource is water. The amount of water used in the production of food adds up to around 250km^3 (**2.5e+14l)** globally due to food waste (Döll, Hoffmann-Dobrev, Portmann, Siebert, Eicker, Rodell, Strassberg & Scanlon, 2012). The wastage of water should be an alarming issue considering that nearly a third of the world's population has limited fresh water availability (Kummu *et al*., 2010). South Africa, being the 30th driest country in the world, cannot afford to lose such a valuable resource while facing severe droughts (Baudoin, Vogel, Nortjie & Naik, 2017; Kummu *et al*., 2010).

Only a few organisations have acted to reduce food waste to lessen its impact on natural resources. The World-Wide Fund (WWF) is an organisation founded in Switzerland in 1961 and formed in South Africa in 1968 to protect the natural environment. One of the organisation's aims is to promote and create long-term, sustainable agricultural practices while reducing the impact of food waste (WWF ZA, 2018). One of WWF's strategies is to educate the consumer about the impact of food waste in an understandable manner.

2.3 FOOD WASTE: WHO IS TO BLAME?

The food supply chain, a lifeline for human existence, consists of multiple role players who ensure that food, through a series of processes and operations, is taken from a raw material state to the consumer's plate (Samir, 2015). The food supply chain is a unique system compared to other supply chains as it must have quality, safe and sustainable efficacy throughout its complicated logistical processes, manufacturing, processing, distribution and consumption stages (Gokarn & Kuthambalayan, 2017). For this study, there are four main role players, namely: farmers, food manufacturers, food retailers and the consumer that contributes to food waste.

To date, one of society's great challenges is to develop more sustainable alternatives to improve the food supply chain (Diaz-ruiz, López-i-gelats & Gil, 2019). Aschemann-Witzel *et al.* (2019) emphasise that food waste is problematic at different stages in the food supply chain depending on the country's economic development (as illustrated in Figure 2.1). Developed countries (such as the UK) which have advanced infrastructure, standards of living, industrialisation and income per capita tend to waste more at consumer stage (Aschemann-Witzel *et al*., 2019; Buzby & Hyman, 2013). Contrarily, developing countries (such as Zimbabwe) which have poor agricultural practices and strive to advance their economic and social status tend to waste more in the early

stages of the food supply (Buzby & Hyman, 2013; Godfray *et al*., 2012). According to Gustavsson *et al*. (2011), developed countries waste between 280-300 kg of food at the consumer stage per person annually, whereas developing countries waste between 120-170 kg of food per person annually.

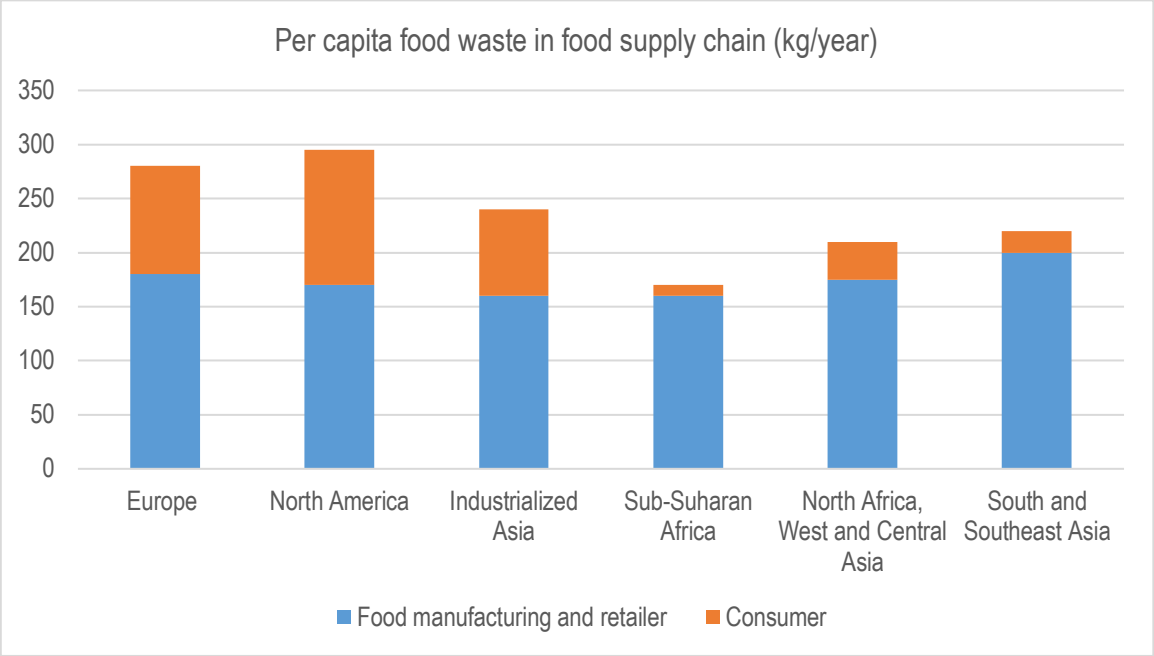

FIGURE 2.1: WASTE PER CAPITA IN DIFFERENT REGIONS (KG/YEAR) (GUSTAVSSON *ET AL*., 2011)

South Africa has a lack of actual up-to-date data on food waste and the existing data is only based on rough or calculated estimates (Oelofse & Nahman, 2012). Figure 2.2 illustrates the calculated food wastage (per 1000 tonnes) for each role player in the food supply chain between 2007 and 2009 in South Africa. It is seen that a large amount of food is wasted before the consumer stage, but the consumer's waste can no longer be ignored as it still adds up to 373 tonnes of food waste per annum (Oelofse & Nahman, 2012).

Reducing food waste will directly improve efficiency levels within the food supply chain and contribute towards enhanced levels of effectiveness when it comes to food security. Enterprises can only adopt interventions to initiate and mitigate food security through identifying the underlying drivers of food waste and their relationship with other food supply chain factors (Irani & Sharif, 2016).

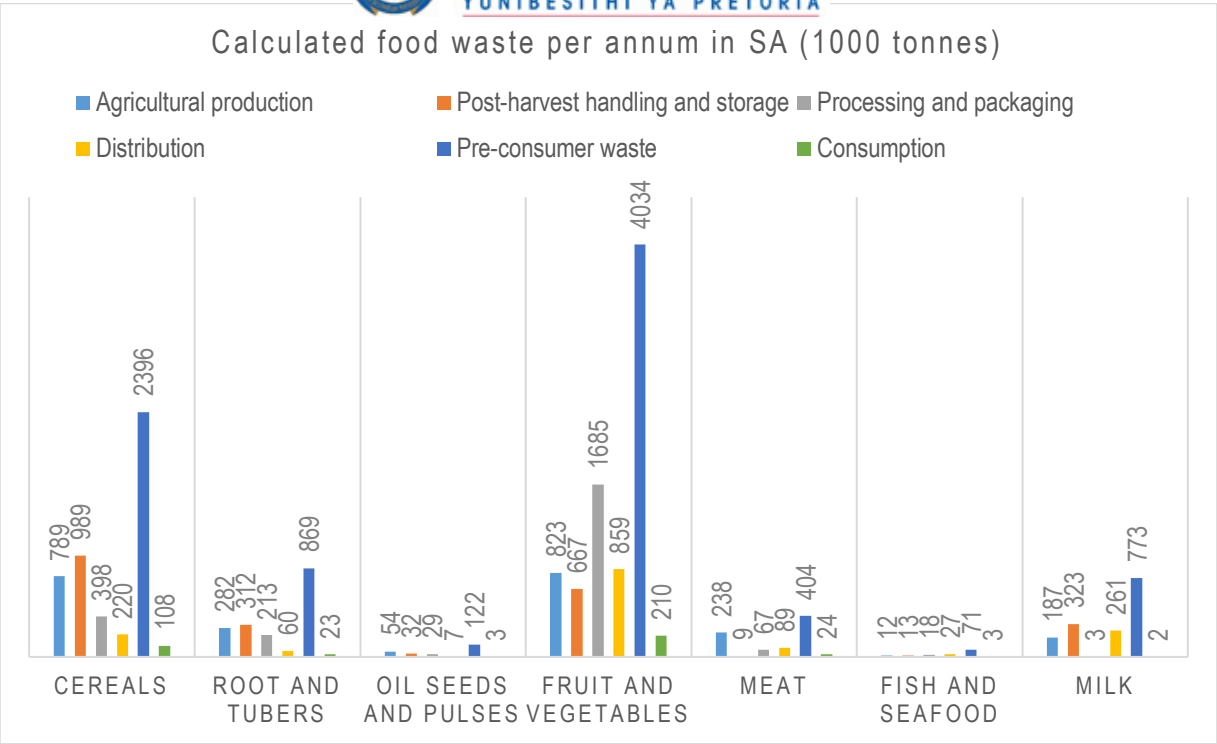

FIGURE 2.2: FOOD WASTE IN SOUTH AFRICA (ADAPTED FROM OELOFSE & NAHMAN, 2012)

2.3.1 Farmers

Farmers are the first role players in the food supply chain (Samir, 2015: 3). Farmers, according to Samir (2015: 3), form part of the agricultural sector which produces food in its raw state. There are three types of farming environments, which are: crop farming (arable), animal farming (pastoral) and a mix of both (Allen, Higgleton & Seaton 1992: 47; 700). South Africa is primarily divided into two categories, namely: commercial farming (farming for the purpose to supply/sell) (Flynn, Canals, Keller, King, Sim, Hastings, Wang & Smith, 2012) and subsistence farming (produce for own consumption) (Parfitt *et al*., 2010).

In South Africa, approximately 50% of food is lost or disposed of at farmer's level (Nahman & De Lange, 2013). Farmers use different resources such as labour, natural resources, technology, storage, cleaning procedures, fertilisers and poison to produce food (Kummu *et al*., 2012). All these resources' costs should be taken into consideration when raw food is discarded (Kummu *et al*., 2012). Waste during farming can be divided into two main categories, namely: organic waste and food waste. **Organic waste** includes all parts of food that were not intended for human consumption, such as the stalks and leaves. (Girotto, Alibardi & Cossu, 2015). **Food waste** is food that was initially produced for human consumption but was discarded for numerous reasons (Girotto *et al*., 2015).

During farming, different factors contribute to food waste on farms (Girotto *et al*., 2015; Notten *et al*., 2014; Papargyropoulou, Lozano, Steinberger, Wright & Ujang, 2014). These factors include:

- Damaged or low-quality crop/food (includes controllable factors like chemical spraying or uncontrollable factors like drought or frost)
- Disease and/or pest infestation
- Unharvested crop due to the low commercial value
- Imperfect forecasting and grading issues (surplus supply)
- Storage and transport damages

According to Ristino, Spiegel and Lustig (2018), one of the major problems of food waste management is that increased production leads to increased revenue even when it results in surplus supply and eventual food waste. A few farmers take surplus or low-quality crops and use them as animal feed and/or make compost (Ristino *et al*., 2018). Yet altogether, food waste on farms directly impacts the farmers' income. The issue of food waste on farms is an on-going problem and should therefore be investigated by taking consumer demands into consideration. Often, the consumer places unnecessary pressure on farms for perfect raw food (Ristino *et al*., 2018). From farms, food is distributed to the industry (including manufacturer and retailer).

2.3.2 Processors

Processors are the second role players in the food supply chain and they are also known as food manufactures (Samir, 2015: 3). According to Samir (2015: 3), the purpose of the food manufacturer is to process the raw food from the producers to meet consumer requirements,(e.g. ready-to-eat or canned food). By processing the raw food, it could increase its availability and shelf life while decreasing food waste (Samir, 2015: 4).

In South Africa, it is estimated that 25% of total food is wasted during processing and packaging (Oelofse & Nahman, 2012). Approximately 30% is fruit and vegetable wastage because of appearance flaws (Rohm, Oostindjer, Aschemann-witzel, Symmank, Almli, Hooge, Normann & Karantininis, 2017). Nearly 55% of food is wasted because of date labelling (i.e. best before) (Rohm et al., 2017). The following factors from Garonne *et al.* (2014) contribute to food waste during processing:

- Quality specification rejection but still good for consumption
- Process losses
- Overproductions
- Incorrect labelling or spelling on food products
- Malfunction of machines

The food manufacturer has several methods of reducing the food waste that ends on landfills. The first step is to reduce surplus food that never reaches the consumer. The food manufacturer is also driven to recycle food waste, but not all food products can be recycled (Ventour, 2008). According to Ventour (2008), food can be recycled for animal feed, compost, fertiliser and biofuel. That said, recycling by using food to produce more food is not feasible for all manufacturers. It is cheaper and less time consuming for food manufacturers to dispose of food than storing and transporting it (Ventour, 2008). Food manufacturers are also facing barriers such as limited availability of recycling facilities.

Papargyropoulou *et al*. (2014) proposed a surplus food waste framework (illustrated in Figure 2.3) for the food manufacturer to reduce surplus food and in doing so, aim for a more sustainable movement. Within this framework, food is divided into food surplus (fit for human consumption) and food waste (unfit for human consumption). Food surplus should either be prevented or re-used (donated to charity). As illustrated in Figure 2.3, food waste can either be viewed as avoidable or unavoidable. Avoidable food waste is where food is unsafe to consume and should thus firstly be prevented and if not, secondly recycled for animal feed or compost. Unavoidable food waste can either be recycled for animal feed or composting (if possible) or used for energy through anaerobic digestion to produce biogas (used to generate electricity) or, only as a last resort, be disposed of on landfills (Papargyropoulou *et al*., 2014).

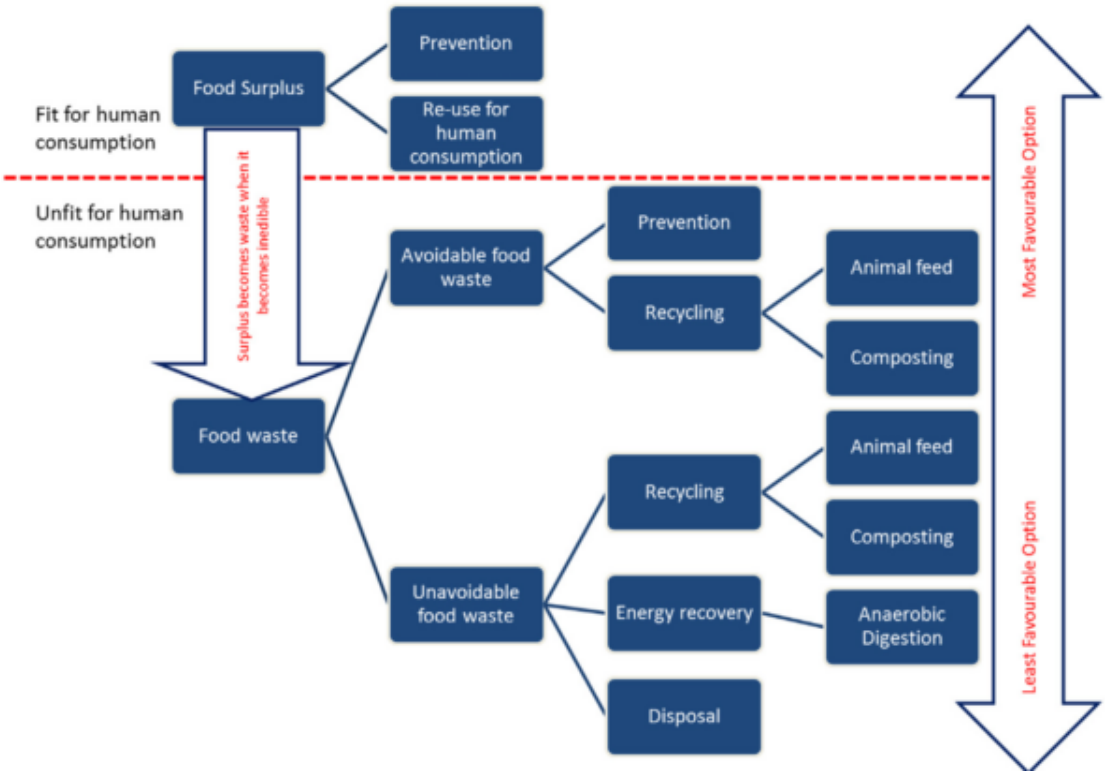

FIGURE 2.3: SURPLUS FOOD WASTE FRAMEWORK (PAPARGYROPOULOU *ET AL*., 2014)

2.3.3 Retailers

Food retailers are the third role players in the food supply chain (Samir, 2015). The retailers' role is to present the food products to the consumer (Samir, 2015). The Europe Commission estimates that retailers in Europe are only responsible for 5% of the total food wastage of 4.4 million tonnes (Cicatiello *et al*., 2016). Cicatiello *et al*. (2016) emphasise that these statistics may be inaccurate as they are estimated and not actual measurements. Parfitt *et al*. (2010) furthermore explain that quantifying retailer waste is a difficult task because of retailer sectors and local policies. In 2012, a study was conducted in Europe over 300 days to quantify the impact of food waste at retailers. This study aimed at recovering food that was fit for consumption but discarded from 25 deliveries per day to food retailers. Approximately 80-100 kg of food was wasted per day, resulting in 23.5 tonnes of food and a financial loss of €46 000.00 (Buzby & Hyman, 2013; Cicatiello *et al*., 2016). In South Africa, estimated 20% of food is wasted at this stage (Oelofse & Nahman, 2012). Considering that South Africa wastes 10 million tonnes of food per annum, retailers are therefore responsible for 2 million tonnes thereof. Numerous factors impact retailers' waste of valuable food (Cicatiello *et al*., 2016). These factors include:

- Overstocking and ordering errors
- Date labelling (i.e. sell-by and use-by dates)
- Packaging and cold chain failures
- Quality specifications
- Damaged goods and product recalls
- Unpopular food products

According to Papargyropoulou *et al*. (2014), some food retailers have used the food recovery hierarchy, as seen in Figure 2.4, as a guideline to reduce food waste. Food retailers focus on the first two stages of the hierarchy. The first stage includes reducing, reusing or recycling.

Reducing food supply is a difficult task for food retailers as consumers drive food supply. Consumers demand freshness and full shelves even at closing time (Cicatiello *et al*., 2016). According to Cicatiello *et al*. (2016), consumers buy food based on appearance and do not consider the overall quality of the product. The challenge for food retailers is to supply the right product and amount thereof to meet consumer demand. Retailers can study purchasing patterns of the consumers from the previous year, but owing to economic and trend changes, store owners can only predict sales to a particular stage (Krzywoszynska, 2011).

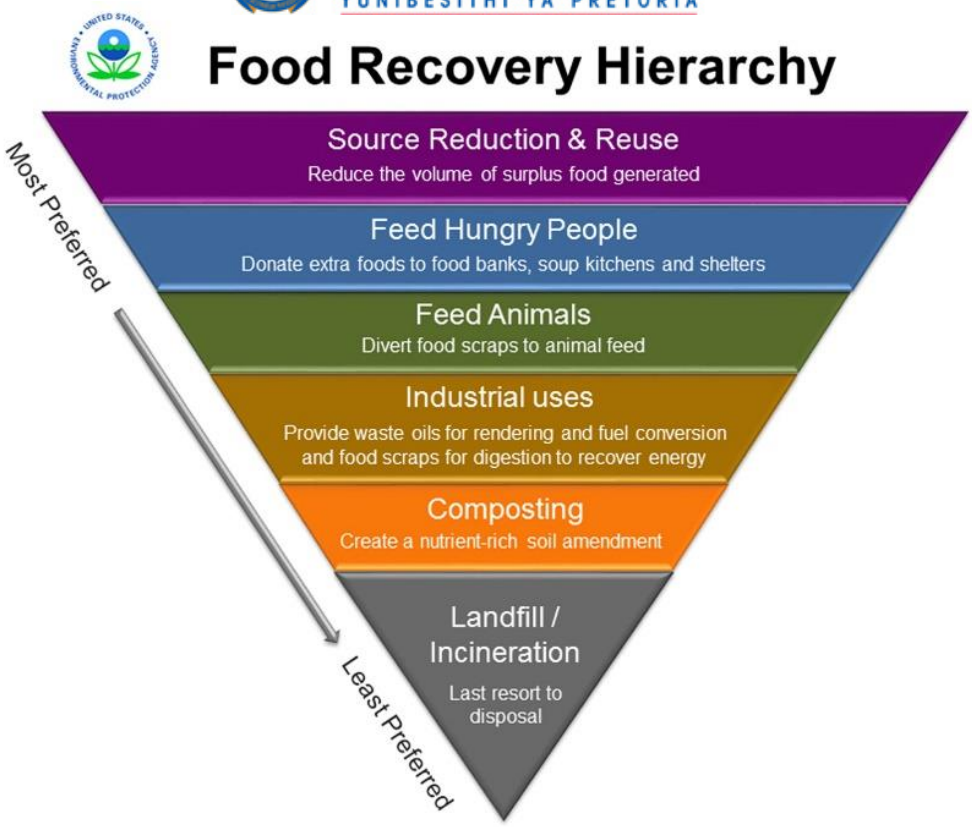

FIGURE 2.4: FOOD RECOVERY HIERARCHY (PAPARGYROPOULOU *ET AL*., 2014)

Certain food retailers started reusing or reducing the price of food products close to expiration date (Papargyropoulou *et al*., 2014). Food retailers reuse food products to create new ones (e.g. using old bananas to produce banana bread) (Cicatiello *et al*., 2016). Food recycling by food retailers is challenging as food items are often sold in combination with other food products, and recycling companies require food retailers to remove food from their packaging (Papargyropoulou *et al*., 2014).

2.3.4 Consumer

Consumers are the final role players in the food supply chain (Samir, 2015). The consumer is an essential part of the food supply chain, as the chain is dependent on the consumers to purchase products and thus send cash upstream to achieve economic sustainability (Samir, 2015). According to FAO (2015), households across the world waste an average of 150 kg of food each year. Gustavsson *et al*. (2011) distinguished the amount of food waste at the consumer level between developed countries (e.g., USA) and developing countries (e.g., South Africa). In developed countries, consumers waste approximately 95-115 kg food per annum compared to developing countries where consumers waste between 6 and 11 kg per annum (Gustavsson *et al*., 2011). Oelofse and Nahman (2012) estimate that consumers are responsible for 5% of the South African food supply chain waste. Food that is not consumed at the consumer level moves

into the waste stream which includes sewerage (poured down the drain), food waste collection, household waste recycling, home composting and animal feed (Griffin, Sobal & Lyson, 2008).

In most countries, a population's demographics play a significant role in the population's food waste practices (Martins, 2007). Income is one of the factors that play a role in the amount of food waste that is generated by the consumer. Some studies, such as those of Martins (2007), indicate that households with lower incomes generated more food waste (12-26.2%) compared to higher income households (7-7.6%). This could be due to the fact that lower income households spend more of their budget on food as a basic need and higher income households tend to consume more food away from home (restaurants). Another study that was done in rural Limpopo reported that higher income households had higher proportional amounts of food waste compared to lower-income households (Ogola *et al*., 2011).

Easy access to food is said to be one of the drivers of wasteful lifestyles among consumers (Parfitt *et al*., 2010). Consumers receive food from three resources, namely: homegrown (or foraged), food retailers and take away restaurants (Quested & Johnson, 2009). Consumers are unattached to the food supply chain, unaware of where food comes from, and unaware of how many resources are used to produce food from farm to fork (Parfitt *et al*., 2010). Consumers are also not aware of the impact of the food they waste and thus have taken little action to reduce their household food waste (Ponis, Papanikolaou, Katimertzoglou, Ntalla & Xenos, 2017). Ponis *et al*. (2017) did a study in Greece where awareness and understanding of food waste has a positive relationship with consumers' food waste management. Unfortunately, not much is known about South African consumers' understanding of food waste, thus this study aims to help narrow this gap.

2.4 FOOD WASTE: AN UNDEFINED CONCEPT

Defining food waste is not a simple task as it often relies on numerous contextual factors such as consumers' country of origin, demographics and lifestyle (Thyberg & Tonjes, 2016). To date, food waste has not been defined in such a manner that presents a standardised, globally acceptable definition (McCarthy & Liu, 2017). The literature shows that although food waste is often interpreted differently, the need to address it still stays the same (Graham-Rowe *et al*., 2014; McCarthy & Liu, 2017). Table 2.1 presents a summary of popular food waste definitions and explanations.

From Table 2.1, it is evident that food waste can be understood as any food that is produced for human consumption but was discarded (avoidably and unavoidably) at some point in the food supply chain for different reasons. These definitions are broadly understood throughout the food supply chain, but Porpino, Parente & Wansink (2015) emphasise that there is a particular lack of understanding of food waste at a household level. Evans (2011) furthermore explains that the lack of understanding of what food waste is may also have consequences on waste management practices at home. It is not only important to address current food waste practices, but also to investigate consumers' accompanying understanding of food waste itself (Stefan, van Herpen, Tudoran & Lähteenmäki, 2013; Williams *et al*., 2012). It is vital to understand the concept of food waste as this may result in understanding its financial and environmental impact as well (Porpino *et al*., 2015). This study defines food waste as any solid or liquid food substance, raw or cooked, which is discarded during the manufacturing, preparation and/or consumption of a food product and/or meal.

TABLE 2.1: FOOD WASTE DEFINED

CONCEPTS	DEFINITIONS	REFERENCE
Food waste categories	Food waste is divided into three categories, namely; kitchen waste, edible waste, and avoidable waste. 1. **Kitchen waste** includes all edible and inedible parts (e.g., eggshells) that are discarded. 2. **Edible waste** is regarded as all food parts that can be used for human consumption. 3. **Avoidable waste** includes all parts of food that are either cooked, prepared or served in surplus or not used in time.	(Quested & Johnson, 2009) (Garrone, Garrone, Melacini & Perego , 2014).
Avoidable, possibly avoidable and unavoidable food waste	• **Avoidable food waste** includes all food items that were meant for human consumption before being discarded. • **Possibly avoidable food waste** is grouped into consumer preference (e.g., fig skin), can only be consumed when prepared (e.g., potato skin) or both (e.g., meat fat). • **Unavoidable food waste** includes parts of food that arise during food processing that are not consumed under normal circumstances (e.g. pips of fruit).	(Parfitt *et al*., 2010)
Food loss vs food waste	Studies in the past identified **food loss** and **food waste** at different levels in the supply chain. • **Food loss** is food that was discarded throughout the food supply chain before it reached the consumer. • **Food waste** is disposed of or discarded at the retailer and/or consumer level because it was unsafe to consume (expiry date and/or spoilage).	(Buzby & Hyman, 2013) (Parfitt *et al*., 2010)

2.5 THEORETICAL PERSPECTIVE: WEINER'S ATTRIBUTION THEORY

Weiner's (1985) attribution theory (as seen in Figure 2.5) was found to be appropriate for this study to guide and align the discussion with the set aim and objectives of the study. The attribution theory was developed to understand why a person acts in a certain manner to ensure a specific outcome (Weiner, 1986). In this study, the attribution theory was chosen to seek an understanding

of food wastage at a household level. This theory investigates how individuals select, process, store, recall and evaluate information and how the information is then used to draw causal inferences (Försterling, 1985). The theory involves a 3-stage process that consists of:

1. Observing the behaviour for an event.
2. Assessing if the behaviour was intentional (attribution search).
3. Attributing the behaviour to internal or external causes (dimensions).

The attribution theory investigates, in the first stage, the underlying causes of consumers' observations and ultimately their understanding of a critical real-world issue, as well as their ability to make valuable decisions and accurate predictions of the environment and possibly control behaviour and outcomes (Fiske & Taylor, 1991). Weiner's (1986) attributional theory focuses on explaining why a specific event has occurred and how the attribution process directs subsequent behaviours to the cause dimensions.

In the second stage (attribution search), the outcome (food waste) is investigated in order to find the underlying dimension of locus of control, stability and controllability generated to determine why there is a linked behaviour (Weiner, 2000). It should be noted here that an outcome can sometimes be linked to a single cause dimension; for other outcomes, more dimensions are involved (Weiner, 2000).

There are three key cause dimensions that form part of the underlying dimensions of the attribution theory, and these include: locus of control, controllability, and stability. Stability refers to the likelihood that an outcome will occur again in the future (Weiner, 1986). This study will not focus on stability but rather on the other two dimensions.

In the third stage, specific behaviours (food waste management practices) are attributed so that the individual knows who is to blame (locus of control) for the specific outcome (i.e. who is responsible for food waste: oneself, someone else or circumstances) (Stephens & Gwinner, 1998; Watson & Spence, 2007). Nyer (1997) called this attribution, which refers to the person who is responsible for and has control over the outcome. Accordingly, blame can only be attributed to the consumer if they (the individuals) are perceived as being responsible for and being in control of the outcome (Nyer, 1997). Hence, in this study, attribution of blame was explored regarding locus of control and controllability of food waste from the consumers' perspective.

2.5.1 Locus of control

The locus of control principle was originally coined by Julian Rotter in 1954 (Spector, 1988). It refers to judgments of who is responsible for an outcome (Spector, 1988). Consumers can assign

locus to either themselves (internal attributions) or an external entity like a food retailer (external attributions). This dimension is influenced by consumers' opinion of who is the guilty party – who is "to blame" when it comes to food waste (Weiner, 1986). This study focuses on the food supply chain which has five key role players (i.e. farmer, food manufacturer, food retailer, consumer and government) and, in the context of this study, any of these role players can be blamed for food waste.

Regarding a problem such as food waste, consumers with a high internal locus of control (who blame themselves for food waste) thrive on achievements (Weiner, 2000). Achievements are measured by the level of task difficulty, ability, luck or effort (Weiner, 1986). These consumers might take charge of proactively and productively implementing waste management practices in their households. These consumers also tend to seek more information on this topic to increase their understanding (Weiner, 2000) of food waste management practices and learn how to decrease the amount of food waste that occurs in their household. These consumers tend to be more confident (success-orientated) which could be inspirational to other consumers (Weiner, 1985).

In contrast to internal locus of control, a consumer with a high external locus of control tends to believe that the outcome (such as food waste) is out of their control and, in this case, blames the government, farmers, food- retailers and/or manufacturers (Weiner, 1986). These consumers seldom take responsibility or have confidence and understanding (Weiner, 2000) of how they can lessen the amount of food wasted at the household level.

2.5.2 Controllability

Controllabilility, in conjuction with locus of control, refers to the extent to which an outcome is controllable or not (Weiner, 1986). Controllability studies whether or not a consumer experiences guilt or shame after a negative event (i.e. food waste) (Weiner, 2000). An event can be attributed to internal locus of control and is subsequently controllable or uncontrollable. Consumers may fail to plan shopping lists which reflects that internal locus of control is also a controllable factor. An uncontrollable factor would be when consumers purchase a product because of promotional marketing, which also reflects internal locus of control.

2.5.3 Conceptual framework

A conceptual framework is used to identify variables and their relations to one another (Leedy & Ormrod, 2013: 42). The conceptual framework (illustrated in Figure 2.5) is an adaption of Weiner's' attribution theory and flows as follows:

- **Outcome/event:** The issue (outcome) is food waste. The extent of the issue is impacted by consumers' understanding of food waste and the amount of food wasted by consumers in their household.
- **Attribution search:** Consumers waste food for certain reasons and by asking 'why' they waste food, they can decide if the reason is controllable or uncontrollable, thus assigning locus of control to a responsible party (internal or external attribution).
- **Cause dimensions (locus):** The consumer questions whether the reason for wasting food is assigned to internal locus of control (consumer themselves) or external locus of control (farmer, food manufacturer, food retailer and/or government).
- **Cause dimensions (controllability):** In this dimension, a consumer investigates whether the factors that attribute to food waste are within their control or if they are uncontrollable.
- **Action (possible solutions):** The consumer, after investigating locus of control and controllability, searches for possible solutions to reduce food waste in their household.

The conceptual framework is a combination of preceding literature on Weiner's' attributions theory. It is used to illustrate an understanding of consumers' perception of who is to blame for food waste. In this framework, consumers firstly observe their household food waste (outcome) by investigating their understanding thereof and their current levels of household food waste (Objective 1). Secondly, consumers assess (attributional search) the reasons (Objective 2) for their food wastage practices. Lastly, consumers attribute blame (locus of control) to either themselves or an external party (i.e. food retailer).

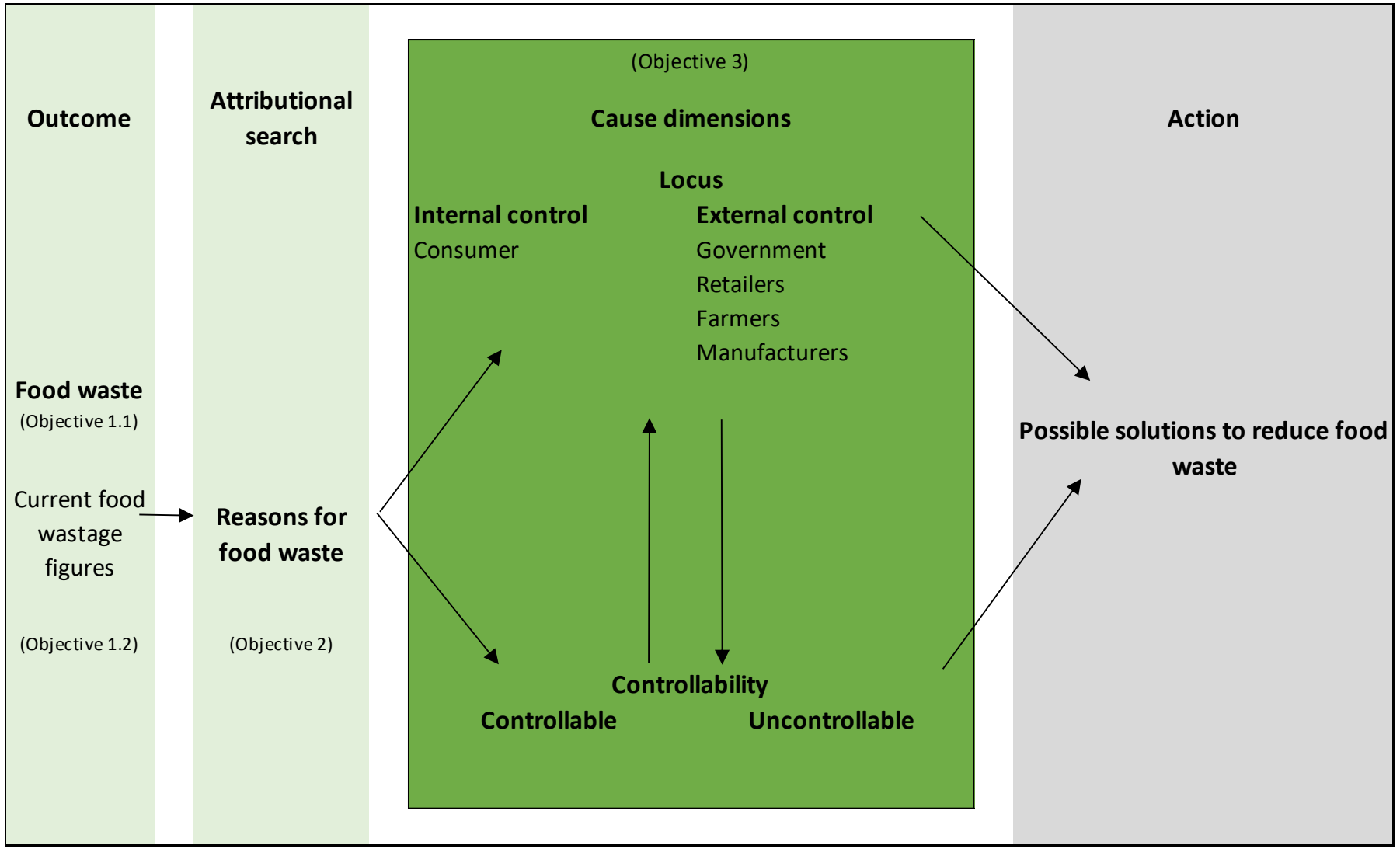

FIGURE 2.5: CONCEPTUAL FRAMEWORK (ADAPTED FROM WEINER, 1986)

2.6 RESEARCH AIM AND OBJECTIVES

2.6.1 Research aim

The principal aim of this study is to investigate and describe consumers' understanding of food waste and how it is reflected in their attribution of blame and current food waste practices.

The following objectives were identified to ensure that the applicable data was obtained to formulate an appropriate conclusion.

2.6.2 Objectives

Objective 1: To investigate consumers' understanding of food waste and current food waste practices.

The following objectives were formulated to investigate and describe consumers' understanding of household food waste and current food waste practices. The main aim was to describe consumers' understanding of household food waste and secondly to present consumers' self-reported food waste figures.

- **Objective 1.1:** To investigate and describe consumers' understanding of food waste.
- **Objective 1.2:** To investigate and present consumers' self-reported food waste figures.

Objective 2: To investigate possible reasons for household food waste.

The following objective was formulated to identify and describe possible reasons for consumers' household food waste. The aim was to explore possible reasons for food waste and identify significant differences between demographic groups.

- **Objective 2:** To identify and describe possible reasons for household food waste and identify its controllability (controllable or uncontrollable by the consumer).

Objective 3: To investigate consumers' attribution of blame

The following objectives were formulated to explore and describe consumers' attribution of blame. The aim was to explore whom consumers perceive as the most responsible party and to explain who consumers believe is best equipped to address food waste in South Africa.

- **Objective 3.1:** To explore and describe consumers' perception of who is responsible (internal or external locus of control) for food waste.
- **Objective 3.2:** To explore and describe consumers' perception of who is best equipped to address food waste in South Africa.

2.7 CONCLUSION

Historic evidence shows that food moved from scarcity to abundance in Western societies (Hebrok & Boks, 2017). This contributed to a modern society that is deemed as not only irresponsible in term of consumption, but also highly likely to be the most wasteful compared to its predecessors (Ferreira, 2014). Globally, 1.3 billion tonnes of food is wasted annually (Gustavsson *et al*., 2011). Food waste impacts urgent issues such as food security, climate change and economic development, which makes it difficult to ignore (FAO, 2015, 2013; Hebrok & Boks, 2017).

This chapter aimed to provide a brief overview of food waste globally and in South Africa through the food supply chain. This review identified that consumers' food waste practices can no longer be ignored. Therefore, it is essential to investigate consumers' understanding of food waste in more detail. The literature identified that the lack of understanding of food waste will not result in any behavioural changes at household level.

This chapter also provided the theoretical perspective on which the conceptual framework was built. The core dimensions (locus of control and controllability) that are used for this study were described regarding the outcome of food waste. The chapter also explained the conceptual framework regarding this study's aim and research objectives. The following chapter presents the research design and methodology used for this study. The data analysis is also briefly explained.

Chapter 3

RESEARCH DESIGN AND METHODOLOGY

This chapter presents the research design and methodology that served as the background for the collection and analysis of data in this study.

3.1 INTRODUCTION

This chapter explains the research design and methodology followed in this study. The conceptual framework developed for this study is discussed in terms of its aims, objectives and operationalisation. The sampling plan, which includes population, the sample, sampling, data collection and measuring instruments, is presented and discussed. Certain measures were taken to ensure that this study is valid, reliable and conducted in an ethical manner.

This study forms part of a more extensive study titled *Food wastage, sustainability, and the triple bottom line – A case study of urban households in Gauteng, South Africa*. Thus, extra care was taken to ensure that specific questions in the initial survey related to the objectives formulated for this specific study.

3.2 RESEARCH DESIGN AND METHODOLOGY

The research design involves an “action plan” that specifies all the appropriate methods used and processes followed when collecting and analysing the information for the data needed to address the objectives. To date, the issue of consumers’ understanding of food waste and the ultimate attribution of blame has received limited attention. Empirical research is usually necessary when investigating a previously unexplored field of interest; hence, the nature of this study is empirical.

The research design is classified according to the fundamental objectives set for the research. An exploratory-descriptive design (Kumar, 2012: 94) is best suited for the nature of this research. As the name implies, exploratory research attempts to explore unfamiliar areas (Kumar, 2012: 385). The intention of this study is to remedy the lack of information regarding consumers’

understanding of food waste, current waste management practices and self-reported food waste figures. The amount of food waste generated in developing countries (i.e., South Africa) has received little to no attention. Contrary to the exploratory investigation, descriptive research aims to explain consumers' attribution of blame related to food waste. Descriptive research also focuses on the relationships between variables and asks the questions of 'who, when, why and what' (Ormrod, 2014: 213).

Descriptive research can be conducted in a longitudinal or cross-sectional manner. Longitudinal research involves repetitive measurement of the same sample over an extended period (Ormrod, 2014: 231). The primary data for this research, however, focused on a specific population cohort at a given point in time and only measured their responses once, thus making the study cross-sectional (Ormrod, 2014: 194). Using a cross-sectional research method allowed the researcher to see a snapshot of the sample at a given time (Kumar, 2012: 107) and thus reflected the current state of consumers' understanding, current practices, self-reported figures of waste and the ultimate attribution of blame for it.

Cross-sectional research studies are also generally carried out during surveys (Salkind, 2012: 329). This study followed a quantitative approach. Primary data was collected in a single phase by using a structured questionnaire. To align with the nature of the study, the structured questionnaire was designed and facilitated in an electronic format so that respondents could complete the questionnaire on an electronic device of their choice (via an e-mail link) in their own time without the assistance of a fieldworker. Online research is deemed to be as effective as traditional research methods if conducted under strict guidelines (Creswell, 2014: 161). Secondary data was obtained from reputable journals to support the literature review.

3.3 METHODOLOGY

3.3.1 The sampling plan: population, the sample, and sampling

Creswell (2014: 158) defines a population as a specific group of individuals who have similar characteristics. The smallest entity included in a study is the unit of analysis, while the population is the collective of all of those units (Creswell, 2014: 158). The population of this study included consumers residing in Gauteng, South Africa.

The unit of analysis for this study was female and male consumers aged 21 and older. The study area was Gauteng, South Africa. The justification for this study area is that Gauteng is the smallest

province with the largest number of people in South Africa (approximately 15,2 million people - 25,8% of the total population) (STATS SA, 2019). The prerequisites for the respondents' participation in this study were that they had to be responsible for food purchase, principal preparation of food and waste management in their household. This study targeted respondents aged 21 years and older because they would probably have had experience in purchasing food, preparing food and managing waste. For this study, no other restrictions or requisites were set out regarding demographics. Thus, all willing individuals were welcome to partake in this study regardless of their population group or gender.

This study used convenience sampling. Convenience sampling is a non-probability sampling technique which is often used due to financial or time constraints. It was preferred since it is fast, inexpensive, easy, and respondents are readily available (Salkind, 2012: 193). The problem, however, is that convenience sampling is seldom representative of the bigger population and, therefore, extra care and caution should be taken when recruiting respondents.

To collect data from a diverse sample across Gauteng, the following measurements were implemented:

- Data collection commenced by identifying possible fieldworkers who resided in the central regions of the study area (Gauteng – see Figure 3.1).

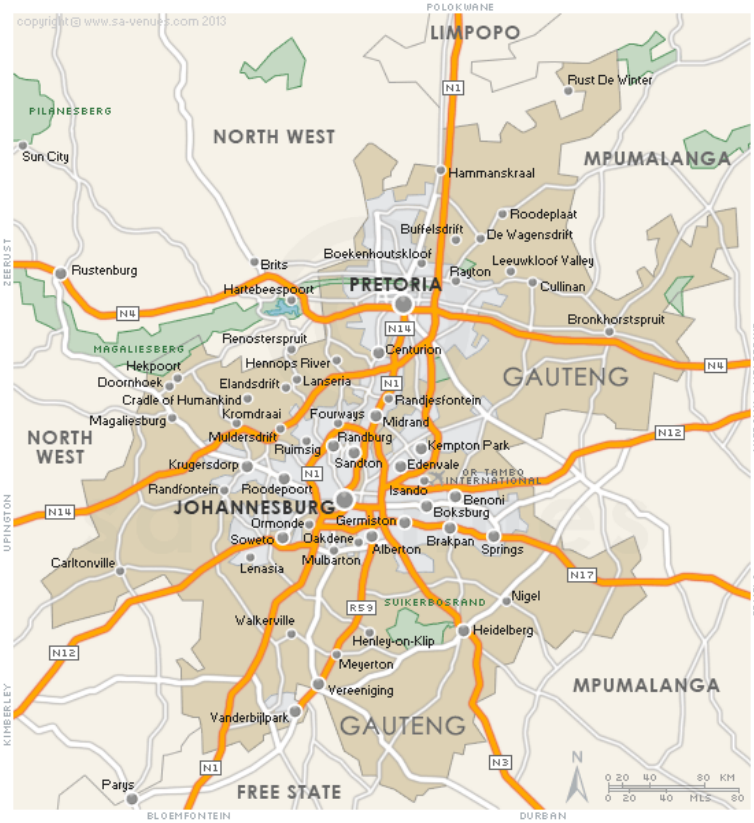

FIGURE 3.1: MAP OF GAUTENG

- Thirty fieldworkers, including the primary investigator, underwent extensive training about the objectives set out for the study and received instruction regarding the distribution of the online survey.
- Fieldworkers received an electronic link which they had to distribute to a minimum of thirty possible respondents. A web-based software system (i.e., Qualtrics) was used to distribute, collect and capture data from respondents.

A sample size of at least 900 respondents was envisaged for this study. The final sample size was 1767.

3.3.2 Data collection

Structured, self-administrated electronic questionnaires (Addendum A) were used to collect quantifiable data. The potential respondents received a link to the questionnaire via email. A cover letter accompanied each questionnaire, which presented information relating to the purpose of the study, the importance of the respondents' contribution, confidentiality, privacy rights, and relevant contact information should respondents have any queries.

Respondents required access to technology since the questionnaire was distributed using a web-based software system, Qualtrics. An electronic questionnaire was ideal as it was easy to collect data, limited human error through computerised capturing and immediately made data available for analysis (Kumar, 2012: 147). The disadvantage of using an online questionnaire is that there are limited opportunities to probe for further detail if responses are unclear (Kumar, 2012: 147). One also runs the risk of screening off respondents who meet the sample criterion but do not have access to the internet. In this scenario, fieldworkers were instructed and trained to collect data via mobiles/tablets from potential respondents. Data collection took place during July 2015.

3.3.3 Measuring instrument

The following sections represent the relevant questions that were selected to be part of this study. See Addendum A for the full questionnaire.

Section 1: Demographic information

Eleven questions were asked in this section to determine gender, age, the highest level of education, the area of residence, household size, population group, monthly household income level, household language, marital status, number of children, and the age of the respondent. In

some instances, the answers were recorded by means of a slider scale and, in others, by ticking a block that indicates the preferred/ correct response option.

Section 2: Definition of and responsible parties for food waste

This section presented four questions:

- The first question consisted of a pictorial collage portraying possible food wastage. The respondent was asked to click on the food products that they defined as food waste in the pictures.
- The second question provided three definitions relating to food waste. The respondent had to select the definition that they felt described food waste most accurately. Definitions were formulated in terms of the literature.
- Regarding attribution of blame (locus of control could either be farmers, consumers, retailers, government or manufacturers), each respective respondent was prompted to firstly indicate who they believe should be held responsible and secondly, indicate who is best equipped to address the food waste in South Africa. Both these questions used a five-point Likert-type agreement scale (Strongly Disagree to Agree Strongly).

Section 3: Self-reported household waste

Respondents were asked to answer questions regarding the wastage of specific food commodities. Information was elicited using a five-point Likert-type likelihood scale (Very Likely to Very Unlikely). Respondents were also asked to indicate on a slider scale (1-100%) which percentage of each commodity they wasted during one calendar month.

Section 4: Reasons for food waste

In this section, respondents were asked to respond to a pool of sixty-four (64) statements that related to possible reasons for food waste. Respondents could once again indicate their answer on a five-point Likert-type agreement scale.

The questionnaire was made available in English as this was found to be the most widespread language used and understood by Gauteng residents. The questionnaire was pilot tested to determine the relevance of scale items, as well as the internal consistency of each category. Pilot testing entailed screening the questionnaire among a sample of peers. The pilot test involved twenty respondents that fit the prerequisites set out for the sample. Minor alterations were made based on the results and the suggestions made during the pilot-testing.

3.3.4 Data analysis

Data analysis, as defined by Salkin (2014: 229), is the application of thought to comprehend the sets of data collected for this study. It entails a selection of suitable techniques often predetermined by the nature of the collected data and the research design. The data was captured and coded electronically to assist in understanding and interpreting the results. The coded data was transferred to a statistical software program (SPSS, 2.1). The principal researcher checked the captured data. Data analysis commenced with descriptive statistics. Descriptive statistics involve presenting the data in terms of means, percentages, and frequencies (Salkin, 2014: 230).

More advanced statistical procedures included an exploratory factor analysis (EFA), t-tests and analysis of variance (ANOVA). Factor analysis is the statistical procedure used to identify the coherence of items and interrelationship that exists among a large number of variables (Mazzocchi, 2008: 221). In Section 4, an EFA was performed. Factors derived through the EFA were then compared across relevant demographic categories (ANOVA) to identify significant differences. Where significant differences were identified, subsequent post-hoc tests were performed.

3.3.5 Operationalisation and conceptualisation

The operationalisation table (Table 3.1) outlines the sections from which the research instrument tested the various research objectives and sub-objectives. This table also indicates the dimensions, questions, and types of statistical methods used.

TABLE 3.1: CONCEPTUALISATION AND OPERATIONALISATION TABLE

SUB OBJECTIVE	DIMENSIONS	INDICATORS	MEASUREMENT	DATA ANALYSIS
Objective 1: To investigate consumers' understanding of food waste and current food waste practices.				
The main aim was to describe consumers' understanding of household food waste and secondly to present consumers' self-reported food waste figures.				
1.1 To investigate and describe consumers' understanding of food waste.	Food waste	Manufacturing Preparation Consumption	**Electronic Questionnaire using an online survey tool: Qualtrics** Questions: Close coded. 17-18	Percentage values & descriptive statistics
1.2 To investigate and present consumers' self-reported food waste figures	Waste management	Twelve commodities	**Electronic Questionnaire using an online survey tool: Qualtrics** Questions: Close coded. 21-29	Mean value, percentage values & descriptive statistics
Objective 2: To investigate possible reasons for household food waste.				
The aim was to explore possible reasons for food waste and identifying significant differences of food waste between demographic groups.				
2 To identify and describe possible reasons for household food waste and identify its controllability (controllable or uncontrollable by the consumer).	Controllability	Reasons for food waste and controllability	**Electronic Questionnaire using an online survey tool: Qualtrics** Questions: Close coded. 34-41	EFA (Exploratory Factor Analysis), Cronbach's Alpha, ANOVA (analysis of variance) Mean value
Objective 3: To investigate consumers' attribution of blame				
The aim was to explore whom consumers perceive as the most responsible party and to explain who consumers believe is best equipped to address food waste in South Africa.				
3.1 To explore and describe consumers' perception of who is responsible (internal or external locus of control) for food waste.	Locus of control	Internal; External	**Electronic Questionnaire using an online survey tool: Qualtrics** Questions: Close coded. 19	Mean value & descriptive statistics
3.2 To explore and describe consumers' perception of who is best equipped to address food waste in South Africa.			**Electronic Questionnaire using online survey tool: Qualtrics** Questions: Close coded. 20	Mean value & descriptive statistics

3.4 QUALITY OF DATA

The researcher's aim should be to ensure that the study is publishable by ensuring the data is reliable and valid. Quality data provides facts that could be used in the academic community for future literature (Kumar, 2012: 177). To achieve accurate and correct data, the researcher should check that all aspects, especially the measuring instrument, of the study were reliable and valid (Ormrod, 2014: 91). All elements of validity were evaluated throughout the research study. The following was taken into consideration to restrict errors:

3.4.1 Validity

Validity in this research study refers to how specific and accurate the obtained data is (Salkin, 2014: 173). It is essential to measure the validity of the data with the set objectives of the research study. The research is only seen as valid if the conclusions are accurate and logical (Kumar, 2012: 178; Ormrod, 2014: 91). Theoretical validity and measurement validity are the two relevant types of validity for this study.

3.4.1.1 Theoretical validity (Conceptualisation)

Concepts for this study were indentitfied and clarified to ensure theoretical validity (De Vos *et al*., 2011: 29). The conceptual framework guides this study and the concepts of this study are the foundation of scientific knowledge. It is critical to have a clear understanding of concepts to ensure correct interpretation and accurate findings. Understanding key concepts allows the researcher to connect interrelated data and draw broader conclusions.

The descriptions and explanations of the concepts in this study are presented in a comprehensive literature review which ensures theoretical validity. The validation included a detailed overview of key concepts such as food waste, possible reasons for household food waste and the attribution of blame.

3.4.1.2 Measurement validity

There are various forms of measurement validity. For this study, validity was measured by means of face validity, content validity and construct validity.

Content validity is when the elements of the construct are represented by the measuring instrument used in the study (Kumar, 2012: 180). Thus, the questionnaire needed to measure

and represent all the questions necessary to study the problem. Content validity for this study was achieved with the help of a conceptualisation and operationalisation table (See Table 3.1). This was done to ensure that all significant dimensions and indicators were identified and represented in the questionnaire. The questionnaire presented questions and themes which a researcher can use to study consumers' understanding of food waste and their attribution of blame.

Construct validity refers to how well the measuring instrument measures the relevant concepts identified in the study (Kumar, 2012: 180). According to Kumar (2012: 180), construct validity is verified by comparing the intended measuring instrument (i.e., a questionnaire) with existing tests and studies. Construct validity was achieved in this study by compiling a structured literature review to identify relevant concepts and scales used for the questionnaire.

Face Validity refers to a measurement procedure which appears to measure what it claims to measure (Kumar, 2012: 179). This form of validity is used to ensure that there is a logical link between the measuring instrument (i.e., a questionnaire) and the set objectives of the study. The advantage of face validity is that, if the respondents understand what the aim of the questionnaire is, the respondents read with more context which could provide more accurate answers. However, respondents could bend their answers (Kumar, 2012: 180) as it is socially unacceptable to admit to one's own unsustainable or poor environmental practices. To ensure face validity, the questionnaire had a cover letter (Addendum A) which explained the purpose of this study.

3.4.2 Reliability

The measuring instrument should be consistent in results to achieve reliability (Walliman, 2011: 366). Thus, a repetition of the test should obtain the same results (Kumar, 2012: 181). Reliability in a study also indicates that the results obtained emerge from the respondents' viewpoints and not from the researcher's perspective (Kumar, 2012: 181). For this study, the following precautions were taken during data collection to reduce errors:

- The questionnaire had a cover letter (Addendum A) from the Department of Consumer Sciences to state the aim of this questionnaire for the respondent.
- The questionnaire was pilot tested by thirty individuals who met the prerequisites of participation. This was done to obtain relevant feedback on the ease of question comprehension and the time it took to complete the questionnaire. Respondents were asked to provide feedback on the completion and the complexity of the questionnaire.
- Feedback was taken into consideration and relevant changes were made prior to the main data collection phase.

3.5 ETHICS

Ethics are the moral principles that are acceptable in a specific field of study (Kumar, 2012: 242). There are a few things that need to be taken into account regarding ethical issues. Overall, data collection procedures should not be misleading in order to obtain findings that are beneficial for the researcher but are ethically incorrect. The following steps were taken to ensure an ethical approach to the study:

- The cover letter attached to the questionnaire stated the aim of the study and assured potential respondents of the confidentiality of their responses. Respondents took part in the study anonymously and voluntarily and gave their consent to use their responses to generate findings for this research study.

- The questionnaire for this study had to comply with the Code of Ethics for Research at the University of Pretoria and was approved by the Ethical Committee. This study is part of a larger food wastage research project. This project protocol was submitted, and ethical clearance was granted on 14 July 2015 (reference number, EC150518-011 – reflected in Addendum B).

- During data analysis, no fraud was committed by manipulating any of the responses of the respondents. The findings of the study were reviewed by a statistician and study leader, ensuring accurate interpretations of the data.

3.6 CONCLUSION

This chapter discussed the research methodology (i.e., quantitative approach) most appropriate for and used in this study. Data collection was discussed through the population, sampling technique, sampling size, and measuring instrument. Details of the questionnaire (measuring instrument) and the scales used in each section relevant to this study were explained. The conceptual model helped identify critical concepts that linked with the objectives of this study. The operationalisation table indicated which data analysis methods were used for each objective set out for this study. Lastly, certain precautions used were explained to ensure this study was valid, reliable, and ethically completed. This enables it to be used for future research.

Chapter 4

RESULTS AND DISCUSSION

This chapter presents the results and a discussion regarding the objectives set for this study.

4.1 INTRODUCTION

This chapter presents the results of this study according to the objectives and sub-objectives formulated. An in-depth discussion that acknowledges the existing literature allows the researcher to interpret the findings drawn from this investigation. This chapter commences with the demographic characteristics of the sample by means of descriptive statistics. Further findings are presented according to the research objectives and these include: the definition of waste, current levels of household food wastages, reasons for food waste and the attribution of blame. Findings are presented by means of descriptive statistics, exploratory factor analysis (EFA), t-tests and analysis of variance (ANOVA).

4.2 DEMOGRAPHICS

The structured questionnaire asked respondents to indicate their gender, age, highest level of education, population group, monthly household income, home language and the total number of members in their household. The demographics in the first section of the questionnaire (Addendum A) enabled the researcher to divide the sample into subsets to conduct statistical analyses such as ANOVAs. The total sample size for this study was N=1767. Table 4.1 presents the findings.

4.2.1 Gender distribution of the sample

The results from this study presented that most respondents (N=1767) were female (62.03%; n=1096; male: 26.88%, n=475; not indicated: 11.09%, n=196). These results could be due to the prerequisites set for participation which were that respondents had to be the main member responsible for food purchasing, preparation and waste management.

A study done in the USA noted that women still tend to take on the traditional role of motherhood (homemaker) which includes food purchasing, preparation and waste management (Katz-wise, Priess & Hyde, 2010). It is therefore plausible that Katz-Wize *et al*'s (2010) notion might also ring true in the sense that many women in South Africa still fulfil the traditional gender role of homemaker.

TABLE 4.1: DEMOGRAPHIC CHARACTERISTICS (N=1767)

Demographic charactaristics	Frequency	Percentage
Gender (N=1767)		
Male	475	26,90%
Female	1096	62,00%
Missing	196	11,10%
Age (N=1767)		
21-30 years	939	53,14%
31-40 years	211	11,94%
41-50 years	210	11,88%
51-60 years	181	10,24%
61-65 years	47	2,66%
Missing	179	10,13%
Educational level (N=1767)		
Lower than grade 12	30	1,70%
Grade 12	517	29,26%
Grade 12 plus a degree or diploma	703	39,78%
Post graduate degree	364	20,60%
Missing	153	8,66%
Population group (N=1767)		
African	239	13,53%
Asian	4	0,23%
Coloured	18	1,02%
Indian	19	1,08%
White	1313	74,31%
Other	11	0,62%
Missing	163	9,22%
Household income (N=1767)		
Less than R10 000	342	19,35%
R10 001-R15 000	2	0,11%
R15 001-R20 000	212	12,00%
R20 001-R30 000	211	11,94%
R30 001-R40 000	196	11,09%
More than R40 000	551	31,18%
Missing	253	14,32%
Home language (N=1767)		
Afrikaans	699	39,56%
English	696	39,39%
Ndebele	8	0,45%
North Sotho	21	1,19%
Sotho	7	0,40%
Swazi	12	0,68%
Tsonga	7	0,40%
Tswana	17	0,96%
Venda	9	0,51%
Xhosa	14	0,79%
Zulu	19	1,08%
Other	65	3,68%
Missing	193	10,92%

4.2.2 Age distribution of the sample

Data collection for this study required participation from respondents older than 21 years of age. Respondents were asked their exact age in an open-ended question. According to Atkins and Hyun (2016), consumers in specific age groups experience similar life events that create certain values, attitudes, perception and behavioural characteristics. For this reason, the ages were converted into five categories (Table 4.1). The age distribution presented that most respondents (n=939, 53.14%) were between the ages of 21-30 years, with 23,82% of respondents (n=421) falling between the ages of 31-50. The minority of respondents were between ages 61-65 (n=47).

Literature emphasises that older generations tend to be more conscious about sustainable practices compared to the younger generations who are often more concerned about convenience (Poortinga, Spence, Whitmarsh, Capstick & Pidgeon, 2011; Atkins & Hyun, 2016). It is also said that younger consumers tend to implement little to no waste management practices in their households and produce a higher amount of food waste in comparison to the older generations who are more attentive to the amount of waste they produce (Parfitt *et al*., 2010; Porpino *et al*., 2015).

4.2.3 Educational level

The findings show that 60.38% of respondents obtained a formal education, i.e. Grade 12, a degree, or a postgraduate degree (Table 4.1). Educational attainment plays a role in consumers' behaviour and influences their waste management practices (Atkins & Hyun, 2016; Koivupuro, Hartikainen, Silvennoinen, Katajajuuri, Heikintalo, Reinikainen & Jalkanen, 2012). Koivupuro *et al*. (2012) found that consumers with a higher level of education refrain from wasting avoidable food waste as they are more aware of the impact of food waste. Thus, it is expected that for this study, consumers would waste less as most respondents have higher, formal education.

4.2.4 Population group

The majority of the population were White (n=1313; 74.31%) with only 13.52% (n=239) representing the African population (Table 4.1). According to STATS SA (2015), 80.5% of South Africa's total population is African, whereas only 8.3% is White. Although this questionnaire requested respondents to indicate the population group to which they belonged to, it was never the intention of this study to distinguish between the waste behaviour of different population groups. This is unfortunately the limitation of convenience sampling as it seldom represents the bigger population.

4.2.5 Household income

In terms of household income, more than half of respondents (54.22%) (n=958) reported a monthly household income of R 20 000 (equating to $1354.77 / R14.76 = $1) (Table 4.1). This shows that the sample was comprised out of a large group of middle to high-income respondents. Middle-class consumers, according to Business Tech (Writer, 2019), have an income of between R 12 000 and R 40 000 per month. Recent literature presented by Setti *et al*. (2016) debated the impact of household income on a consumer's waste management practices and highlighted that food wastage is more prominent amongst higher income brackets. In support, McCarthy and Liu, (2017) acknowledged that higher-income households' often have a lower financial risk perception, thus they could discard food products more quickly and often unnecessarily due to factors such as unappetising appearances.

4.2.6 Home language

The study's questionnaire was made available in English as this was found to be the most widespread language understood by Gauteng residents. In this study, 39.56% (n=699) of the respondents indicated their home language as Afrikaans, closely followed by English with 39.39% respondents (n=696). According to STATS SA (2016), the top three languages spoken by South African households are IsiZulu (24.6%), IsiXhosa (17.0%) and Afrikaans (12.1%). Results presented that only 6.45% of respondents (n=114) selected one of the African languages as their home language. According to Suttan and Tobin (2011), home language is the most complex demographic variable when it comes to consumer's capability to amend current food waste practices. This is due to the fact that it directly influences consumers' ability to not only access relevant information (such as sustainable food waste practices), but also processing that information.

4.2.7 Household size

Respondents were asked to indicate how many members their households include. The average household consists of 3.5 members (Table 4.2).

TABLE 4.2: HOUSEHOLD SIZE

Members		n	%	Members		n	%
1	One	**138**	7,81%	6	Six	**69**	3,90%
2	Two	**378**	21,39%	7	Seven	**32**	1,81%
3	Three	**333**	18,85%	8	Eight	**16**	0,91%
4	Four	**403**	22,81%	9	Nine	**9**	0,51%
5	Five	**198**	11,21%	10	Ten	**11**	0,62%
Not indicated				175		9,90%	

This is a little more than the national norm of 3.3 people per household (STATS SA, 2016). Stancu *et al*. (2016) found that households with fewer members wasted less food. This contradicted Parfitt *et al*. (2010) who found that larger households discard less food per capita compared to smaller households.

In summary, the sample was predominantly female, white, between 21-20 years of age and with an educational level of Grade 12 plus a degree or diploma.

4.3 DATA ANALYSIS, RESULTS AND DISCUSSION

The discussion of the results will follow in sequential order according to the objectives formulated for this specific research study:

- Consumers' understanding of food waste (Objective 1.1)
- Consumers' self-reported food waste figures (Objective 1.2)
- Consumers' possible reasons for food waste (Objective 2)
- Consumers' attribution of blame (Objective 3.1)
- Consumers' beliefs about who is best equipped to address food waste (Objective 3.2)

4.3.1 Consumers' understanding of food waste and self-reported food waste practices (Objective 1)

The initial results (section 4.3.1.1) are descriptive and aim to provide some background concerning consumers' understanding of food waste (Objective 1.1). Section 4.3.1.2 will present the findings (Objective 1.2) of consumers' current food waste practices.

4.3.1.1 Consumers' understanding of food waste (Objective 1.1)

To explore and describe consumers' understanding of food waste, they were asked to select one of the provided definitions/ statements, which, according to them, best described the concept of food waste.

The findings in Figure 4.1 revealed that the majority of respondents (n=885; 68.76%) selected the second, more comprehensive definition. This was encouraging as it showed that consumers' understanding of food waste is not only restricted to household post-consumption waste, but also acknowledges the industry's (pre-consumer waste streams) contribution. It was, however, concerning to note that although the majority of respondents acknowledged/defined food waste

to be a concern emanating from both pre- and post-consumer streams, about a quarter of the sample (n=23.62%) still only perceived waste as an industry-related issue.

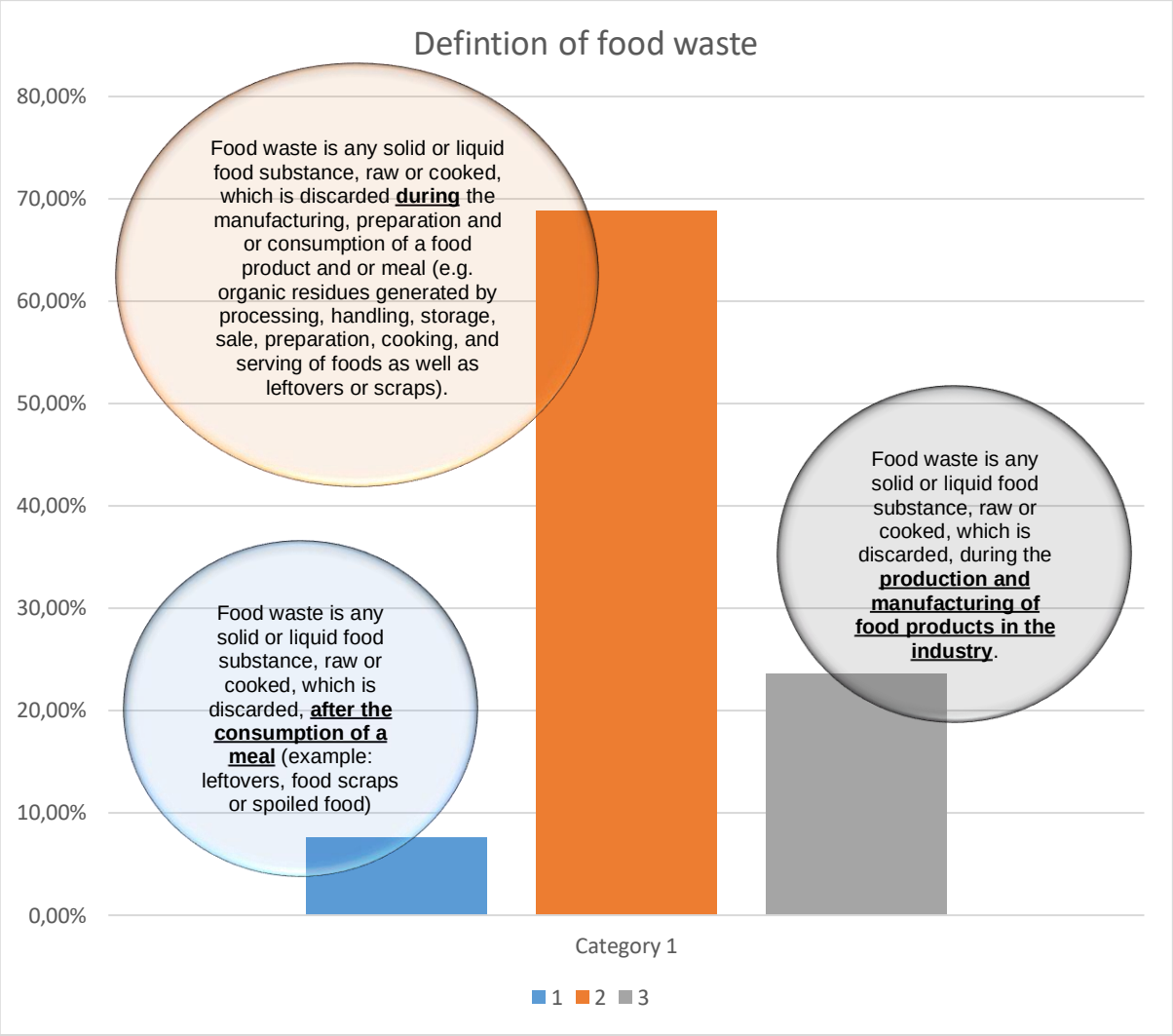

FIGURE 4.1: CONSUMERS' SELECTED DEFINITION OF FOOD WASTE (N=1287)

To further explore consumers' understanding of food waste, they were also given a collage (Figure 4.2). Respondents were then asked to identify items within the collage which they considered to be food waste. Respondents could select multiple items or pictures. For ease of interpretation, findings were tabulated (Table 4.2).

FIGURE 4.2: PICTURE ILLUSTRATION IN THE QUESTIONNAIRE (QUESTION 17)

The findings in Figure 4.3 and Table 4.2 indicate that most respondents selected picture 1 (n=959, 69.39%) closely followed by picture 2 (n=858, 62.08%). Literature often associates or categorises these depicted items as avoidable food waste. Avoidable food waste is food that was meant for human consumption but never reached the table to be consumed (Parfitt *et al*., 2010).

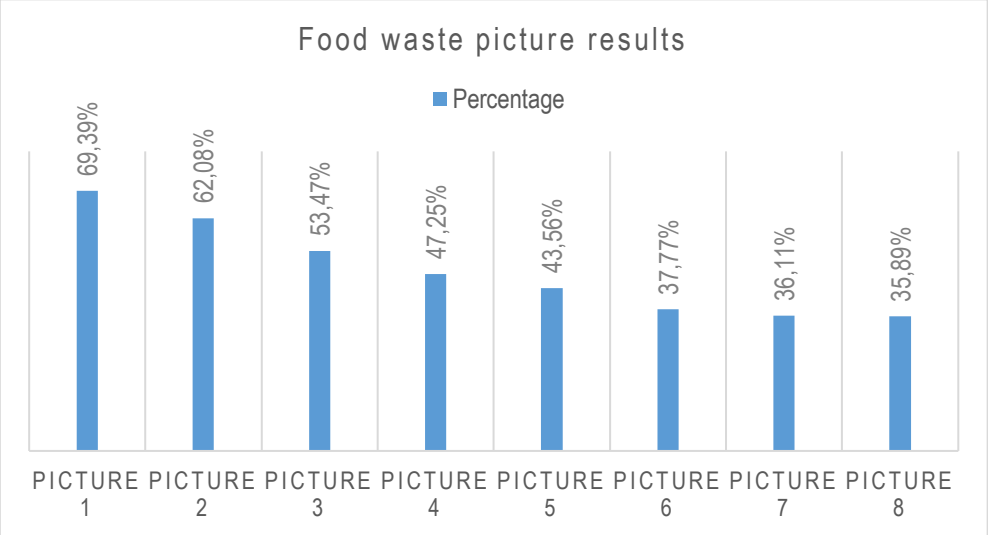

FIGURE 4.3: FOOD WASTE PICTURE ILLUSTRATION PERCENTAGE RESULTS

The three least selected pictures were picture 6 (n=522, 37.77%), picture 7 (n=499, 36.11%) and picture 8 (n=496, 35.89%). According to literature, pictures 6 and 7 are often associated with unavoidable food waste. Unavoidable food waste includes parts of food that arise during food processing and is not consumed under normal circumstances (e.g. pips of fruit (Parfitt *et al*., 2010)). In terms of picture 8 (waste skip filled with oranges) it was concerning to note that only 35.89% considered it to be waste. However, it is possible that respondents did not recognise the waste skip and assumed it is something else. This could be due to consumers' detachment from food production and/or farming in general.

In essence, it seemed that respondents overall acknowledged the pictures that they could associate with and/or resembled wastage that could be avoided. This supports the notion that consumers tend to be less concerned about unavoidable food waste and the waste created by industry.

TABLE 4.2: FOOD WASTE PICTURE (AVOIDABLE AND UNAVOIDABLE FOOD WASTE) (N=1382)

		Defined	Selected	Percentage
1		Avoidable	959	69.39%
2		Avoidable	858	62.08%
3		Avoidable	739	53.47%

		Defined	Selected	Percentage
4		Possibly avoidable	653	47.25%
5		Possibly avoidable	602	43.56%
6		Unavoidable	522	37.77%
7		Unavoidable	499	36.11%
8		Unavoidable or Avoidable	496	35.89%

4.3.1.2 Consumers' self-reported food waste figures (Objective 1.2)

Consumers' self-reported food waste patterns/figures were explored by asking respondents to report the overall wastage percentage of 12 primary food commodities. This was followed by prompting respondents to rank the 12 commodities according to the extent to which each was wasted during the last calendar month (1 = category most wasted, 12= category least wasted).

Lastly, respondents were asked to provide detail in terms of the likelihood of specific food items (within the 12 food commodities) being wasted. Results in Figure 4.4 present consumers' self-reported estimated percentages in terms of food per primary food commodity. Results in Figure 4.5 present the ranking of the 12 primary food categories in terms of most to least wasted. Figure 4.6 – 4.11 presents the likelihood of specific food commodities and related products being wasted.

- *Consumers' general wastage of 12 food commodities*

To determine the amount of food wasted per primary food commodity, respondents were asked to indicate the percentage of waste created per food commodity on a slider scale. Results in Figure 4.4 present consumers' self-reported estimated percentages in terms of food per primary food commodity.

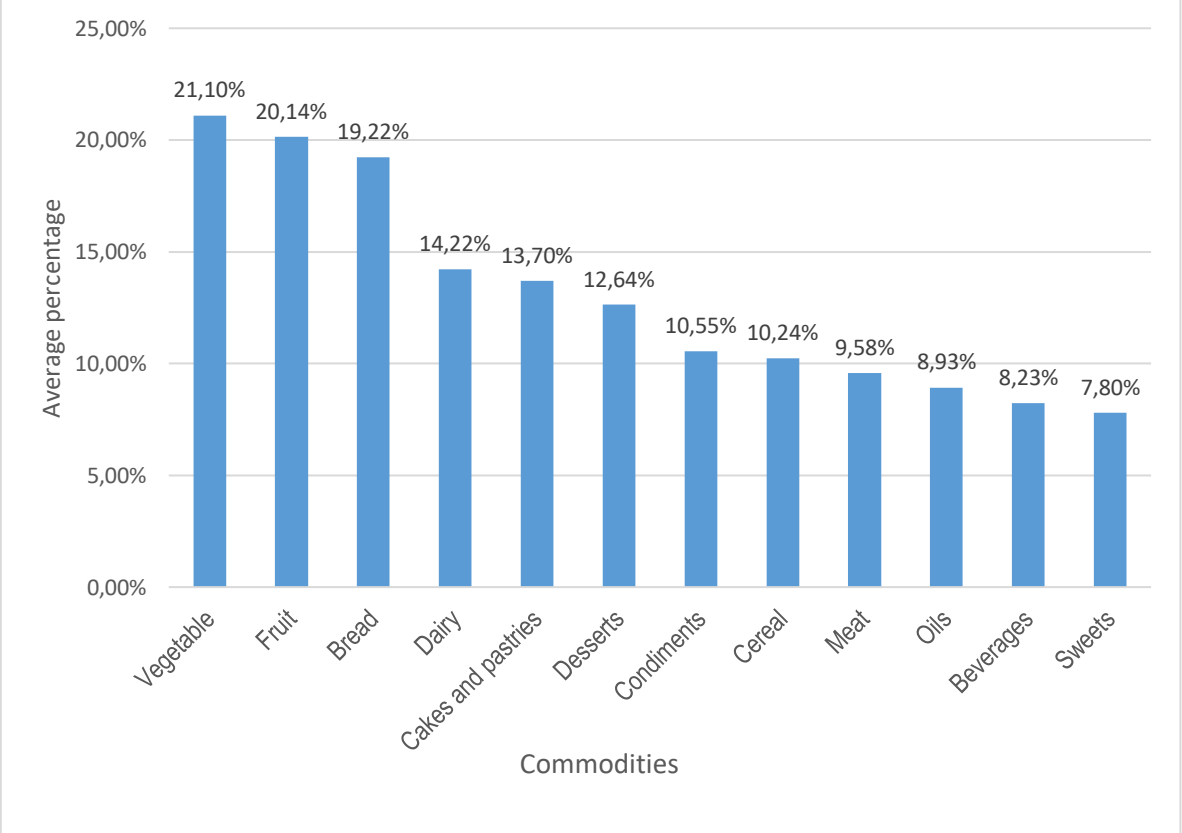

FIGURE 4.4: CONSUMERS' SELF-REPORTED ESTIMATES (%) OF FOOD PER CATEGORY WASTED

Results (Figure 4.4) indicate that respondents wasted on average 21.10% of vegetables, 20.14% of fruit, 19.22% of bread and 14.22% of dairy. Reasons for these wastages might be due to these commodities being highly perishable with a shorter shelf-life, compared to the other commodities such as oils (8.93%), beverages (8.23%) and sweets (7.80%) which were wasted at a lower percentage. In terms of perishable products, respondents indicated that they only wasted 9.58% of meat. The reasoning behind this could be contributed to the fact that meat is not only a more expensive commodity, but is also stored more carefully, thus prolonging shelf-life (Garrone *et al*., 2014).

- *Consumers' ranking of 12 food commodities*

Following on consumers' general wastage per food commodity, respondents were then prompted to rank and thus compare the 12 commodities according to the extent each was wasted during

the last calendar month (1 = category most wasted, 12= category least wasted). Results in Figure 4.5 present the ranking of the 12 primary food categories in terms of most to least wasted.

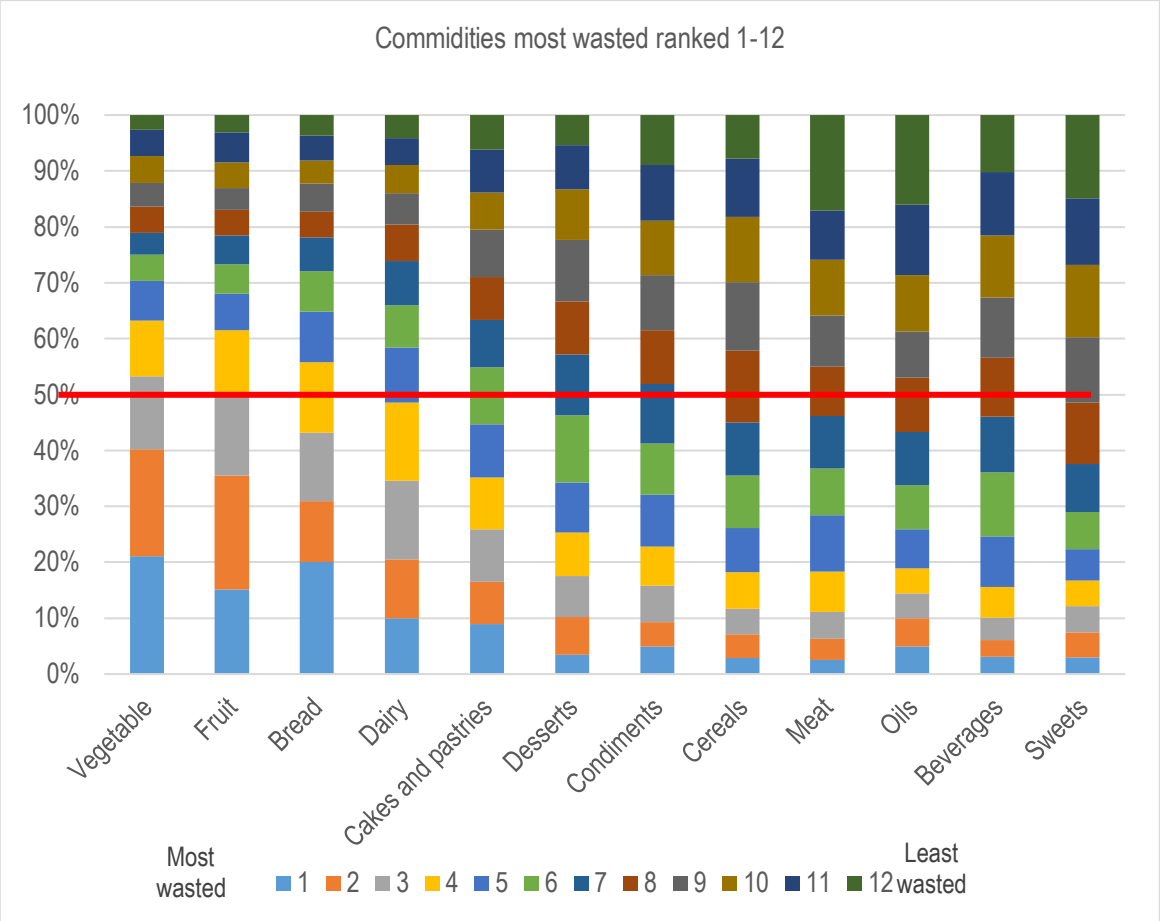

FIGURE 4.5: FOOD COMMODITIES RANKING

Findings pertaining to respondents' ranking of food commodities presented that respondents ranked vegetables, fruit and bread (baked goods) as the commodities mostly wasted, with oil, beverages and sweets being the commodities least wasted. These findings not only supported the results presented in Figure 4.4 but also underscored the concern regarding the wastage of more perishable products.

- *Consumers' wastage of selected/specific food items*

In order to investigate consumers' household food wastage in more detail, respondents were asked to reflect on their food consumption during the last calendar month and then indicate the likelihood of wastage for specific food items. A 5-point Likert type likelihood scale was used (very unlikely = 1 to very likely = 5). Each food item that was included in the measuring instrument was selected based on its popularity status with a specific food commodity/category (i.e. vegetable, fruit etc.) as well its prevalence and accessibility amongst South African consumers (e.g., dairy such as yoghurt). As a point of departure, Figure 4.6 presents the means calculated for each primary food commodity. The following discussion will focus on these food categories and items

that were highlighted as most concerning (i.e. vegetable, fruit, dairy, bread, meat). The results confirmed that the wastage of Vegetable (Mean=2.53), Fruit (Mean=2.38), Bread (Mean=2.58) and Dairy (Mean=2.22) are the commodities of most concern. In terms of specific food items wasted within these commodities, respective results are presented in Figure 4.6.

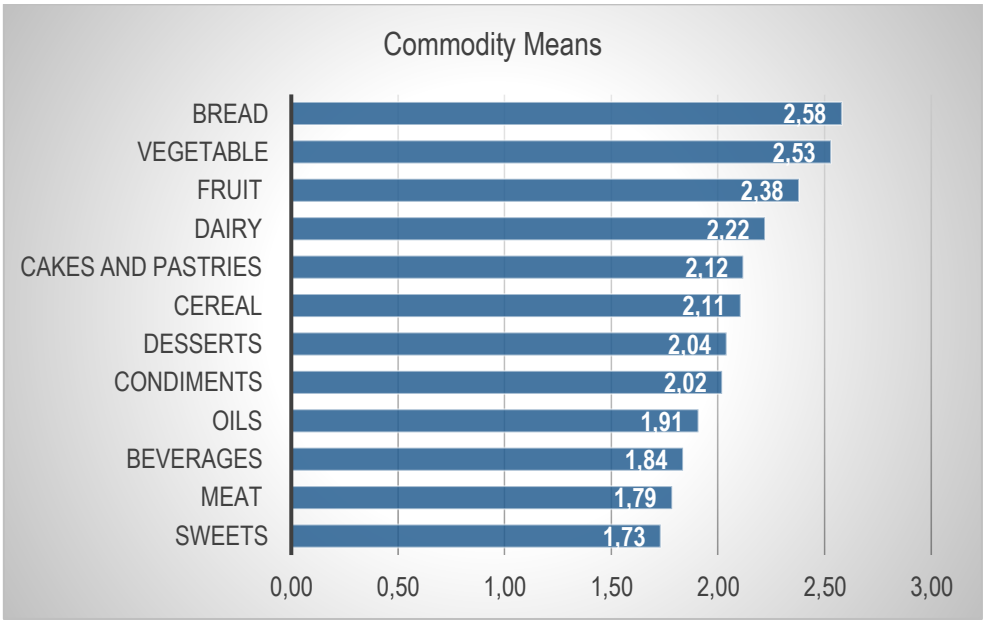

FIGURE 4.6: COMMODITY MEANS (5-POINT LIKERT-SCALE)

Within the scope of this study, only food items within commodities that were highlighted as worrisome (i.e. vegetable, fruit, bread, dairy and meat) will be discussed.

Consumers' wastage of vegetables

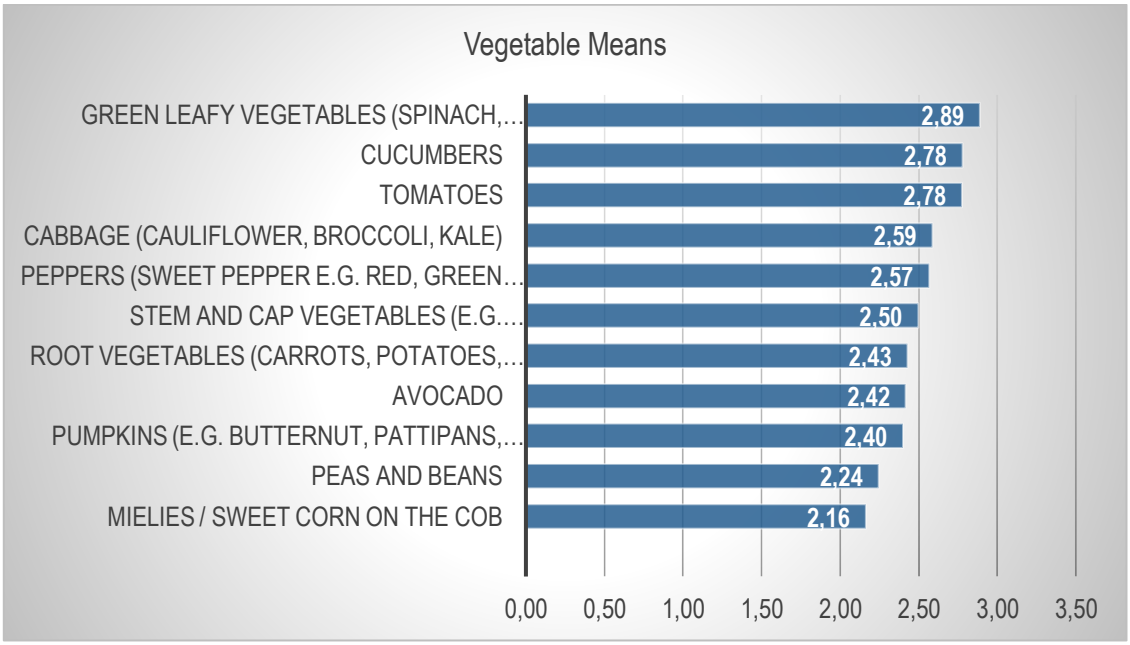

FIGURE 4.7: VEGETABLE MEANS

Findings presented in Figure 4.7 shows that green leafy vegetables (Mean=2.89), cucumber (Mean=2.78) and tomatoes (Mean=2.78) are the vegetables wasted the most. The higher means indicate that most respondents are more likely to waste these products. Reasons for this might be due to the higher purchasing rate but also perishability of these products compared to products such as mielies (Mean=2.16) and peas and beans (Mean=2.24) which tend to be more shelf-stable if stored correctly (Sánchez-Mata, Cámara & Diez-Marqués, 2003).

Consumers' wastage of fruit

Results presented in Figure 4.8 indicate that soft tropical fruit (i.e. bananas – Mean=2.68) were more likely to be wasted by respondents compared to stone fruit (Mean=2.45). This could also be attributed to the higher perishability of tropical fruit compared to stone fruit. Quested and Johnson (2009) state that fruits like soft tropical fruit (i.e. banana) have a shorter shelf life compared to hard fruits (i.e. apple) if stored at the same conditions.

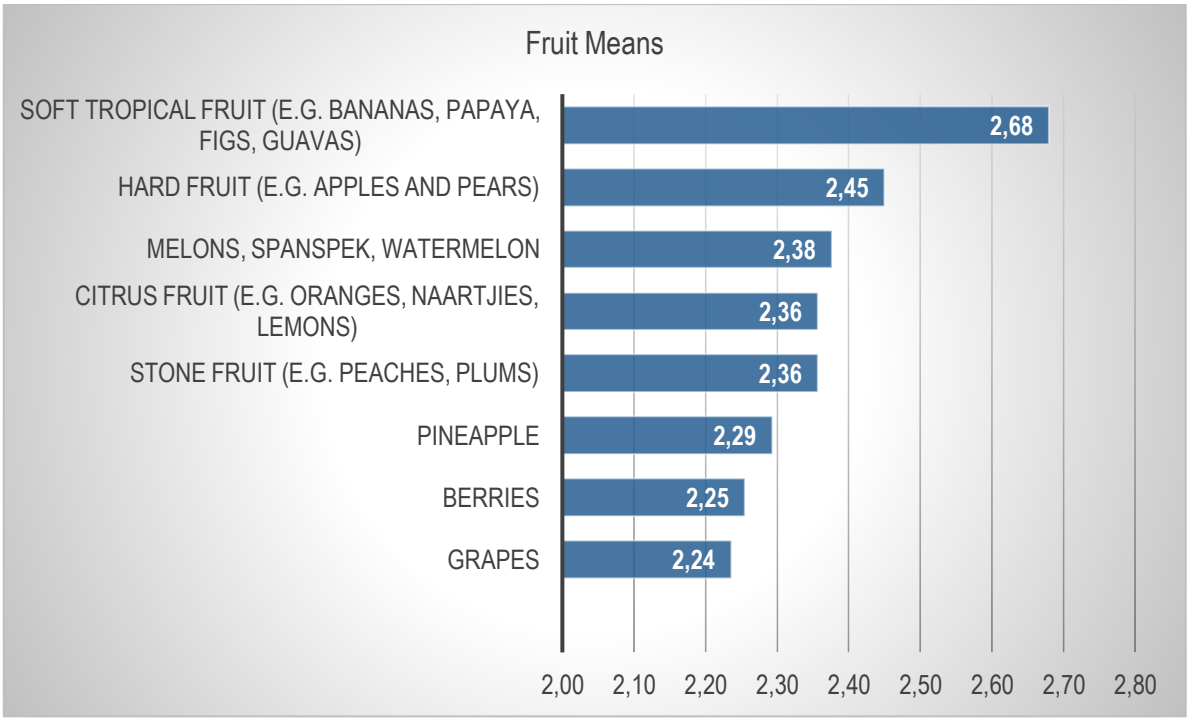

FIGURE 4.8: FRUIT MEANS

Interestingly, berries (Mean=2.25) (which are deemed extremely perishable) were wasted the least. Reasons for this could be attributed to berries not only being priced at a premium rate but they tend to be packaged in smaller quantities and also sold and can be stored at sub minimum (frozen) temperatures (Childs, 2016).

Consumers' wastage of bread

Results presented in Figure 4.9 indicated that sliced bread (Mean=2.75) along with bread rolls/buns (Mean=2.75) as regular purchased items were more likely to be wasted by respondents compared to items such as vetkoek (Mean=2.25). Reasons for this could be attributed to the fact that items such as vetkoek are often bought individually, thus wasted less than other bread products like a whole loaf which is not regularly consumed in one sitting.

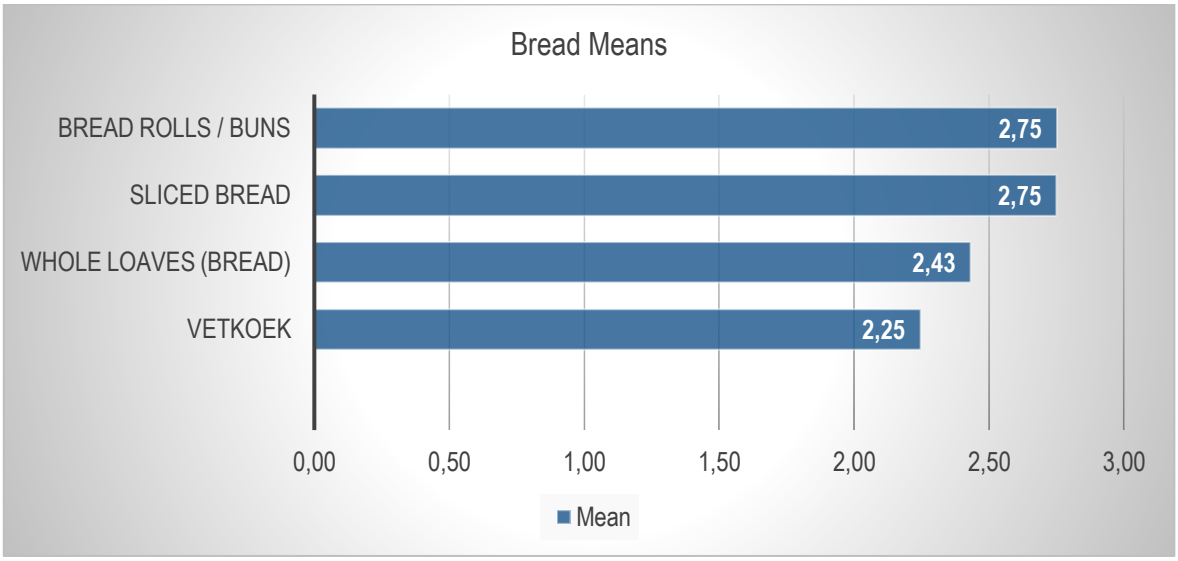

FIGURE 4.9: BREAD MEANS

Consumers' wastage of dairy

Figure 4.10 presents consumers' wastage of dairy products. Results indicate that Cream (Mean=2.65) and Yogurt (Mean=2.48) were more likely to be wasted compared to items such as Cheese (Mean=2.13) and Butter (Mean=1.71). The reasoning for this could be attributed to the fact that these products are more shelf-unstable (McCarthy & Liu, 2017) and consumers' sensitivity to sell-by dates. Consumers' reliance on and misinterpretation of sell-by dates provided by retailers often results in discarding food that is still safe to consume (Venter, 2017).

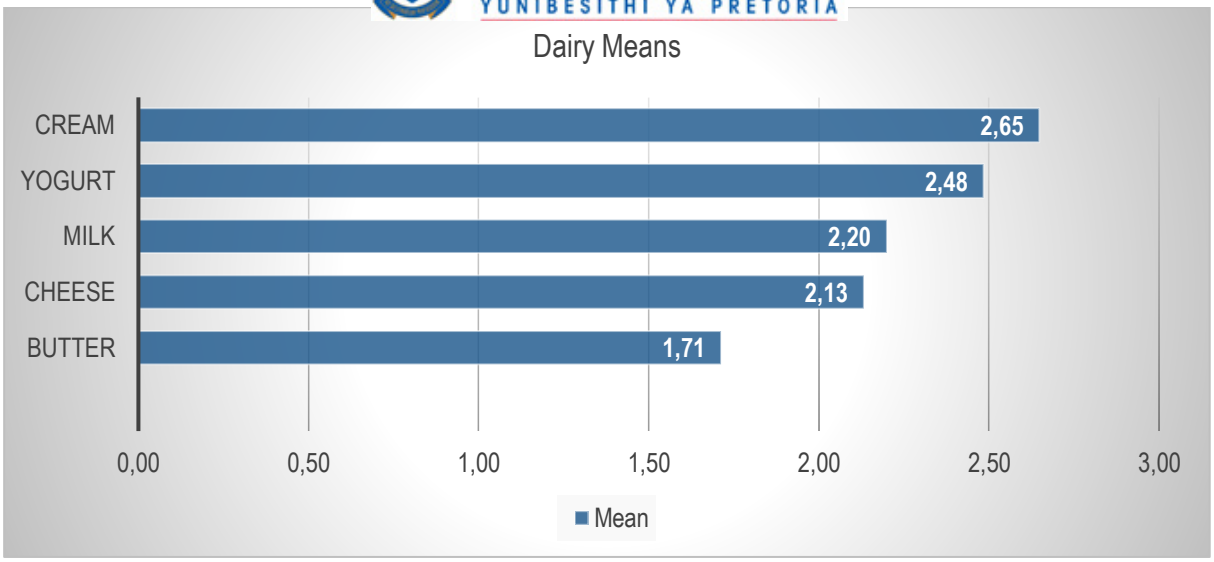

FIGURE 4.10: DAIRY MEANS

Consumers' wastage of meat

Figure 4.11 presents the results pertaining to the meat category as a commodity. Findings revealed that shellfish, poultry and fish tend to be wasted more compared to red meat alternatives such as beef, lamb and venison. In general, seafood products are consumed just after preparation and are not ideal or appetising to consume the following day and this results in possible premature discarding. Reasons for this could be attributed to food safety concerns. In terms of the red meat alternatives (i.e. Venison (Mean=1.65), Mutton/Lamb (Mean=1.70) and Beef (Mean=1.72)), one could argue that these products are wasted less due to them being more expensive compared to products such as poultry. Products such as Venison could be seen as a luxury product which is only available in certain seasons (i.e. less available) (Quested and Johnson, 2009).

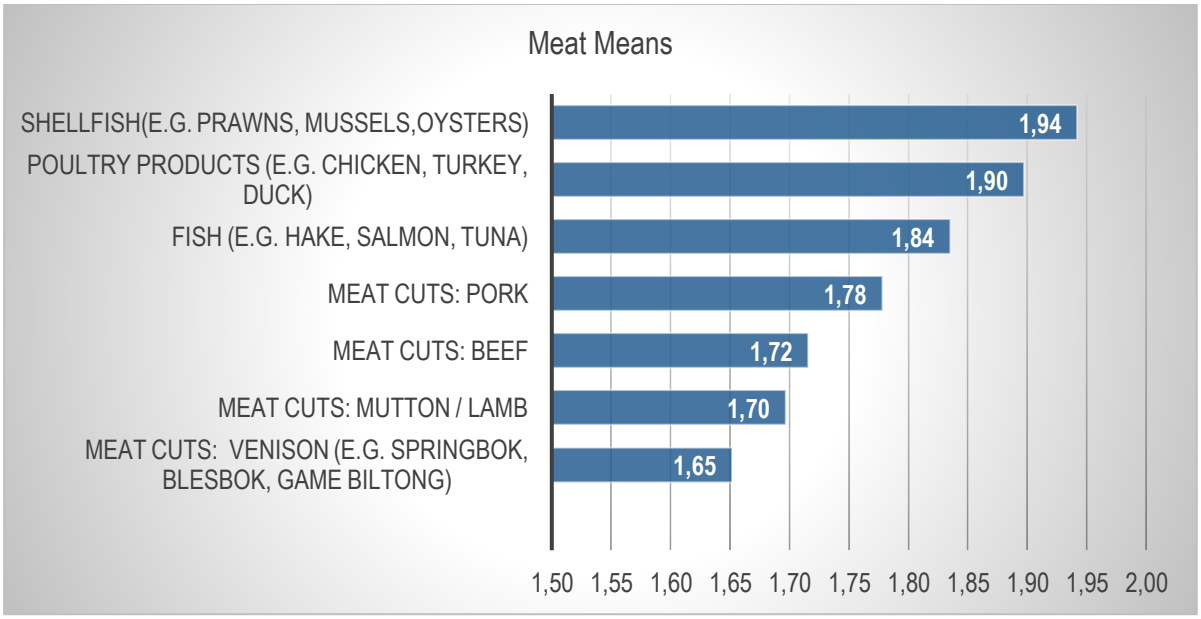

FIGURE 4.11: MEAT MEANS

4.4 POSSIBLE REASONS FOR HOUSEHOLD FOOD WASTE (OBJECTIVE 2)

The initial results in section 4.4 present the findings of possible reasons for food waste (Objective 2). In South Africa, little research has been done regarding reasons for food waste at the consumer level (Scott & Vigar-Ellis, 2014). Recent research was done by Aschemann-Witzel *et al*. (2019), who investigated Uruguayan households to determine the reasons why consumers waste in emerging economies.

In order to investigate possible reasons for consumers' household food wastage, respondents were asked to complete a pool of 46 self-designed scale items. A four-point Likert-type agreement scale (with increments ranging from Strongly Disagree to Strongly Agree) was used. To summarise and reduce the items into coherent constructs, an Exploratory Factor Analysis (EFA) was performed by using the maximum likelihood method and an Oblimin with Kaizer normalisation rotation method as the extraction method. Various criteria were taken into account, including Eigenvalues > 1, which indicated that the data followed a normal distribution as the condition, with a criterion of $p>0.05$. The respondents with not indicated data were excluded from the analysis by implementing the 'exclude listwise' function within SPSS. Therefore, only complete responses were used. Please refer to the operationalisation Table 3.1 for more detail regarding the scale design and/or Addendum A for an example of the questionnaire.

The EFA revealed seven factors which retained 39 of the 46 original scale items. Some items were omitted due to low communalities and because they did not logically load on any of the individual factors.

Suitable factor labels were identified for each factor and these more detail is also presented in Table 4.3. The factor labels are as follows:

Factor 1: **Lack of Skills and Knowledge/Information**
Consumers' lack knowledge or information of usage, preparation, and serving of the food product.

Factor 2: **Date Labelling**
Consumers are purchasing too close to sell-by, use-by and expiration dates.

Factor 3: **Health & Safety**
Food products might be slimy, mouldy or smell bad to consumers and could have a health or safety implication.

Factor 4: **Planning & Purchasing**

Consumers lack planning regarding meals which leads to bulk or unplanned purchasing.

Factor 5: **Marketing & Trends**

Consumers are purchasing food products because the material promotions in the store influenced them to.

Factor 6: **Packaging & Storage**

Food products are stored incorrectly or lack resealable packaging.

Factor 7: **Product Appearance**

The food product is unappetising in appearance to the consumer because of being bruised, deformed, blemished or old.

The Cronbach's alphas and means were determined for each of the factors. The results in terms of the Cronbach's alphas ranged between 0.763 and 0.940, which was considered acceptable. Means greater than two were considered as a positive indication that the specific factor positively contributed to consumers' fresh produce wastage. Table 4.3 presents the content of the 7 factors and the relevant statistical values.

TABLE 4.3: EFA REASONS FOR FOOD WASTE

	Factor						
	1	2	3	4	5	6	7
	Lack of skills and knowledge/ information	Date labelling	Health & Safety	Planning & Purchasing	Marketing & Trends	Packaging & Storage	Product Appearance
We waste because we do not have proper information regarding the preparation of the product.	.805	-.497	.097	.230	-.582	.503	-.420
We waste because we often prepare food incorrectly.	.816	-.440	.099	.293	-.518	.353	-.395
We waste because we often serve food incorrectly.	.780	-.450	.128	.307	-.494	.354	-.432
We waste because we do not have the correct information to utilize the commodity.	.773	-.456	.150	.237	-.553	.474	-.388
We waste because we do not have the necessary culinary skills to utilize the commodity.	.754	-.425	.118	.261	-.504	.420	-.348
We waste because we buy too close to the sell by date.	.397	-.907	.230	.365	-.446	.342	-.374
We waste because we buy too close to the expiry date.	.355	-.911	.174	.367	-.413	.315	-.303
We waste because we buy too close to the "use by" date.	.383	-.934	.212	.376	-.432	.333	-.374
We waste because we are concerned about the health and safety of the product.	.259	-.303	.468	.153	-.230	.352	-.412
We waste because the product might seem slimy / mouldy	.057	-.176	.751	.186	-.168	.230	-.355
We waste because the product might smell bad	.130	-.239	.738	.146	-.231	.223	-.437
We waste because the product appeared rotten.	.024	-.187	.673	.178	-.126	.211	-.499
We waste because we buy too large quantities.	.239	-.465	.168	.776	-.419	.382	-.317
We waste because we buy in bulk.	.344	-.503	.154	.588	-.531	.376	-.338
We waste because we do not plan our purchases.	.335	-.453	.112	.686	-.430	.244	-.230
We waste because we buy more than we need.	.259	-.442	.187	.814	-.434	.300	-.302
We waste because the amount per pack is more than we can consume.	.147	-.373	.258	.621	-.275	.439	-.226
We waste because we often forget about the product in storage.	.176	-.273	.311	.478	-.311	.260	-.255
We waste because we often prepare too much.	.339	-.323	.200	.581	-.370	.276	-.341
We waste because we do not have time to plan a menu that includes these commodities.	.407	-.361	.203	.542	-.443	.328	-.263
N	1096	1106	1094	1088	1100	1091	1088
Mean	1.333	1.901	2.684	2.334	1.541	1.885	2.160
Standard Deviation	4.892	3.520	3.421	7.009	4.292	6.221	6.342
% Variance Explained	35.301	7.686	6.203	4.113	2.883	2.667	2.620
Cronbach alpha	.903	.940	.763	.866	.864	.846	.866
Eigen Value	14.474	3.151	2.543	1.686	1.182	1.094	1.074

TABLE 4.3: EFA REASONS FOR FOOD WASTE (CONTINUED)

	Factor						
	1	2	3	4	5	6	7
	Lack of skills and knowledge/ information	Date labelling	Health & Safety	Planning & Purchasing	Marketing & Trends	Packaging & Storage	Product Appearance
We waste because the promotional material in the store prompted me to buy in excess	.384	-.428	.199	.393	-.831	.401	-.351
We waste because the promotional material in the store prompted me to buy these products even though it was not on my list	.443	-.445	.215	.358	-.847	.366	-.381
We waste because I'm easily swayed to buy new or interesting products from this category	.536	-.415	.126	.324	-.743	.374	-.406
We waste because we try to abide to new trends, fads or diets concerning these commodities	.546	-.420	.158	.275	-.685	.388	-.447
We waste because we do not have sufficient or correct storage space available (freezer/refrigerator).	.447	-.388	.161	.295	-.443	.529	-.343
We waste because we are not properly informed about the perishability of the product.	.579	-.426	.191	.200	-.456	.704	-.412
We waste because the amount per pack exceeds the amount that can be consumed before the product loses quality.	.147	-.315	.293	.498	-.266	.570	-.252
We waste because the packaging does not provide proper protection to the product.	.317	-.310	.252	.241	-.396	.684	-.324
We waste because the packaging is difficult to empty.	.436	-.332	.184	.202	-.403	.637	-.393
We waste because, once opened, the packaging cannot be resealed.	.215	-.337	.305	.374	-.361	.605	-.327
We waste because we do not have proper information regarding correct storage.	.633	-.472	.157	.218	-.517	.705	-.417
We waste because pests might infest the product in storage.	.369	-.276	.302	.083	-.375	.343	-.434
We waste because the food product appears unappetising although it might still be edible	.387	-.352	.362	.359	-.393	.374	-.549
We waste because the product appeared to be of poor quality.	.304	-.334	.501	.230	-.392	.337	-.741
We waste because the product appeared bruised.	.298	-.361	.405	.280	-.374	.326	-.782
We waste because the product appeared deformed.	.401	-.374	.341	.203	-.386	.327	-.754
We waste because the product appeared blemished.	.333	-.348	.437	.216	-.395	.356	-.821
We waste because the product appeared old.	.172	-.298	.601	.237	-.234	.288	-.670
N	1096	1106	1094	1088	1100	1091	1088
Mean	1.333	1.901	2.684	2.334	1.541	1.885	2.160
Standard Deviation	4.892	3.520	3.421	7.009	4.292	6.221	6.342
% Variance Explained	35.301	7.686	6.203	4.113	2.883	2.667	2.620
Cronbach alpha	.903	.940	.763	.866	.864	.846	.866
Eigen Value	14.474	3.151	2.543	1.686	1.182	1.094	1.074

As seen in Table 4.3, findings indicate that respondents mostly agreed with the content of **Factor 3** (Health and safety) (Mean=2.68), **Factor 4** (Planning and purchasing) (Mean=2.33) and **Factor 7** (Product appearance) (Mean=2.16) and thus these factors could be deemed as main reasons for household food wastage. Further analysis of the factor means showed that respondents were less likely to agree that items presented in **Factor 1** (Lack of skills and knowledge) (Mean=1.33), **Factor 2** (Date labelling) (Mean=1.90), **Factor 5** (Marketing and trends) (Mean=1.54) and **Factor 6** (Packaging and storage) (Mean=1.88) contributed to waste. Aschemann-Witzel *et al*. (2019) investigated why consumers waste food in emerging economies and discovered that consumers mostly discard food for three reasons, and these reasons are: the product is low in quality, incorrect or prolonged food item storage and excessive food purchasing. This empirical evidence supports the findings of this study in that product appearance (Factor 7) and planning and purchasing (Factor 4) contribute towards household food wastage.

A one-way analysis of variance (ANOVA)

To seek significant differences within the sample in terms of gender, age, education, population group and household income, a one-way analysis of variance (ANOVA) was done and t-tests were performed to explore possible, significant differences between two gender categories. The ANOVA was performed on all seven factors. The findings of these tests are presented in Table 4.4. Where significant differences were evident, relevant post-hoc tests were done to specify the differences. The significant differences that were identified are presented and discussed per factor in the following sections.

4.4.1 Factor 1: Lack of skills and knowledge/information

Papargyropoulou *et al*. (2014) found that a lack of cooking skills is one of the significant causes of food waste in households.

Gender, age and level of education:

No significant difference could be confirmed ($p>0.05$) amongst the subsets of the data in either of the demographic categories mentioned above. Thus, one can conclude that neither gender, age, nor the level of education can be used to predict food waste due to lack of skills and knowledge.

TABLE 4.4: SEVEN-FACTOR REASONS FOR FOOD WASTAGE ACROSS THE VARIOUS DEMOGRAPHIC CATEGORIES

	Factor 1 (Lack of skills and knowledge or information)			Factor 2 (Date labelling)			Factor 3 (Health & Safety)			Factor 4 (Planning and Purchasing)			Factor 5 (Marketing and Trends)			Factor 6 (Packaging and Storage)			Factor 7 (Product Appearance)		
GENDER	**n**	**M***	**SEM**	**n**	**M***	**SEM**	**n**	**M***	**SEM**	**N**	**M***	**SEM**	**n**	**M***	**SEM**	**n**	**M***	**SEM**	**n**	**M***	**SEM**
Male	352	1.36	0.050	354	1.85	0.061	351	2.62	0.045	351	2.21	0.047	353	1.50	0.053	351	1.86	0.047	353	2.20	0.048
Female	712	1.33	0.037	720	1.93	0.044	712	2.73	0.032	705	2.40	0.033	715	1.57	0.042	709	1.91	0.033	704	2.16	0.034
Total	1064			1074			1063			1056			1068			1060			1057		
p-value	0.063			0.096			0.875			0.240			0.001			0.810			0.860		
AGE	**n**	**M***	**SEM**	**n**	**M***	**SEM**	**n**	**M***	**SEM**	**N**	**M***	**SEM**	**n**	**M***	**SEM**	**n**	**M***	**SEM**	**n**	**M***	**SEM**
25y - 30y	469	1.31	0.045	471	1.84	0.054	468	2.71	0.040	464	2.26	0.042	471	1.48	0.048	469	1.85	0.041	465	2.16	0.043
31y-40y	138	1.30	0.091	143	1.80	0.099	139	2.50	0.079	140	2.25	0.075	139	1.47	0.097	140	1.83	0.084	139	1.94	0.084
41y-50y	150	1.44	0.087	149	2.08	0.104	148	2.67	0.072	148	2.50	0.072	147	1.70	0.094	144	2.00	0.078	147	2.20	0.078
50y-60y	282	1.30	0.052	286	1.95	0.066	281	2.73	0.047	279	2.39	0.049	285	1.57	0.063	283	1.88	0.048	281	2.20	0.048
Older than 60	37	1.42	0.154	37	2.02	0.188	38	2.93	0.102	37	2.34	0.140	38	1.75	0.140	37	1.95	0.144	37	2.42	0.145
Total	1076	1.33		1086	1.90		1074	2.69		1068	2.33		1080	1.54		1073	1.88		1069	2.16	
p-value	0.631			0.172			0.034			0.030			0.136			0.454			0.017		
EDUCATION	**n**	**M***	**SEM**	**n**	**M***	**SEM**	**n**	**M***	**SEM**	**N**	**M***	**SEM**	**n**	**M***	**SEM**	**n**	**M***	**SEM**	**n**	**M***	**SEM**
Lower than grade 12	19	1.76	0.241	19	2.33	0.242	19	3.03	0.125	19	2.40	0.219	19	1.87	0.242	19	2.50	0.217	19	2.54	0.171
Grade 12	338	1.37	0.053	344	1.90	0.064	340	2.68	0.047	337	2.27	0.049	343	1.54	0.058	339	1.86	0.050	338	2.21	0.049
Grade 12 plus a degree or diploma	469	1.33	0.046	470	1.92	0.054	466	2.66	0.041	467	2.37	0.040	469	1.57	0.051	465	1.91	0.041	467	2.17	0.042
Post graduate degree	265	1.24	0.059	268	1.83	0.072	264	2.69	0.050	260	2.34	0.053	264	1.45	0.064	263	1.82	0.052	259	2.04	0.056
Total	1091	1.33		1101	1.90		1089	2.68		1083	2.33		1095	1.54		1086	1.88		1083	2.16	
p-value	0.093			0.299			0.352			0.433			0.262			0.011			0.025		
ETHNICITY	**n**	**M***	**SEM**	**n**	**M***	**SEM**	**n**	**M***	**SEM**	**N**	**M***	**SEM**	**n**	**M***	**SEM**	**n**	**M***	**SEM**	**n**	**M***	**SEM**
African	159	1.88	0.089	159	2.27	0.094	159	2.69	0.077	158	2.50	0.078	160	1.99	0.093	155	2.15	0.083	159	2.35	0.078
Asian	2	2.40	0.200	2	2.83	0.167	1	2.75	0.000	2	2.56	0.188	2	2.63	0.375	2	2.43	0.143	2	2.71	0.286
Coloured	13	1.38	0.264	13	1.97	0.393	13	2.67	0.341	13	2.34	0.300	12	1.92	0.381	13	2.12	0.194	13	2.18	0.323
Indian	12	1.57	0.187	12	1.89	0.327	12	2.92	0.274	11	2.64	0.268	12	2.00	0.292	11	1.97	0.274	11	2.69	0.326
White	894	1.23	0.031	904	1.83	0.039	894	2.68	0.028	888	2.30	0.029	898	1.45	0.034	894	1.83	0.029	887	2.12	0.030
Other	6	1.13	0.281	6	1.33	0.502	5	2.70	0.470	6	1.69	0.376	6	0.96	0.368	6	0.93	0.319	6	1.71	0.512
Total	1086	1.33		1096	1.90		1084	2.68		1078	2.33		1090	1.54		1081	1.88		1078	2.16	
p-value	0.000			0.001			0.965			0.045			0.000			0.000			0.013		

	Factor 1 (Lack of skills and knowledge or information)			Factor 2 (Date labelling)			Factor 3 (Health & Safety)			Factor 4 (Planning and Purchasing)			Factor 5 (Marketing and Trends)			Factor 6 (Packaging and Storage)			Factor 7 (Product Appearance)		
HOUSEHOLD INCOME	**n**	**M***	**SEM**	**n**	**M***	**SEM**	**n**	**M***	**SEM**	**N**	**M***	**SEM**	**n**	**M***	**SEM**	**n**	**M***	**SEM**	**n**	**M***	**SEM**
<= R20000.00	379	1.46	0.054	381	1.95	0.062	379	2.69	0.044	376	2.30	0.047	380	1.57	0.056	375	1.92	0.050	378	2.15	0.049
R20001.00 - 40000.00	281	1.28	0.056	284	1.87	0.067	278	2.62	0.054	279	2.31	0.051	284	1.49	0.064	279	1.94	0.052	278	2.12	0.055
R40001.00 - 60000.00	192	1.34	0.069	193	1.92	0.086	192	2.67	0.063	189	2.46	0.056	190	1.57	0.074	194	1.86	0.062	189	2.19	0.063
R60001.00 - 80000.00	93	1.16	0.094	93	1.79	0.117	93	2.78	0.084	93	2.32	0.093	92	1.60	0.111	93	1.88	0.075	91	2.16	0.091
R80001.00+	87	1.12	0.101	89	1.78	0.124	87	2.70	0.084	87	2.24	0.103	88	1.35	0.114	86	1.65	0.089	88	2.16	0.091
Total	1032	1.33		1040	1.89		1029	2.68		1024	2.33		1034	1.53		1027	1.89		1024	2.15	
p-value	0.009			0.625			0.583			0.236			0.424			0.098			0.943		

M* = Mean maximum of 4; **SEM** = Standard error of the mean; **p – values** indicate significant differences, (p≤0.05)

Population group:

TABLE 4.5: CONSUMERS' FOOD PREPARATION SKILL AND KNOWLEDGE/ INFORMATION IN TERMS OF ETHNICITY

Population	Population groups	Mean	Mean differences	SEM	p-value
African M=1,87	Asian	2.40	-0.52075	0.6758	0.441
	Coloured	1.38	0.49463	0.2740	0.071
	Indian	1.57	0.31258	0.2843	0.272
	White	1.23	.65195*	0.0817	0.000
	Other	1.13	0.74591	0.3950	0.059
Asian M=2.40	African	1.88	0.52075	0.6758	0.441
	Coloured	1.38	1.01538	0.7214	0.160
	Indian	1.57	0.83333	0.7254	0.251
	White	1.23	1.17271	0.6724	0.081
	Other	1.13	1.26667	0.7755	0.103
Coloured M=1.38	African	1.88	-0.49463	0.2740	0.071
	Asian	2.40	-1.01538	0.7214	0.160
	Indian	1.57	-0.18205	0.3802	0.632
	White	1.23	0.15732	0.2653	0.553
	Other	1.13	0.25128	0.4688	0.592
Indian M=1.56	African	1.88	-0.31258	0.2843	0.272
	Asian	2.40	-0.83333	0.7254	0.251
	Coloured	1.38	0.18205	0.3802	0.632
	White	1.23	0.33937	0.2760	0.219
	Other	1.13	0.43333	0.4749	0.362
White M=1.22	African	1.88	-.65195*	0.0817	0.000
	Asian	2.40	-1.17271	0.6724	0.081
	Coloured	1.38	-0.15732	0.2653	0.553
	Indian	1.57	-0.33937	0.2760	0.219
	Other	1.13	0.09396	0.3891	0.809
Other M=1.13	African	1.88	-0.74591	0.3950	0.059
	Asian	2.40	-1.26667	0.7755	0.103
	Coloured	1.38	-0.25128	0.4688	0.592
	Indian	1.57	-0.43333	0.4749	0.362
	White	1.23	-0.09396	0.3891	0.809

M* = Mean maximum of 4; **SEM** = Standard error of the mean; **p – values** indicate significant differences, (p≤0.05)

As illustrated in Table 4.4, significant differences amongst the population groups (p=0.000) were identified through ANOVA. The LSD post hoc test that was subsequently done revealed that the African population group (M=1.87) was more likely to waste due to lack of skills and knowledge compared to the White group (M=1.22). The lack of knowledge in the African population could be attributed to the fact that before 1994, the population group was previously disadvantaged because of limited formal education (Marx-Pienaar, 2014).

Household income:

TABLE 4.6: CONSUMERS' FOOD PREPARATION SKILL AND KNOWLEDGE/ INFORMATION IN TERMS OF HOUSEHOLD INCOME

Income	Income groups	Mean	Mean Difference	SEM	p-value
<= R20000.00 M=1,46	20001.00 - 40000.00	1.28	.17285*	0.07716	0.025
	40001.00 - 60000.00	1.34	0.11374	0.08682	0.190
	60001.00 - 80000.00	1.16	.29627*	0.11342	0.009
	80001.00+	1.12	.33127*	0.11652	0.005
R20001.00 - 40000.00 M=1.28	<= 20000.00	1.46	-.17285*	0.07716	0.025
	40001.00 - 60000.00	1.34	-0.05910	0.09177	0.520
	60001.00 - 80000.00	1.16	0.12342	0.11725	0.293
	80001.00+	1.12	0.15842	0.12025	0.188
R40001.00 - 60000.00 M=1.34	<= 20000.00	1.46	-0.11374	0.08682	0.190
	20001.00 - 40000.00	1.28	0.05910	0.09177	0.520
	60001.00 - 80000.00	1.16	0.18253	0.12383	0.141
	80001.00+	1.12	0.21753	0.12667	0.086
R60001.00 - 80000.00 M=1.16	<= 20000.00	1.46	-.29627*	0.11342	0.009
	20001.00 - 40000.00	1.28	-0.12342	0.11725	0.293
	40001.00 - 60000.00	1.34	-0.18253	0.12383	0.141
	80001.00+	1.12	0.03500	0.14619	0.811
R80001.00+ M=1.16	<= 20000.00	1.46	-.33127*	0.11652	0.005
	20001.00 - 40000.00	1.28	-0.15842	0.12025	0.188
	40001.00 - 60000.00	1.34	-0.21753	0.12667	0.086
	60001.00 - 80000.00	1.16	-0.03500	0.14619	0.811

M* = Mean maximum of 4; **SEM** = Standard error of the mean; **p – values** indicate significant differences, (p≤0.05)

Findings derived after an ANOVA was performed (Table 4.4) indicate significant difference amongst different income groups (p=0.009). The post-hoc LSD test that was then done revealed that the lowest income level group (R<20,000) is significantly more inclined to waste food due to lack of skills and/or knowledge compared to the higher income groups (R60,000 & R80,000). The lower mean (M=1.46) for the lower-income group could possibly be attributed to lower educational levels and/or lower exposure to informational sources. Gustavsson *et al*. (2011) mentioned that lower-income groups are more often cautious about their consumption and wastage due to the financial risk involved.

4.4.2 Factor 2: Date labelling:

Date labelling is one of the ways consumers use to judge if a product is still fit for consumption (Hebrok & Boks, 2017). Date labelling includes "Best-Before", "Use-by" and "Sell-by". Date labelling is a confusing area for consumers owing to the food industry having misleading information on their labels (Gunders, 2013).

Gender, age, level of education and household income:

No significant difference could be confirmed ($p>0.05$) amongst the subsets of the data in either of the demographic categories mentioned above. Thus, one can conclude that neither gender, age, level of education, nor household income can be used to predict food waste due to date labelling.

Population group:

Findings presented in Table 4.7 reflect on different population groups' food waste as a result of date labelling. ANOVA revealed a significant difference between the population groups. Although the means of all the population groups indicate that none (except Asians M=2.83) are significantly prone to waste due to date labelling, the post-hoc LSD test indicated that Africans (M=2.27) were significantly more inclined to waste due to date labelling compared to Whites (M=1.83).

TABLE 4.7: CONSUMERS' FOOD WASTAGE PRACTICES AS A RESULT OF DATE LABELLING IN TERMS OF THE POPULATION GROUPS

Population	Population groups	Mean	Mean differences	SEM	p-value
African M=2.27	Asian	2.83	-0.56709	0.82998	0.495
	Coloured	1.97	0.29189	0.33648	0.386
	Indian	1.89	0.37736	0.34920	0.280
	White	1.83	.43181*	0.10031	0.000
	Other	1.33	0.93291	0.48510	0.055
Asian M=2.83	African	2.27	0.56709	0.82998	0.495
	Coloured	1.97	0.85897	0.88599	0.333
	Indian	1.89	0.94444	0.89089	0.289
	White	1.83	0.99889	0.82572	0.227
	Other	1.33	1.50000	0.95241	0.116
Coloured M=1.97	African	2.27	-0.29189	0.33648	0.386
	Asian	2.83	-0.85897	0.88599	0.333
	Indian	1.89	0.08547	0.46696	0.855
	White	1.83	0.13992	0.32583	0.668
	Other	1.33	0.64103	0.57570	0.266
Indian M=1.89	African	2.27	-0.37736	0.34920	0.280
	Asian	2.83	-0.94444	0.89089	0.289
	Coloured	1.97	-0.08547	0.46696	0.855
	White	1.83	0.05445	0.33895	0.872
	Other	1.33	0.55556	0.58323	0.341
White M=1.83	African	2.27	-.43181*	0.10031	0.000
	Asian	2.83	-0.99889	0.82572	0.227
	Coloured	1.97	-0.13992	0.32583	0.668
	Indian	1.89	-0.05445	0.33895	0.872
	Other	1.33	0.50111	0.47778	0.294
Other M=1.33	African	2.27	-0.93291	0.48510	0.055
	Asian	2.83	-1.50000	0.95241	0.116
	Coloured	1.97	-0.64103	0.57570	0.266
	Indian	1.89	-0.55556	0.58323	0.341
	White	1.83	-0.50111	0.47778	0.294

4.4.3 Factor 3: Health and safety

According to Godfray *et al*. (2012), consumers often dispose of food because they believe the food is unsafe to consume. Food products might have a bad odour, slimy appearance and/or may seem rotten and therefore be perceived as unsafe and no longer suitable for human consumption (Godfray *et al*., 2012).

Gender, level of education, population group and household income:

No significant difference could be confirmed (p>0.05) amongst the subsets of the data in either of the demographic categories mentioned above. Thus, one can conclude that neither gender, level of education, population group, nor household income can be used to predict food waste due to health and safety.

Age:

TABLE 4.8: CONSUMERS' FOOD WASTE PRACTICES AS A RESULT OF HEALTH AND SAFETY IN TERMS OF AGE

Age	Age Groups	Mean	Mean differences	SEM	p-value
25y - 30y M=2.71	31y-40y	2.50	.20153*	0.08195	0.014
	41y-50y	2.67	0.03452	0.08001	0.666
	50y-60y	2.73	-0.02174	0.06403	0.734
	Older than 60	2.93	-0.22250	0.14310	0.120
31y-40y M=2.50	25y - 30y	2.71	-.20153*	0.08195	0.014
	41y-50y	2.67	-0.16701	0.10021	0.096
	50y-60y	2.73	-.22327*	0.08797	0.011
	Older than 60	2.93	-.42403*	0.15530	0.006
41y-50y M=2.67	25y - 30y	2.71	-0.03452	0.08001	0.666
	31y-40y	2.50	0.16701	0.10021	0.096
	50y-60y	2.73	-0.05626	0.08617	0.514
	Older than 60	2.93	-0.25702	0.15428	0.096
51y-60y M=2.73	25y - 30y	2.71	0.02174	0.06403	0.734
	31y-40y	2.50	.22327*	0.08797	0.011
	41y-50y	2.67	0.05626	0.08617	0.514
	Older than 60	2.93	-0.20076	0.14663	0.171
Older than 60 M=2.93	25y - 30y	2.71	0.22250	0.14310	0.120
	31y-40y	2.50	.42403*	0.15530	0.006
	41y-50y	2.67	0.25702	0.15428	0.096
	50y-60y	2.73	0.20076	0.14663	0.171

As illustrated in Table 4.4, significant differences among the five age groups (p = 0.034) were identified through ANOVA. The mean of all five age groups (>M=2.50) indicates that none are particularly more prone to waste due to health and safety. However, the LSD post-hoc test indicated that the age group 31y-40y (M=2.50) was significantly less likely to waste food due to health and safety compared to the other age groups (i.e. 25y-30y M=2.71; 41y-50y M=2.08; 51y-

60y M=2.73; older than 60 M=2.93). A reason for this could be that this age group is adopting more sustainable behaviour following the trend of 'green consumerism' (McCarthy & Liu, 2017).

4.4.4 Factor 4: Planning and purchasing

Recent literature emphasises that planning and shopping routines have a direct impact on the amount of food wasted by households (Stefan *et al*., 2013). It is furthermore said that consumers lack planning, which often leads to impulsive and over purchasing, which then contributes to unnecessary product spoilage (Bell, Corsten & Knox, 2011).

Gender, level of education and household income:

No significant difference could be confirmed ($p>0.05$) amongst the subsets of the data, in either of the demographic categories mentioned above. Thus, one can conclude that neither gender, level of education, nor household income can be used to predict food waste due to planning and purchasing.

Age:

As illustrated in Table 4.4, significant differences among the five age groups ($p = 0.030$) were identified using ANOVA. A subsequent LSD post-hoc test (Table 4.9) indicated that the age group 41y-50y (M=2.50) was significantly more inclined to waste food as a result of poor planning and purchasing compared to the two younger age groups (i.e. 25y-30y M=2.26 and 31y-40y M=2.25). Reason for this could be that the younger generation value more sustainable practices when managing and purchasing food (McCarthy & Liu, 2017).

TABLE 4.9: CONSUMERS' FOOD WASTE PRACTICES AS A RESULT OF PLANNING AND PURCHASING IN TERMS OF AGE

Age	Age Groups	Mean	Mean differences	SEM	p-value
25y - 30y M=2.26	31y-40y	2.25	0.01158	0.08429	0.891
	41y-50y	2.50	-.23419*	0.08252	0.005
	50y-60y	2.39	-.13089*	0.06622	0.048
	Older than 60	2.34	-0.07625	0.14933	0.610
31y-40y M=2.25	25y - 30y	2.26	-0.01158	0.08429	0.891
	41y-50y	2.50	-.24578*	0.10306	0.017
	50y-60y	2.39	-0.14247	0.09054	0.116
	Older than 60	2.34	-0.08784	0.16159	0.587
41y-50y M=2.50	25y - 30y	2.26	.23419*	0.08252	0.005
	31y-40y	2.25	.24578*	0.10306	0.017
	50y-60y	2.39	0.10330	0.08889	0.245
	Older than 60	2.34	0.15794	0.16067	0.326
51y-60y M=2.39	25y - 30y	2.26	.13089*	0.06622	0.048
	31y-40y	2.25	0.14247	0.09054	0.116
	41y-50y	2.50	-0.10330	0.08889	0.245
	Older than 60	2.34	0.05464	0.15294	0.721
Older than 60 M=2.34	25y - 30y	2.26	0.07625	0.14933	0.610
	31y-40y	2.25	0.08784	0.16159	0.587
	41y-50y	2.50	-0.15794	0.16067	0.326
	50y-60y	2.39	-0.05464	0.15294	0.721

Population group:

As illustrated in Table 4.4, significant differences among the five population groups (p=0.045) were identified using ANOVA. The subsequent post-hoc LSD test revealed that the Indian (M=2.64) and African (M=2.50) population group were significantly more inclined to waste food due to poor planning and purchasing habits compared to the White group (M=2.30). Marx-Pienaar (2014) explains that the African population is often more inclined to purchase and consume more compulsively due to highly persuasive and clever marketing techniques.

TABLE 4.10: CONSUMERS' FOOD WASTAGE PRACTICES AS A RESULT OF POOR PLANNING AND PURCHASING IN TERMS OF ETHNICITY

Population	Population groups	Mean	Mean differences	SEM	p-value
African M=2.50	Asian	2.56	-0.06646	0.62205	0.915
	Coloured	2.34	0.15951	0.25224	0.527
	Indian	2.64	-0.14032	0.27260	0.607
	White	2.30	.19438*	0.07548	0.010
	Other	1.69	.80854*	0.36360	0.026
Asian M=2.56	African	2.50	0.06646	0.62205	0.915
	Coloured	2.34	0.22596	0.66400	0.734
	Indian	2.64	-0.07386	0.67200	0.912
	White	2.30	0.26084	0.61885	0.673
	Other	1.69	0.87500	0.71378	0.221
Coloured M=2.34	African	2.50	-0.15951	0.25224	0.527
	Asian	2.56	-0.22596	0.66400	0.734
	Indian	2.64	-0.29983	0.35814	0.403
	White	2.30	0.03488	0.24423	0.886
	Other	1.69	0.64904	0.43146	0.133
Indian M=2.64	African	2.50	0.14032	0.27260	0.607
	Asian	2.56	0.07386	0.67200	0.912
	Coloured	2.34	0.29983	0.35814	0.403
	White	2.30	0.33470	0.26521	0.207
	Other	1.69	.94886*	0.44367	0.033
White M=2.30	African	2.50	-.19438*	0.07548	0.010
	Asian	2.56	-0.26084	0.61885	0.673
	Coloured	2.34	-0.03488	0.24423	0.886
	Indian	2.64	-0.33470	0.26521	0.207
	Other	1.69	0.61416	0.35809	0.087
Other M=1.69	African	2.50	-.80854*	0.36360	0.026
	Asian	2.56	-0.87500	0.71378	0.221
	Coloured	2.34	-0.64904	0.43146	0.133
	Indian	2.64	-.94886*	0.44367	0.033
	White	2.30	-0.61416	0.35809	0.087

4.4.5 Factor 5: Marketing and trends

Consumers are often influenced and overwhelmed by marketing techniques in grocery stores (Graham-Rowe *et al*., 2014). Graham-Rowe *et al*. (2014) explain that consumers want to buy the best value for money, which often leads to buying bulk ingredients or promotional products that were not initially planned.

Gender:

TABLE 4.11: CONSUMERS' FOOD WASTAGE PRACTICES AS A RESULT OF MARKETING AND TRENDS IN TERMS OF GENDER

Gender	N	Mean	SEM
Male	353	2.35	0.05946
Female	722	2.43	0.04442
Total	1075		
p-value (t-test)		0.001	

As illustrated in Table 4.4, significant differences between male and female (p=0.001) were identified through ANOVA. The subsequent post-hoc T-test revealed that males (M=2.35) are less inclined to waste food due to marketing in grocery stores and trends compared to females (M=2.43). This could be attributed to the notion that females are still the primary grocery shoppers and responsible for the food preparation and waste management in the majority of households in SA. Katz-wise *et al*. (2010) support this notion and stated that females still take the traditional role of motherhood (homemaker), including food purchasing.

Age, level of education and household income:

No significant difference could be confirmed (p>0.05) amongst the subsets of the data in either of the demographic categories mentioned above. Thus, one can conclude that neither age, level of education, nor household income can be used to predict food waste due to marketing techniques and trends.

Population group:

As illustrated in Table 4.4, significant differences among the five population groups (p=0.000) were identified as utilising ANOVA. The post-hoc LSD test that was done revealed that the Other (M=0.95) and White (M=1.44) population groups were less inclined to waste food due to marketing techniques compared to the African (M=1.99) and Indian (M=2.00) population groups.

TABLE 4.12: CONSUMERS' FOOD WASTAGE PRACTICES AS A RESULT OF MARKETING AND TRENDS IN TERMS OF ETHNICITY

Population	Population groups	Mean	Mean differences	SEM	p-value
African M=1.99	Asian	2.63	-0.63906	0.75030	0.395
	Coloured	1.92	0.06927	0.31562	0.826
	Indian	2.00	-0.01406	0.31562	0.964
	White	1.45	.53800*	0.09049	0.000
	Other	0.96	1.02760*	0.43850	0.019
Asian M=2.63	African	1.99	0.63906	0.75030	0.395
	Coloured	1.92	0.70833	0.80540	0.379
	Indian	2.00	0.62500	0.80540	0.438
	White	1.45	1.17706	0.74648	0.115
	Other	0.96	1.66667	0.86101	0.053
Coloured M=1.92	African	1.99	-0.06927	0.31562	0.826
	Asian	2.63	-0.70833	0.80540	0.379
	Indian	2.00	-0.08333	0.43050	0.847
	White	1.45	0.46873	0.30644	0.126
	Other	0.96	0.95833	0.52726	0.069
Indian M=2.00	African	1.99	0.01406	0.31562	0.964
	Asian	2.63	-0.62500	0.80540	0.438
	Coloured	1.92	0.08333	0.43050	0.847
	White	1.45	0.55206	0.30644	0.072
	Other	0.96	1.04167*	0.52726	0.048
White M=1.45	African	1.99	-.53800*	0.09049	0.000
	Asian	2.63	-1.17706	0.74648	0.115
	Coloured	1.92	-0.46873	0.30644	0.126
	Indian	2.00	-0.55206	0.30644	0.072
	Other	0.96	0.48961	0.43194	0.257
Other M=0.96	African	1.99	-1.02760*	0.43850	0.019
	Asian	2.63	-1.66667	0.86101	0.053
	Coloured	1.92	-0.95833	0.52726	0.069
	Indian	2.00	-1.04167*	0.52726	0.048
	White	1.45	-0.48961	0.43194	0.257

4.4.6 Factor 6: Packaging and storage

Consumers often waste food due to incorrect packaging and storage practices. Consumers often keep food products in their original packaging which may not be appropriate (e.g. reusable packaging) which then causes fast spoilage (Quested, Stunell & Parry, 2013).

Gender, age and household income:

No significant difference could be confirmed ($p>0.05$) amongst the subsets of the data in either of the demographic categories mentioned above. Thus, one can conclude that neither gender, age nor household income can be used to predict food waste due to packaging and storage.

Level of education:

As illustrated in Table 4.4, significant differences among the four educational groups ($p=0.011$) were identified using ANOVA. The subsequent post-hoc T-test revealed that the group with an

education level lower than grade 12 (M=2.49) was more inclined to waste food due to incorrect food packaging and storage compared to higher educational levels (i.e. Grade 12 M=1.86; Grade 12 plus a degree or diploma M=1.91; Postgraduate degree M=1.82). Williams *et al*. (2012) found that more educated consumers tend to have more sustainable environmental practices in their household compared to less educated consumers.

TABLE 4.13: CONSUMERS' FOOD WASTAGE PRACTICES AS A RESULT OF PACKAGING AND STORAGE IN TERMS OF THE LEVEL OF EDUCATION

Educational level	Educational groups	Mean	Mean differences	SEM	p-value
Lower than grade 12 M=2.50	Grade 12	1.86	.63193*	0.20879	0.003
	Grade 12 plus a degree or diploma	1.91	.58656*	0.20729	0.005
	Post graduate degree	1.82	.68092*	0.21039	0.001
Grade 12 M=1.86	Lower than grade 12	2.50	-.63193*	0.20879	0.003
	Grade 12 plus a degree or diploma	1.91	-0.04537	0.06325	0.473
	Post graduate degree	1.82	0.04899	0.07277	0.501
Grade 12 plus a degree or diploma M=1.91	Lower than grade 12	2.50	-.58656*	0.20729	0.005
	Grade 12	1.86	0.04537	0.06325	0.473
	Post graduate degree	1.82	0.09436	0.06833	0.168
Postgraduate degree M=1.82	Lower than grade 12	2.50	-.68092*	0.21039	0.001
	Grade 12	1.86	-0.04899	0.07277	0.501
	Grade 12 plus a degree or diploma	1.91	-0.09436	0.06833	0.168

Population group:

As illustrated in Table 4.4, significant differences among the five population groups (p=0.000) were identified through ANOVA. The mean of all six population groups (<M=2.50) indicates that none are particularly more prone to waste food due to food packaging and storage. However the subsequent post-hoc LSD test revealed that Other (M=0.95) was less inclined to waste food due to food packaging and storage compared to the other four population groups (i.e. African M=2.15; Asian M=2.43; Coloured M=2.12; Indian M=1.97; White M=1.83). The African (M=2.15) population group was significantly more inclined to waste food compared to the White (M=1.83) population group.

TABLE 4.14: CONSUMERS' FOOD WASTAGE PRACTICES AS A RESULT OF PACKAGING AND STORAGE IN TERMS OF POPULATION GROUP

Population	Population groups	Mean	Mean differences	SEM	p-value
African M=2.15	Asian	2.43	-0.27465	0.62730	0.662
	Coloured	2.12	0.03304	0.25452	0.897
	Indian	1.97	0.17989	0.27504	0.513
	White	1.83	.31915*	0.07669	0.000
	Other	0.93	1.22535*	0.36676	0.001
Asian M=2.43	African	2.15	0.27465	0.62730	0.662
	Coloured	2.12	0.30769	0.66953	0.646
	Indian	1.97	0.45455	0.67759	0.502
	White	1.83	0.59380	0.62399	0.342
	Other	0.93	1.50000*	0.71972	0.037
Coloured M=2.12	African	2.15	-0.03304	0.25452	0.897
	Asian	2.43	-0.30769	0.66953	0.646
	Indian	1.97	0.14685	0.36111	0.684
	White	1.83	0.28611	0.24625	0.246
	Other	0.93	1.19231*	0.43505	0.006
Indian M=1.97	African	2.15	-0.17989	0.27504	0.513
	Asian	2.43	-0.45455	0.67759	0.502
	Coloured	2.12	-0.14685	0.36111	0.684
	White	1.83	0.13925	0.26740	0.603
	Other	0.93	1.04545*	0.44736	0.020
White M=1.83	African	2.15	-.31915*	0.07669	0.000
	Asian	2.43	-0.59380	0.62399	0.342
	Coloured	2.12	-0.28611	0.24625	0.246
	Indian	1.97	-0.13925	0.26740	0.603
	Other	0.93	.90620*	0.36106	0.012
Other M=0.93	African	2.15	-1.22535*	0.36676	0.001
	Asian	2.43	-1.50000*	0.71972	0.037
	Coloured	2.12	-1.19231*	0.43505	0.006
	Indian	1.97	-1.04545*	0.44736	0.020
	White	1.83	-.90620*	0.36106	0.012

4.4.7 Factor 7: Product appearance

Consumers waste food due to it being bruised, of poor quality, deformed, blemished and/or old but not necessarily unsafe to consumer (Quested & Johnson, 2009).

Gender and household income:

No significant difference could be confirmed ($p>0.05$) amongst the subsets of the data in either of the demographic categories mentioned above. Thus, one can conclude that neither gender nor household income can be used to predict food waste due to product appearance.

Age:

TABLE 4.15: CONSUMERS' FOOD WASTE PRACTICES AS A RESULT OF THE PRODUCT IN TERMS OF AGE

Age	Age Groups	Mean	Mean differences	SEM	p-value
25y - 30y M=2.16	31y-40y	1.94	.22059*	0.08731	0.012
	41y-50y	2.20	-0.03824	0.08546	0.655
	50y-60y	2.20	-0.04136	0.06824	0.545
	Older than 60	2.42	-0.25601	0.15427	0.097
31y-40y M=1.94	25y - 30y	2.16	-.22059*	0.08731	0.012
	41y-50y	2.20	-.25883*	0.10685	0.016
	50y-60y	2.20	-.26195*	0.09365	0.005
	Older than 60	2.42	-.47660*	0.16707	0.004
41y-50y M=2.20	25y - 30y	2.16	0.03824	0.08546	0.655
	31y-40y	1.94	.25883*	0.10685	0.016
	50y-60y	2.20	-0.00312	0.09193	0.973
	Older than 60	2.42	-0.21777	0.16611	0.190
51y-60y M=2.20	25y - 30y	2.16	0.04136	0.06824	0.545
	31y-40y	1.94	.26195*	0.09365	0.005
	41y-50y	2.20	0.00312	0.09193	0.973
	Older than 60	2.42	-0.21465	0.15795	0.174
Older than 60 M=2.42	25y - 30y	2.16	0.25601	0.15427	0.097
	31y-40y	1.94	.47660*	0.16707	0.004
	41y-50y	2.20	0.21777	0.16611	0.190
	50y-60y	2.20	0.21465	0.15795	0.174

As illustrated in Table 4.4, significant differences among the five age groups (p = 0,034) were identified through ANOVA. Although the means of all the age groups indicate that none were in particularly prone to waste due to product appearance (<M=2.42), the post-hoc LSD test indicated that the age group 31y-40y (M=1.94) was significantly less inclined to waste food due to product appearance compared to all other age groups (i.e. 25y-30y M=2.16; 41y-50y M=2.20; 51-60y M=2.20; older than 60 M=2.42). A reason for this could be that this age group could be starting a family and have less disposable income to spend on perfectly aesthetic food products (Graham-Rowe *et al*., 2014)

Level of education:

The findings presented in Table 4.16 reflect on different levels of education groups' "food waste as a result of product appearance". ANOVA revealed a significant difference between the levels of education groups. The post-hoc LSD test that was subsequently done revealed that respondents with a Postgraduate degree (M=2.03) were less inclined to waste food due to product appearance compared to respondents with Grade 12 (M=2.21) or lower than Grade 12 (M=2.54). This could be an indication that consumers with a higher level of education understand that product appearance does not necessarily influence the quality of the product (Schanes, Dobernig & Burcu, 2018).

TABLE 4.16: CONSUMERS' FOOD WASTAGE PRACTICES AS A RESULT OF PRODUCT APPEARANCE IN TERMS OF THE LEVEL OF EDUCATION

Educational level	Educational groups	Mean	Mean differences	SEM	p-value
Lower than grade 12 M=2.54	Grade 12	2.21	0.32749	0.21322	0.125
	Grade 12 plus a degree or diploma	2.17	0.37341	0.21165	0.078
	Post graduate degree	2.04	.50440*	0.21495	0.019
Grade 12 M=2.21	Lower than grade 12	2.54	-0.32749	0.21322	0.125
	Grade 12 plus a degree or diploma	2.17	0.04592	0.06458	0.477
	Post graduate degree	2.04	.17691*	0.07468	0.018
Grade 12 plus a degree or diploma M=2.17	Lower than grade 12	2.54	-0.37341	0.21165	0.078
	Grade 12	2.21	-0.04592	0.06458	0.477
	Post graduate degree	2.04	0.13099	0.07006	0.062
Postgraduate degree M=2.04	Lower than grade 12	2.54	-.50440*	0.21495	0.019
	Grade 12	2.21	-.17691*	0.07468	0.018
	Grade 12 plus a degree or diploma	2.17	-0.13099	0.07006	0.062

Population group:

Findings derived from the ANOVA (Table 4.4) indicate a significant difference amongst different population groups (p=0.013). Although the means of all (except Other M=1.71) population groups (>M=2.10) indicate that none are particularly more prone to waste due to product appearance, the subsequent post-hoc LSD test nonetheless revealed that the White (M=2.11) population group was significantly less inclined to waste food due to product appearance compared to the African (M=2.34) and Indian (M=2.68) population groups. This could be attributed to the fact that the African population as the 'previously disadvantaged' aspire to better their life quality with the best and not necessarily applying sustainable waste management practices at home (Marx-Pienaar, 2014).

TABLE 4.17: CONSUMERS' FOOD WASTAGE PRACTICES AS A RESULT OF PRODUCT APPEARANCE IN TERMS OF POPULATION GROUPS

Population	Population groups	Mean	Mean differences	SEM	p-value
African M=2.35	Asian	2.71	-0.36927	0.64208	0.565
	Coloured	2.18	0.16919	0.26030	0.516
	Indian	2.69	-0.34330	0.28133	0.223
	White	2.12	.22615*	0.07771	0.004
	Other	1.71	0.63073	0.37528	0.093
Asian M=2.71	African	2.35	0.36927	0.64208	0.565
	Coloured	2.18	0.53846	0.68540	0.432
	Indian	2.69	0.02597	0.69366	0.970
	White	2.12	0.59543	0.63879	0.351
	Other	1.71	1.00000	0.73679	0.175
Coloured M=2.18	African	2.35	-0.16919	0.26030	0.516
	Asian	2.71	-0.53846	0.68540	0.432
	Indian	2.69	-0.51249	0.36968	0.166
	White	2.12	0.05696	0.25210	0.821
	Other	1.71	0.46154	0.44537	0.300
Indian M=2.69	African	2.35	0.34330	0.28133	0.223
	Asian	2.71	-0.02597	0.69366	0.970
	Coloured	2.18	0.51249	0.36968	0.166
	White	2.12	.56945*	0.27376	0.038
	Other	1.71	.97403*	0.45797	0.034
White M=2.12	African	2.35	-.22615*	0.07771	0.004
	Asian	2.71	-0.59543	0.63879	0.351
	Coloured	2.18	-0.05696	0.25210	0.821
	Indian	2.69	-.56945*	0.27376	0.038
	Other	1.71	0.40457	0.36964	0.274
Other M=1.71	African	2.35	-0.63073	0.37528	0.093
	Asian	2.71	-1.00000	0.73679	0.175
	Coloured	2.18	-0.46154	0.44537	0.300
	Indian	2.69	-.97403*	0.45797	0.034
	White	2.12	-0.40457	0.36964	0.274

4.5 CONSUMERS' ATTRIBUTION OF BLAME AND GUILTY PARTY (OBJECTIVE 3)

Consumers often feel powerless in terms of addressing their household food waste. This has not only led to ignorance about food waste, but it has also caused customers to feel contempt for/revert blame to the government and food retailers (Krzywoszynska, 2011). Consumers can assign locus to either themselves (internal attributions) or an external entity like a food retailer (external attributions).

4.5.1 Consumers' attribution of blame (Objective 3.1) (Who is to blame?)

Objective 3.1 was set out to explore consumers' attribution of blame. Respondents were asked to indicate (on a five-point Likert-type agreement scale anchored from Strongly Disagree (one = 1) to Strongly Agree (five=5)) who they believe should be "blamed" for food wastage in South Africa. The respondents were presented with five key role-players/stakeholders in the current food

supply chain, namely: farmer, food manufacturer, food retailer, consumer and government. Figure 4.12 presents the results.

FIGURE 4.12: WHO IS TO BLAME?

Results revealed that respondents mostly agreed that consumers (Mean=4.41) were to blame for food waste in South Africa. On the contrary, respondents were least likely to blame farmers. This might reflect respondents' ignorance in terms of the amount of food wasted at the farming level. According to Nahman and De Lange (2013), in South Africa, approximately 50% of food is lost or disposed of at the farmer's level. It is estimated that in South Africa, consumers contribute to 5% of the total food waste in the country (Oelofse & Nahman, 2012). However, it should be noted that research regarding food waste in South Africa is limited and figures are often based on mere estimates (Scott & Vigar-Ellis, 2014)

4.5.2 Consumers' beliefs regarding who is best equipped to address the problem of food waste in South Africa (Objective 3.2)

The respondents were again presented with five key role-players/stakeholder in the current food supply chain. Respondents were asked to indicate (on a five-point Likert-type agreement scale) who they believe is best equipped to address food waste in South Africa. Figure 4.13 illustrates the results.

Results revealed that respondents mostly agreed that the Government (Mean=4.32) and Retailers (Mean=4.05) are best equipped to address the problem of food waste. This could indicate that consumers believe that they do not have the right resources or knowledge to address this ongoing issue. They feel helpless and tend to leave it at the feet of the government. Literature explains that the government plays a vital role in implementing policies and regulating food waste at every point in the food supply chain. Therefore, furthering attention in this regard is crucial (FAO, 2009; Marx-Pienaar, 2014; Quested & Johnson, 2009).

FIGURE 4.13: WHO IS BEST EQUIPPED TO ADDRESS FOOD WASTE?

4.6 CONCLUSION

The results were gathered by implementing quantitative data collection techniques. The results were presented according to the objectives of the study. The research focused on consumers' understanding of food waste, self-reported food waste figures, as well as their attribution of blame.

The study had a sample of 1767 respondents in total. For this study, most respondents were female (62%, n=1096). This was expected because in South Africa, women are still known for taking on the traditional role of homemaker, which includes food planning, purchasing and preparation. The findings revealed that 68,76% (n=885) of respondents understood that food waste includes all sections of the food supply chain, from farmer to consumer-level, although consumers are more ignorant about food waste found at manufacturer level.

Regarding the specifics of what consumers waste, respondents indicated that they waste 21.10% of vegetables, 20.14% of fruit, 19.22% of bread and 14.22% of dairy during one calendar month and that they were least likely to waste sweets (Mean=1.79) and meats (Mean=1.73; Five-point Likert agreement scale).

Possible reasons for food waste were also investigated. Results indicated that health and safety (Mean=2.68) and planning & purchasing (Mean=2.33; four-point Likert agreement scale) were mostly presented as main reasons for food waste.

Lastly, respondents indicated that consumers (Mean=4.41; five-point Likert agreement scale) acknowledge ("blame") themselves for food waste in South Africa. However, they indicated that the government (Mean=4.32) is best equipped to address the on-going food waste problem in South Africa. In conclusion, it is believed that these research findings could contribute to the research focus of the Department of Consumer Science at the University of Pretoria and could

assist in addressing the need for food waste management identified by the CSIR and the Government of RSA.

Chapter 5

CONCLUSION

This chapter presents the conclusions of the research in terms of the main objectives set for the study. The recommendations given are based on the interpretation of the findings with specific attention to how the intricate issue of food waste could be better managed and/or mitigated through acknowledging and understanding consumer attribution of blame. Shortcomings of the study are highlighted and assisted in the idea formulation for future research.

5.1 INTRODUCTION

Recent figures indicate that the world's population is growing at an alarming rate of 80 million people per year, or about 220,000 people per day. It is estimated that by the year 2050, Earth will be home to 2 to 3 billion more human beings (Clay, 2011). This projected population growth raises a host of questions about the future of humanity and the planet we inhabit. Problems associated with overpopulation include the increased demand, consumption and wastage of natural resources – mainly freshwater and food. This is concerning as it is emphasised that we would, if we continued our current trajectory, need three more planets to produce enough food (Clay, 2011). Current global figures indicate that 842 million individuals already do not have access to sufficient food and are exposed to chronic hunger, while on the contrary, one-third of all food produced is wasted (FAO, 2015).

South Africa, as an emerging economy, is no stranger to food waste and with an annual rate of 10.2 million tonnes of food waste per year (one-third of all food produced) (Nahman & De Lange, 2013) urgent attention is much needed. This food waste negatively impacts different environments. Economically, food waste costs South Africa R65.1 billion (D'Oliveira, 2013). Seeing that SA is the 30th driest country in the world, we should be even more attentive to food waste (including water, and water's role in food production) (Baudoin *et al.,* 2017; Kummu *et al.,* 2010). Lastly, food waste drastically influences South African citizens – roughly 50% of SA's population is food insecure (Oxford, 2018).

Addressing issues such as food waste is therefore essential to ensure a sustainable supply of food for future generations. The problem, however, is that addressing food waste is no simple

matter. With very little known about the current state of affairs in SA and with multiple stakeholders/role players involved, pinpointing “guilty parties” and/or assigning responsibility is somewhat problematic.

Recent studies highlight that although food wastage tends to be a concern across the supply chain, wastage amongst households becomes even more worrisome as a country progresses towards becoming more developed (Gustavsson *et al*., 2011). For this reason, food wastage amongst this waste stream (Gauteng households) was of particular interest in this study.

Samir (2015) states that the consumer is an essential part of the food supply chain because the chain is depended on the consumers to purchase products and send cash upstream to achieve economic sustainability. Unfortunately, recent literature indicates that irresponsible consumer consumption is becoming a matter of contention which requires serious consideration and mitigation. Consumers today tend to consume and ultimately discard food that no longer meets their (often fickle) needs without considering the consequences of their actions (Marx-Pienaar, 2013). Regarding possible reasons for food wastage, numerous factors and/or elements are highlighted in literature, yet very little is known about these factors a South African context. This is also exacerbated by the fact that no information regarding consumers’ controllability (which refers to the extent to which an outcome is controllable or not by the consumer (Weiner, 1986) could be accessed.

This study, therefore, aimed to address the identified gap through investigating and describing consumers’ understanding of food waste, current food waste practices and possible reasons therefor. This not only enabled the analysis of consumers’ wastage practices and possible reasons for wastage (in terms of various demographic characteristics) but also assisted in setting an evidence-based scene for practical and policy-related recommendations that involve and encourage all role players (“farm to fork”) towards more sustainable food consumption and waste management.

5.2 CONCLUSION OF THE OBJECTIVES

5.2.1 Consumers' understanding of food waste and current food waste practices Objective 1)

5.2.1.1 Consumers' understanding of food waste (Objective 1.1)

At present, food waste still needs to be defined in a way that presents a standardised, globally acceptable definition (McCarthy & Liu, 2017). This lack of proper definition not only contributes to the problem at hand, but also hinders the investigation and mitigation thereof. In terms of this study, findings revealed that most respondents (n=885; 68.76%) acknowledged that the definition of food waste encompasses more than just post-consumption "peels and bones". Food waste is any solid or liquid food substance, raw or cooked, which is discarded during the manufacturing, preparation and or consumption of a food product and/ or meal. Although this is a positive result, the fact that almost a quarter (23.62%) of respondents still perceive food waste to be limited to post-consumer consumption is still worrisome. This concern is furthermore corroborated by the results obtained from food waste pictorial collages where respondents were least likely to identify pre-consumer waste (i.e. production, processing and retail) as food waste. In terms of the theoretical perspective chosen for this study (Weiner's Attribution Theory), consumers' ignorance regarding pre-consumer waste could be explained or **attributed** in terms of **locus of control**. Pre-consumer waste might be perceived by consumers as an **external locus of control** in which they, therefore, have no part in. The saying of "out of sight, out of mind" might be very relevant in this respect.

It is, therefore, argued that consumers' understanding of the concept of food waste is still somewhat lacking and needs further attention. Evans (2011) explains that a deficit/lack of understanding of food waste may have dire consequences on waste management practices at home. This research thus confirms that there is much room for improvement regarding defining food waste in general and that consumers' understanding of food waste in particularly needs further attention.

5.2.1.2 Consumers' food waste practices (Objective 1.2)

As mentioned earlier, food waste occurs throughout the supply chain. However, Aktas, Sahin, Topaloglu, Oledinma, Huda, Irani, Sharif, van't Wout and Kamrava (2018) state that the value-added lost to waste is the highest when consumers waste food. It is therefore unfortunate to note that, when considering a topic such as sustainability, consumers today tend to discard food merely

because it no longer meets their needs or quality preferences. In South Africa, 10.2 million tonnes of food are wasted per year with fresh produce contributing the most considerable amount of waste (Nahman & de Lange, 2013).

In terms of this study, findings revealed that the commodities mostly wasted included vegetables (21.10%; Mean=2.53), fruit (20.14%: Mean=2.38), bread (19.22%; Mean=2.58) and dairy (14.22%; Mean=2.22) with an initial reasoning being that these commodities are highly perishable (a factor that might be considered **uncontrollable** by many consumers). However, further investigation noted that respondents were least likely to waste meat and meat products (9.58%; Mean=1,79), despite it being a commodity that is just as if not more perishable than the previously mentioned commodities, thus refuting the interpretation of uncontrollability. The final interpretation of these results presented the reasoning that respondents might be less likely to waste meat since meat is not only a more expensive commodity, but is often also stored more carefully, thus prolonging self-life (Garrone *et al*., 2014). It is therefore concluded that consumers' wastage of food, specifically perishable goods, is not only unfortunate but also unnecessary due to their plausible ability to better control and mitigate the outcome.

5.2.2 Possible reasons for food waste (Objective 2)

Findings regarding consumers' reasoning for food wastage were revealed through the exploratory factor analysis (EFA). A final interpretation and/or explanation was presented following the underlying assumption of the chosen theoretical perspective (Weiner's Attribution Theory). Results revealed seven prominent reasons for consumer wastage of food. The primary reason was health & safety (Factor 3; Mean=2.68). In terms of the theoretical perspective, this could be attributed/interpreted based on the fact that consumers often perceive food safety as a complex and scientific phenomenon which is considered to be beyond layman's scope and thus an **uncontrollable element.** When determining the element least likely to contribute towards food waste it was interesting to note that Factor 1 (Consumers' food product knowledge and skills – Mean=1.33) was highlighted. When interpreting this information with the attribution theory in mind, one could deduce that consumers might feel more in control when it comes to their product knowledge and skills and thus might feel that food waste could be limited/should not be a problem thanks to their abilities in this respect.

5.2.3 Consumers' attribution of blame (Objective 3)

Food waste is a sensitive topic from farm to fork (Parfitt *et al*., 2010). This often results in a blame game between supply chain members, and individual role players are seldom willing to take full responsibility. Göbel, Langen, Blumenthal, Teitscheid and Ritter (2015) highlight that to address

a complex issue such as food waste, blame cannot be attributed to one single role player but rather to the contribution of all.

Literature that reflects on the food supply chain in South Africa presents a breakdown of food waste as follows: 50% is contributed by farmers, 25% is contributed by food manufacturers, 20% is contributed by retailers, and lastly 5% is contributed by the consumer (Oelofse & Nahman, 2012). In terms of international trends, Gustavsson *et al*. (2011) stipulate that food waste moves up the food supply chain, from pre-consumer to post-consumer stages, as the level of development in a country increases. South Africa, with its emerging economy, is therefore likely to follow suit (i.e. see an escalation amongst the household waste stream). For this reason, this study mainly focused on consumer/household food wastage.

Findings from this study indicated that respondents/consumers acknowledged their contribution. Furthermore, they seemed to understand that their needs and wants could be fuelling waste at various points throughout the supply chain. However, on responding to who is best equipped to address the issue of food waste, respondents/consumers were less eager to commit and most opted to identify retailers and the government as better suited. In terms of Weiner's attribution theory, these results could be interpreted as follows – it seems that despite acknowledging their contribution towards the food waste issue, consumers'/respondents' taking action are still lacking. This could be due to the **locus of control.** When reflecting on the results pertaining to blame, consumers might perceive the locus of control to be internal (something within their control), but when reviewing the results pertaining to taking action (who is best equipped to address the issue), consumers might perceive the locus of control to be external (something that is out of their control).

Evidence from this study, therefore, suggests that addressing a complex issue such as food waste is not an easy task and that pinpointing a single role player (i.e. consumers) is not necessarily going to result in any long-term solutions. A holistic approach and further investigation regarding all role players' contributions, abilities and overall control is thus essential to formulate a final plan of action.

5.3 THE RESEARCH IN RETROSPECT

It is essential for the researcher to evaluate the research objectively at the end of the investigation to ascertain that all the objectives set for this study have been met.

When considering the sustainable development goals, it is clear that food waste can no longer be ignored. This is proven by Indicator 12.3.1 which states that we need to halve global food waste per capita at the retail and consumer levels and reduce food losses (including post-harvest losses) along production and supply chains by 2030. Food waste is not only a global issue, but it also contributes to food insecurity in South Africa and costs billions in terms of the loss of valuable economic, social and natural resource. Turning a blind eye is no longer an option.

Despite the high interest and emphasis on food waste, research that focusses on household food waste practices in South Africa is limited. With this in mind, the problem statement, relevant objectives and conceptual framework for this study were formulated.

In terms of the methodology (presented in Chapter 3), essential measurements were taken to ensure reliability and validity. The chosen theoretical perspective (Weiner's attribution theory) not only enabled the researcher to structure the study, but also assisted in the final interpretation of the findings. Because this study followed a quantitative approach, primary data was collected in a single phase using a structured questionnaire which was distributed via email. Respondents, therefore, could complete the questionnaire in their own time which created a less rushed/stressed environment. The questionnaire had a cover letter addressed to the respondents that accentuated the aim of this study, the researcher's association with the University of Pretoria and the fact that all information collected will be treated as confidential. The respondents were recruited through convenience sampling and participated voluntarily, thus increasing reliability. Convenience sampling is a non-probability sampling technique which is often used due to financial or time constraints. It was preferred since it is fast, inexpensive, easy, and respondents are readily available (Salkind, 2012: 193).

5.3.1 Achievement of the objectives set out for this research

The objectives set for the study were attended to and addressed satisfactorily. The conclusions that were drawn were relevant and reflected well in terms of the main objectives formulated for the study. No unexpected issues were identified regarding the study in general, data collection or this questionnaire. It is believed that the results presented for this study add to the relevant literature about food waste in Gauteng households and their ultimate attribution of blame.

5.4 LIMITATIONS OF THE STUDY

It was vital for the researcher to follow sound research methods to ensure the study was conducted ethically to obtain accurate, reliable data. The study was still restricted by certain inevitable limitations. These following limitations could serve as guidance for future research:

1. Due to financial and time constraints, the data collection for this study was restricted to convenience sampling, thus only obtaining voluntary respondents. Given more funding, one could extend this study to other provinces in SA and incorporate a more representative sample.
2. The prerequisites for respondents were that they had to be 21 years or older and be responsible for the food purchasing, preparation and waste management in their household. This restricted the audience to the primary member in the household responsible for food preparation and therefore excluded the awareness and practices of household members that are not directly involved in food preparation.
3. Convenient sampling was implemented as it allowed fast, inexpensive and easily accessible data collection. This, however, resulted in a sample that, although significant, did not include sufficient numbers of all the SA population groups. Given more time and funding, future qualitative studies could include more in-depth data collection with a more a more representative sample.

5.5 RECOMMENDATIONS FOR FUTURE RESEARCH

This research aimed at providing empirical evidence regarding consumers' food wastage behaviour and ultimate attribution of blame. In certain countries, consumer food waste has been investigated in depth and led to vital policy changes. However, very little has been done in SA in this regard so far. Through the knowledge obtained in this study, these are the following recommendations:

- The DEA (government) could explore regulations and policies that would require consumers to separate their waste (recyclables, wet waste/food waste and general waste) to ensure that less food waste ends on landfills.
- Further studies can be done to investigate evidential food quantities wasted through the food supply chain in South Africa.
- A tool can be developed based on the reasons/factors for food waste to guide the consumers' food waste management practices and ultimately reduce food waste at household level.

- It is recommended that educated material (that takes cultural implications into consideration) should be developed for the consumer to aid consumers' understanding of the impact food waste has in South Africa through the food supply chain.
- A similar study can be repeated to include all consumers and not just the primary member in the household responsible for food purchasing, food preparation and waste management practices in the household.

5.6 IMPLICATIONS OF THE FINDINGS

5.6.1 Implications for the consumer

The South African market is becoming more sophisticated in terms of resource availability and sustainability. Thus, it is essential to educate and address consumers regarding waste management practices. Consumers are often motivated to support a sustainable lifestyle but often lack the knowledge to apply it in their daily routine (McCarthy & Liu, 2017). It is thus essential to educate the consumer on practical solutions to reduce food waste, such as correct storage procedures to prolong shelf life or how to store leftovers safely (Visschers, Wickli & Siegrist, 2016).

Consumers cannot make informed decisions in mitigating unnecessary food waste if they do not understand the implications and impact their household food waste has on the economy, social environment and natural resources. Thus, this study could help aid the gap in educating consumers to understand food waste in a South African context.

5.6.2 Implications for retailers and the government

The findings of this study confirm that the mitigation of food waste is reliant on the contribution of all supply chain role players (farm to fork). One cannot rely on the willingness and behavioural changes of single role players, such as consumers or retailers. However, results from the study indicate that the most plausible catalyst in terms of waste mitigation seems to be the retailer. Thus, it is proposed that food waste mitigation will be more successful and have a more significant impact if initiated by the retail industry, as opposed to by consumers or the government. The wastage of food not only disadvantages the economy of South Africa, but also plays a pivotal role in terms of the country's food security. It is imperative to find possible avenues that could assist consumers in adopting more sustainable practices. Findings from this study suggest that consumers acknowledge their contribution to food waste, but most consumers feel helpless (ill-

equipped) to address and improve the issue at hand. Thus, the role of the government and retailers is crucial to “nudge” consumers towards behaviour that reflects a more sustainable lifestyle.

5.7 CONCLUDING REMARKS

From the research conducted, it becomes evident that consumers lack an understanding of food waste in South Africa. The researcher is positive that with proper support (including retailer and government support) and education, the next generation can be taught to make more sustainable lifestyle decisions which will not only be beneficial for the planet, but also for themselves. Many consumers are eager to reduce the negative impact on the planet, but very few have the tools to improve their current lifestyle. Thus, it is vital to develop educational or awareness campaigns in a way that motivates sustainable behaviour and, ultimately, a sustainable lifestyle.

In South Africa, this will not be an easy task when one takes culture, language, level of income and education barriers into consideration, but it is vital to start making behavioural changes if we want our country to be sustainable for the generations still to come.

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Addendum A

QUESTIONNAIRE

2015 Household food waste - Final for distribution

Start of Block: Section A: Contact person

Q1 **Food wastage, sustainability and the triple bottom line -**

A case study of urban households in Gauteng, South Africa Informed Consent Form

Dear respondent

The purpose of this study is to gain insight into the on-going problem of food wastage in South Africa. The study is particularly interested in both consumers' and retailers' current food consumption and waste management practices. Through this research project we would like to identify problem areas and to subsequently provide guidelines so that both retailers and consumers would know how they could become involved in supporting this worthy cause. Thank you for taking the time to share your perspectives and views in this regard.

Participants in this study will be asked to answer a number of questions regarding their own food consumption and waste management practices and policies. All answers will be recorded for further use by the investigators only. Respondents are welcome to refrain from answering any questions that they view to be the cause of any discomfort or infringement of their privacy. Refusal to participate or withdrawal of consent, or discontinued participation in the study will not result in any penalty. Please note that your participation is voluntary and does in no way release the researchers or involved institutions from their legal and professional responsibilities. All information will be treated as highly confidential and the identity of respondents need not to be disclosed and will remain anonymous. The results of this study will be presented in aggregated format.

Your decision to respond to the questions posed will be interpreted as confirmation that you have agreed to participate.

Q2 Should you wish to partake in future research projects such as focus group discussions pertaining to this study, please provide your email address and mobile phone number in the spaces provided.

Please provide your e-mail address in the space below:

_____

Q3 Please provide your mobile phone number in the space below: Please do not enter the country code or any spaces or brackets.

_____

Q4 Please select the **person** that contacted you to complete the questionnaire
▼ Maike Böhmer (1) ... Other (29)

End of Block: Section A: Contact person

Start of Block: Section B: Please tell us more about yourself.

Q5 What is your **gender**?
▼ Male (1) ... Female (2)

Q6 What was your **age** at your most recent birthday?

21232526283032333537394042444647495153545658606163 65

Age ()

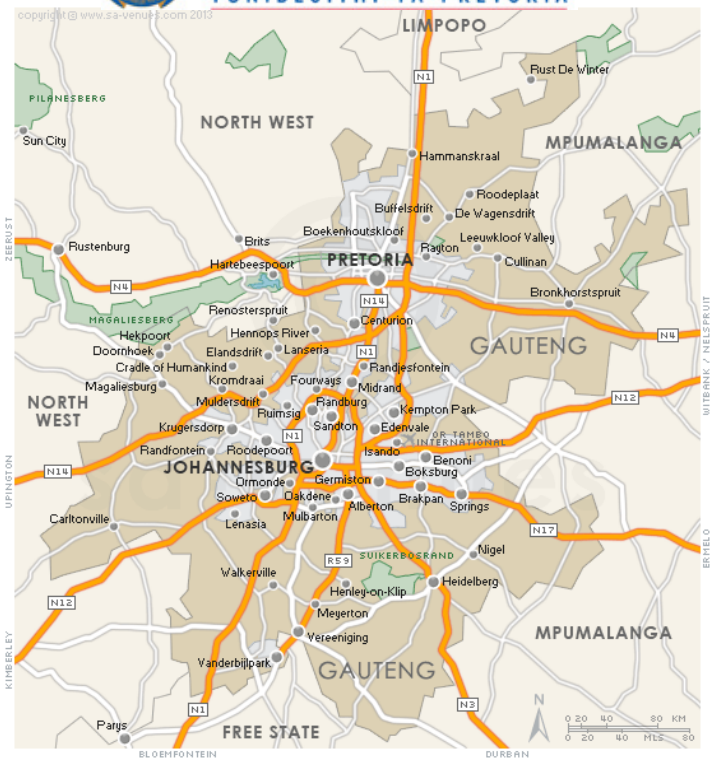
Q7 What is your **highest level of education**?
▼ Lower than grade 12 (1) ... Post graduate degree (4)

Q8 Please indicate your area of **residence within Gauteng** (please be specific regarding the **City and suburb** e.g. Pretoria, Garsfontein)

_____

Q9 Please indicate your **specific area of residence** on the following map of Gauteng

	Dislike (1)	Neutral (2)	Like (3)
Buffelsdrift (4)			
Rust De Winter (5)			
Hammanskraal (6)			
Roodeplaat (7)			
De Wagensdrift (8)			
Boekenhoutskloof (9)			
Leeuwkloof Valley (10)			
Rayton (12)			
Cullinan (13)			
Bronkhorstspruit (14)			
Centurion (15)			
Randjesfontein (16)			
Kemptonpark (17)			
Midrand (18)			
Fourways (19)			
Lanseria (20)			
Edenvale (21)			
Benoni (22)			
Nigel (23)			
Springs (24)			
Heidelberg (25)			
Meyerton (26)			
Henley-on-klip (27)			
Vereeniging (28)			
Vanderbijlpark (29)			
Walkerville (30)			
Lenasia (31)			
Mulbarton (32)			
Alberton (33)			
Brakpan (34)			
Boksburg (35)			
Isando (36)			
Sandton (37)			
Randburg (38)			
Soweto (39)			
Oakdene (40)			
Germiston (41)			
Ormonde (42)			
Roodepoort (43)			
Randfontein (44)			
Krugersdorp (45)			
Ruimsig (46)			
Muldersdrift (47)			
Kromdraai (48)			
Magaliesburg (49)			
Carltonville (50)			
Elandsdrift (51)			
Cradle of humankind (52)			
Hekpoort (53)			
Doornhoek (54)			
Hennops River (55)			
Renosterspruit (56)			
Pretoria (57)			
Suikerbosrand (58)			
JohannesburgCBD (59)			



Q10 How many **members** are there in your current household? (Total number of people living together)

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20

Household size ()	

Q11 In terms of the employment Equity Act of SA, to which **population group** do **you** (as person / not household per se) belong to?

▼ African (1) ... Other (6)

Q12 What is your approximate total **monthly household income** rounded up to the nearest R1000?

0 10000 20000 30000 40000 50000 60000 70000 80000 90000 100000

Monthly household income ()	

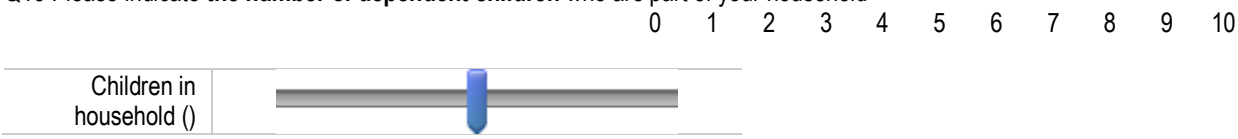
Q13 What is your preferred home **language**?

Afrikaans (1)
English (2)
Ndebele (3)
Northern Sotho (4)
Sotho (5)
Swazi (6)
Tsonga (7)
Tswana (8)
Venda (9)
Xhosa (10)
Zulu (11)
Other (12)

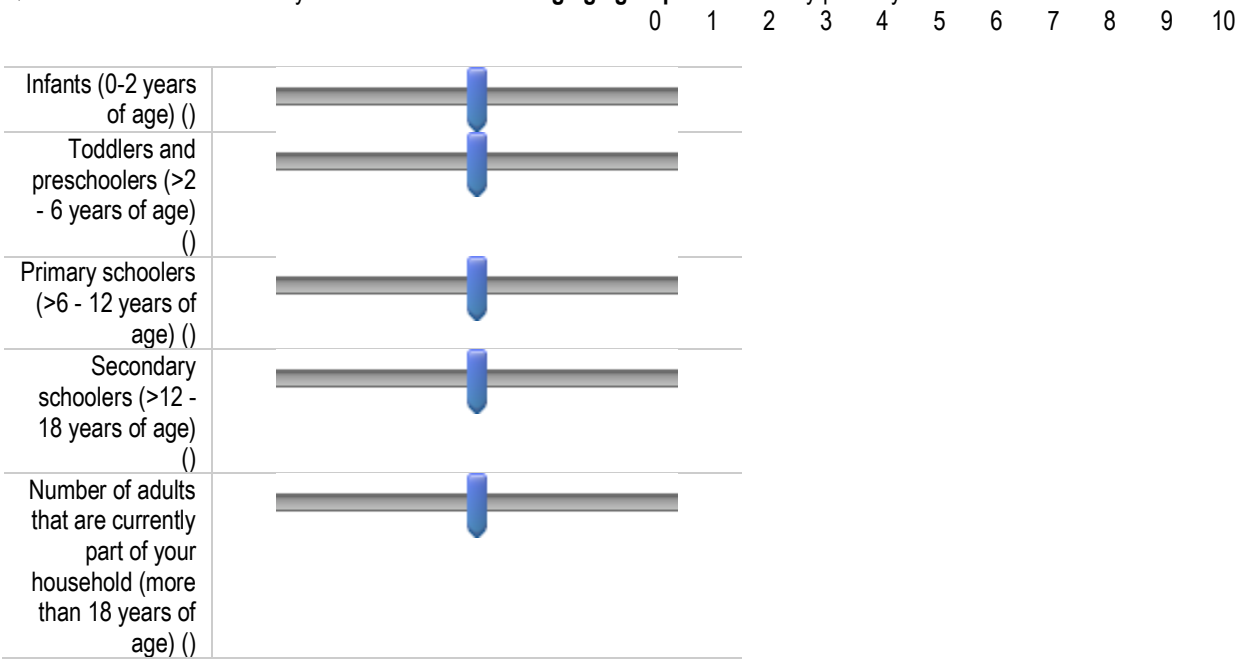
Q14 Please indicate your **marital status**

▼ Single without children / divorced / widowed (1) ... Couple / Married (with children) (4)

Q15 Please indicate **the number of dependent children** who are part of your household



Q16 Please indicate how many **children of the following age groups** are currently part of your household



End of Block: Section B: Please tell us more about yourself.

Start of Block: Section C

Q17 Carefully evaluate the following illustration, then **click once on any picture or item** within a picture **you consider as food waste** (shading that area). You are welcome to select multiple areas.

	Off (1)	On (2)
Egg Shells (5)		
Apple Core (6)		
Half banana (7)		
Tea bag (8)		
Carrot trimmings (9)		
Grape stalks (10)		
Leek Leaves (11)		
Tea bags (12)		
Ground coffee (13)		
Farmer skip filled with oranges (14)		
Industry off-cuts (15)		
Restaurant kitchen trimmings (16)		
Plate wastage chicken drumstick (17)		
Plate wastage mashed potato (18)		
Plate wastage green beans (19)		
plate wastage carrot (20)		
Plate wastage carrot (21)		
Plate wastage carrot (22)		
Plate wastage sauce (23)		
Plate wastage sauce (24)		
Leek leaves (25)		
Leek leaves (26)		
Leek leaves (27)		
Carrot trimmings (28)		
Plate wastage french fries (29)		
Plate wastage salad (30)		
Plate wastage spaghetti (31)		
Plate wastage purple cabbage (32)		
Milkshake (33)		
Retail prepackaged salad (34)		
Retail Milk spoiled (35)		
Retail boxed desserts (36)		
Retail prepacked salad spoiled (37)		
Tin can (38)		
Plastic Bottle (39)		
Cooldrink Coke (40)		
Vegetable trimmings Avo (41)		
Milkshake (42)		
Orange peel (43)		
Onion (44)		
Carrot whole (45)		
Orange peel (46)		
Bread and cereals (47)		
Carrot whole (48)		
Tomato stalks (49)		
Tomato stalks (50)		

Q18 Please **select one of the provided definitions**, which according to you **best describes the concept food waste**.

Food waste is any solid or liquid food substance, raw or cooked, which is discarded, after the consumption of a meal (example: leftovers, food scraps or spoiled food) (1)
Food waste is any solid or liquid food substance, raw or cooked, which is discarded, during the manufacturing, preparation and or consumption of a food product and or meal (example: organic residues generated by processing, handling, storage, sale, preparation, cooking, and serving of foods as well as leftovers or scraps) (2)
Food waste is any solid or liquid food substance, raw or cooked, which is discarded, during the production and manufacturing of food products in industry. (3)

Q19 Please indicate who you believe should be **held responsible** for food wastage in South Africa

	Strongly Disagree (4)	Disagree (5)	Neither Agree nor Disagree (6)	Agree (7)	Strongly Agree (8)
Retail (1)					
Consumers (2)					
Farmers (3)					
Manufacturers (4)					
Government (5)					

Q20 Please indicate who you believe is **best equipped** to address the problem of food waste in South Africa successfully

	Strongly Disagree (1)	Disagree (2)	Neither Agree nor Disagree (3)	Agree (4)	Strongly Agree (5)
Retail (1)					
Government (2)					
Farmers (3)					
Manufacturers (4)					
Consumers (5)					

End of Block: Section C

Start of Block: Section D

Q21 Reflecting on your **consumption behaviour during the last month / past 4 weeks**, **please indicate how likely you are to waste the following food products in your household. (If you never buy a specific product, please select the not applicable tick box)**

	Very Unlikely (1)	Unlikely (2)	Undecided (3)	Likely (4)	Very Likely (5)	Not applicable (6)
Milk (1)						
Yogurt (2)						
Cheese (3)						
Butter (4)						
Cream (5)						
Ice Cream (6)						
Citrus fruit (e.g. Oranges, naartjies, lemons) (7)						
Berries (8)						
Stone fruit (e.g. Peaches, plums) (9)						

Q22 Reflecting on your **consumption behaviour during the last month / past 4 weeks**, **please indicate how likely you are to waste the following food products in your household. (If you never buy a specific product, please select the not applicable tick box)**

	Very Unlikely (1)	Unlikely (2)	Undecided (3)	Likely (4)	Very Likely (5)	Not applicable (6)
Grapes (10)						
Hard fruit (e.g. apples and pears) (11)						
Soft tropical fruit (e.g. Bananas, papaya, figs, guavas) (12)						
Melons, Spanspek, Watermelon (13)						
Pineapple (14)						
Green leafy vegetables (Spinach, lettuce, salad greens) (15)						
Root vegetables (Carrots, potatoes, sweet potatoes, beetroot, onions) (16)						
Stem and cap vegetables (e.g. Mushrooms, asparagus) (17)						
Cabbage (cauliflower, broccoli, kale) (18)						

Q23 Reflecting on your **consumption behaviour during the last month / past 4 weeks**, **please indicate how likely you are to waste the following food products in your household. (If you never buy a specific product, please select the not applicable tick box)**

	Very Unlikely (1)	Unlikely (2)	Undecided (3)	Likely (4)	Very Likely (5)	Not applicable (6)
Pumpkins (e.g. butternut, pattipans, zucchini/ babymarrow) (19)						
Peppers (Sweet pepper e.g. Red, green yellow and or hot peppers) (20)						
Peas and beans (21)						
Tomatoes (22)						
Cucumbers (23)						
Mielies / sweet corn on the cob (24)						
Avocado (25)						

Q24 Reflecting on your **consumption behaviour during the last month / past 4 weeks**, **please indicate how likely you are to waste the following food products in your household. (If you never buy a specific product, please select the not applicable tick box)**

	Very Unlikely (1)	Unlikely (2)	Undecided (3)	Likely (4)	Very Likely (5)	Not applicable (6)
Meat cuts: Beef (26)						
Meat cuts: Mutton / lamb (27)						
Meat cuts: Pork (28)						
Meat cuts: Venison (e.g. Springbok, Blesbok, game biltong) (29)						
Poultry products (e.g. chicken, turkey, duck) (30)						
Fish (e.g. hake, salmon, tuna) (31)						
Shellfish (e.g. prawns, mussels,oysters) (32)						
Eggs (33)						

Q25 Reflecting on your **consumption behaviour during the last month / past 4 weeks**, **please indicate how likely you are to waste the following food products in your household. (If you never buy a specific product, please select the not applicable tick box)**

	Very Unlikely (1)	Unlikely (2)	Undecided (3)	Likely (4)	Very Likely (5)	Not applicable (6)
Maize (pap) (34)						
Rice (35)						
Pasta (36)						
Flour (e.g. cake / bread flour) (37)						
Oats (38)						
Sliced bread (39)						
Bread rolls / buns (40)						
Whole loaves (Bread) (41)						
Vetkoek (42)						
Cakes (43)						
Muffins / scones (44)						
Doughnuts (45)						
Pastries / pies (46)						
Biscuits / cookies / rusks (47)						
Baked puddings (48)						
Cold desserts (49)						

Q26 Reflecting on your **consumption behaviour during the last month / past 4 weeks**, **please indicate how likely you are to waste the following food products in your household. (If you never buy a specific product, please select the not applicable tick box)**

	Very Unlikely (1)	Unlikely (2)	Undecided (3)	Likely (4)	Very Likely (5)	Not applicable (6)
Oils (e.g. olive, sunflower, avocado) (50)						
Hard fats / lard (51)						
Margarine (52)						
Vinegars (53)						
Sauces/ Condiments (pesto, tomato, mustard, BBQ, mayonnaise, chutney) (54)						
Pickled products (Relish, atchar, olives, capers, artichokes, vegetables) (55)						
Salad dressings (56)						
Jams, marmalades and jellies (57)						
Bread spreads (Peanut butter, Marmite/Bovril, Melrose cheese) (58)						
Dry herbs and spices (59)						
Chocolates (60)						
Hard sweets (e.g. lollipops, mints) (61)						
Soft sweets (e.g. gums, jellies, marshmallows, toffees, fudge) (62)						

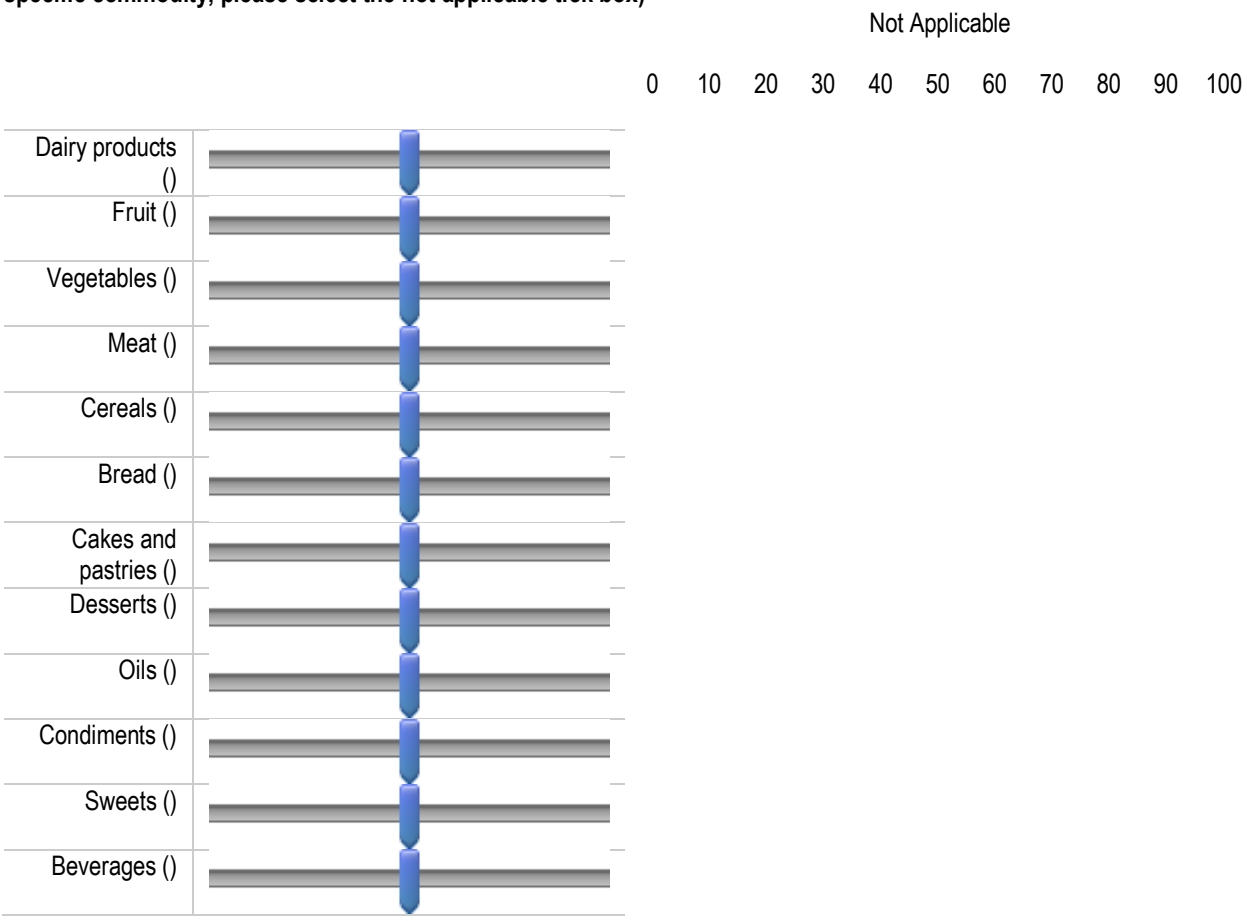
Q27 Reflecting on your **consumption behaviour during the last month / past 4 weeks**, **please indicate how likely you are to waste the following food products in your household. (If you never buy a specific product, please select the not applicable tick box)**

	Very Unlikely (1)	Unlikely (2)	Undecided (3)	Likely (4)	Very Likely (5)	Not applicable (6)
Wine (63)						
Champagne (64)						
Beer (65)						
Cider (66)						
Spirits (Vodka, Gin, Whiskey, Brandy, Rum) (67)						
Liquors (68)						
Tea (69)						
Coffee (70)						
Hot chocolate (71)						
Milk drinks (72)						
Squash / cordials (73)						
Fruit juice (74)						
Carbonated soft drinks (e.g. Coke, Fanta, Sprite) (75)						
Bottled water (76)						

Q28 Please **rank** the following food categories [DAIRY, FRUIT etc.] according to the extent that it is wasted in your household **during one calendar month / during the last 4 weeks**. Use the following ranking scale, with **1 = most wasted food type**, and **12 = least wasted** food type (**please rank each food commodity by dragging and dropping the commodities in the ranking order that suits you.)**

_____ Dairy products (1)
_____ Fruit (2)
_____ Vegetables (3)
_____ Meat (4)
_____ Cereals (5)
_____ Bread (6)
_____ Cakes and pastries (7)
_____ Desserts (8)
_____ Oils (9)
_____ Condiments (10)
_____ Sweets (11)
_____ Beverages (12)

Q29 Please indicate the **amount (percentage)** for each of the following commodities indicating **waste per calendar month (4 weeks)** in your household. i.e. we waste 20% of the dairy purchased in our household per calendar month. **(If you never buy a specific commodity, please select the not applicable tick box)**



End of Block: Section D

Start of Block: Section G

Q30 Please indicate the likelihood of the following statements **causing non consumption, poor usage or discard** of food in your household

	Very Unlikely (22)	Unlikely (23)	Undecided (24)	Likely (25)	Very Likely (26)
Image:Childwasting (1)					
Image:Dieting (2)					
Image:Cheese (3)					
Image:Banana 3 630x466 (4)					
Image:Mi+greet+potatos+flickr (5)					
Image:Messyfridge (6)					
Image:Tomato fruitworm1241 (7)					
Image:Sellbydates (8)					
Image:Strsbdfruit299 opt (9)					
Image:Burnt toast (10)					
Image:Buy1get2free (11)					

End of Block: Section G

Start of Block: Section H

Q31 Please provide at least one **barrier that limits** your household in terms of curbing / addressing your weekly food wastage.

_____

Q32 Please provide at least one **suggestion that might encourage or enable** your household to address your current weekly food wastage.

_____

End of Block: Section H

Start of Block: Section E

Q33 Among the categories below, please **select the three categories in which you have generated the most waste** in the past 4 weeks:
Dairy products (1)
Fruits (2)
Vegetables (3)
Meat (4)
Cereals (5)
Bread (6)
Cakes and pastries (7)
Desserts (8)
Oils (9)
Condiments (10)
Sweets (11)
Beverages (12)

End of Block: Section E

Start of Block: Section F

Display This Question:
If If Among the categories below, please select the three categories in which you have generated the most waste in the past 4 weeks: q://QID42/SelectedChoicesCount Is Less Than or Equal to 3

Q34 Based on the waste of **${lm://Field/1}**, please indicate the degree to which each of the following factors have contributed towards the waste of **${lm://Field/1}**.

	Strongly Disagree (11)	Disagree (12)	Neither Agree nor Disagree (13)	Agree (14)	Strongly Agree (15)
Poor planning and purchasing decisions (1)					
Improper packaging (2)					
Insufficient storage (3)					
Perishability of the product (4)					
Personal food preferences (i.e. picky eaters) (5)					
Date labeling of the product (i.e. sell by date) (6)					
Incorrect preparation of the product (7)					
Quality concerns (8)					
Health and safety concerns (9)					
Promotions and advertisements (10)					
Poor time management (11)					
Lack of knowledge pertaining to the product (12)					
Lack of skills regarding utilization of the product (13)					
Concerns regarding the appearance of the product (14)					
Diets and trends (15)					
Size and or quantity of the product (16)					
Pest invasion (17)					

End of Block: Section F

Start of Block: Block 8

Q35 Reflecting on your households' general food wastage please **indicate the degree** to which each of the following statements/reasons have contributed towards wastage.

	Strongly Disagree (11)	Disagree (12)	Neither Agree nor Disagree (13)	Agree (14)	Strongly Agree (15)
We waste because we buy too large quantities. (1)					
We waste because we buy in bulk. (2)					
We waste because we buy too close to the sell by date. (3)					
We waste because we buy too close to the expiry date. (4)					
We waste because we buy too close to the "use by" date. (5)					
We waste because we do not plan our purchases. (6)					
We waste because we buy more than we need. (7)					
We waste because the amount per pack is more than we can consume. (8)					

Q36 Reflecting on your households' general food wastage please **indicate the degree** to which each of the following statements/reasons have contributed towards wastage.

	Strongly Disagree (11)	Disagree (12)	Neither Agree nor Disagree (13)	Agree (14)	Strongly Agree (15)
We waste because the amount per pack exceeds the amount that can be consumed before the product loses quality. (9)					
We waste because the packaging does not provide proper protection to the product. (10)					
We waste because the packaging is difficult to empty. (11)					
We waste because, once opened, the packaging cannot be resealed. (12)					
We waste because we do not have proper information regarding correct storage. (13)					
We waste because we are not properly informed about the perishability of the product. (2)					
We waste because we do not have sufficient or correct storage space available e.g. freezer / refrigerator. (1)					

Q37 Reflecting on your households' general food wastage please **indicate the degree** to which each of the following statements/reasons have contributed towards wastage.

	Strongly Disagree (11)	Disagree (12)	Neither Agree nor Disagree (13)	Agree (14)	Strongly Agree (15)
We waste because we often forget about the product in storage. (16)					
We waste because pests might infest the product in storage. (17)					
we waste because we do not prefer to store left over food. (18)					
We waste because the sell by date indicated that the product had expired. (19)					
We waste because the expiry date indicated that the product had expired. (20)					

Q38 Reflecting on your households' general food wastage please **indicate the degree** to which each of the following statements/reasons have contributed towards wastage.

	Strongly Disagree (11)	Disagree (12)	Neither Agree nor Disagree (13)	Agree (14)	Strongly Agree (15)
We waste because we do not have proper information regarding the preparation of the product. (22)					
We waste because we often prepare food incorrectly. (23)					
We waste because we often prepare too much. (24)					
We waste because we often serve food incorrectly. (25)					
We waste because we are concerned about the health and safety of the product. (26)					
We waste because the food product appears unappetizing although it might still be edible (27)					

Q39 Reflecting on your households' general food wastage please **indicate the degree** to which each of the following statements/reasons have contributed towards wastage.

	Strongly Disagree (11)	Disagree (12)	Neither Agree nor Disagree (13)	Agree (14)	Strongly Agree (15)
We waste because the product might seem slimy / moldy (28)					
We waste because the product might smell bad (29)					
we waste because the product has an unappetizing texture (30)					
We waste because the promotional material in the store prompted me to buy in excess (32)					
We waste because the promotional material in the store prompted me to buy these products even though it was not on my list (33)					
We waste because I'm easily swayed to buy new or interesting products from this category (34)					
We waste because we try to abide to new trends, fads or diets concerning these commodities (35)					

Q40 Reflecting on your households' general food wastage please **indicate the degree** to which each of the following statements/reasons have contributed towards wastage.

	Strongly Disagree (11)	Disagree (12)	Neither Agree nor Disagree (13)	Agree (14)	Strongly Agree (15)
We waste because we do not have the correct information to utilize the commodity. (36)					
We waste because we do not have the necessary culinary skills to utilize the commodity. (37)					
We waste because we do not have sufficient time to recycle or compost the commodity. (38)					
We waste because we do not have time to plan a menu that includes these commodities. (39)					
We waste because we believe that buying these products are essential to our well-being. (40)					
We waste because we believe that buying these products are part of a healthy diet. (41)					

Q41 Reflecting on your households' general food wastage please **indicate the degree** to which each of the following statements/reasons have contributed towards wastage.

	Strongly Disagree (11)	Disagree (12)	Neither Agree nor Disagree (13)	Agree (14)	Strongly Agree (15)
We waste because we believe that buying these products reflects success. (42)					
We waste because the product appeared to be of poor quality. (43)					
We waste because the product appeared bruised. (44)					
We waste because the product appeared deformed. (45)					
We waste because the product appeared blemished. (46)					
We waste because the product appeared rotten. (47)					
We waste because the product appeared old. (48)					

Q42 Thank you very much for sharing your views with us.

End of Block: Block 8

Addendum B

LETTER FROM ETHICS COMMITTEE FOR RESEARCH

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Reference Number: EC150518-011 14-Jul-2015

JMM MarxPlenaar
Consumer Science
UNIVERSITY OF PRETORIA

Dear MarxPlenaar,

FACULTY OF NATURAL AND AGRICULTURE SCIENCES COMMITTEE FOR RESEARCH

Your recent application to the > Faculty Of Natural And Agriculture Sciences Committee refers.

1. I hereby wish to inform you that the research project titled "*Food wastage, sustainability and the triple bottom line - A case study of urban households in Gauteng, South Africa*" has been approved by the Committee.

   This approval does not imply that the researcher, student or lecturer is relieved of any accountability in terms of the Codes of Research Ethics of the University of Pretoria, if action is taken beyond the approved proposal.

2. According to the regulations, any relevant problem arising from the study or research methodology as well as any amendments or changes, must be brought to the attention of any member of the Faculty Committee who will deal with the matter.

3. The Committee must be notified on completion of the project.

The Committee wishes you every success with the research project.

Prof. Norman Casey
Chair: Faculty of Natural and Agriculture Sciences Committee for Research Ethics
FACULTY OF NATURAL AND AGRICULTURAL SCIENCES

Addendum C

CONFERENCE CONTRIBUTION

Attended: WasteCon - 22nd conference and exhibition Emperors Palace, Johannesburg, South Africa
Theme: Changing Face of Waste Management: 17-21 October

50th SASDT (South African Society of Dairy Technology) AGM and symposium Kievits Kroon Country Estate, Pretoria
Theme: Dare to dairy 9-11 May
Presented: It is time to cry over spilled milk

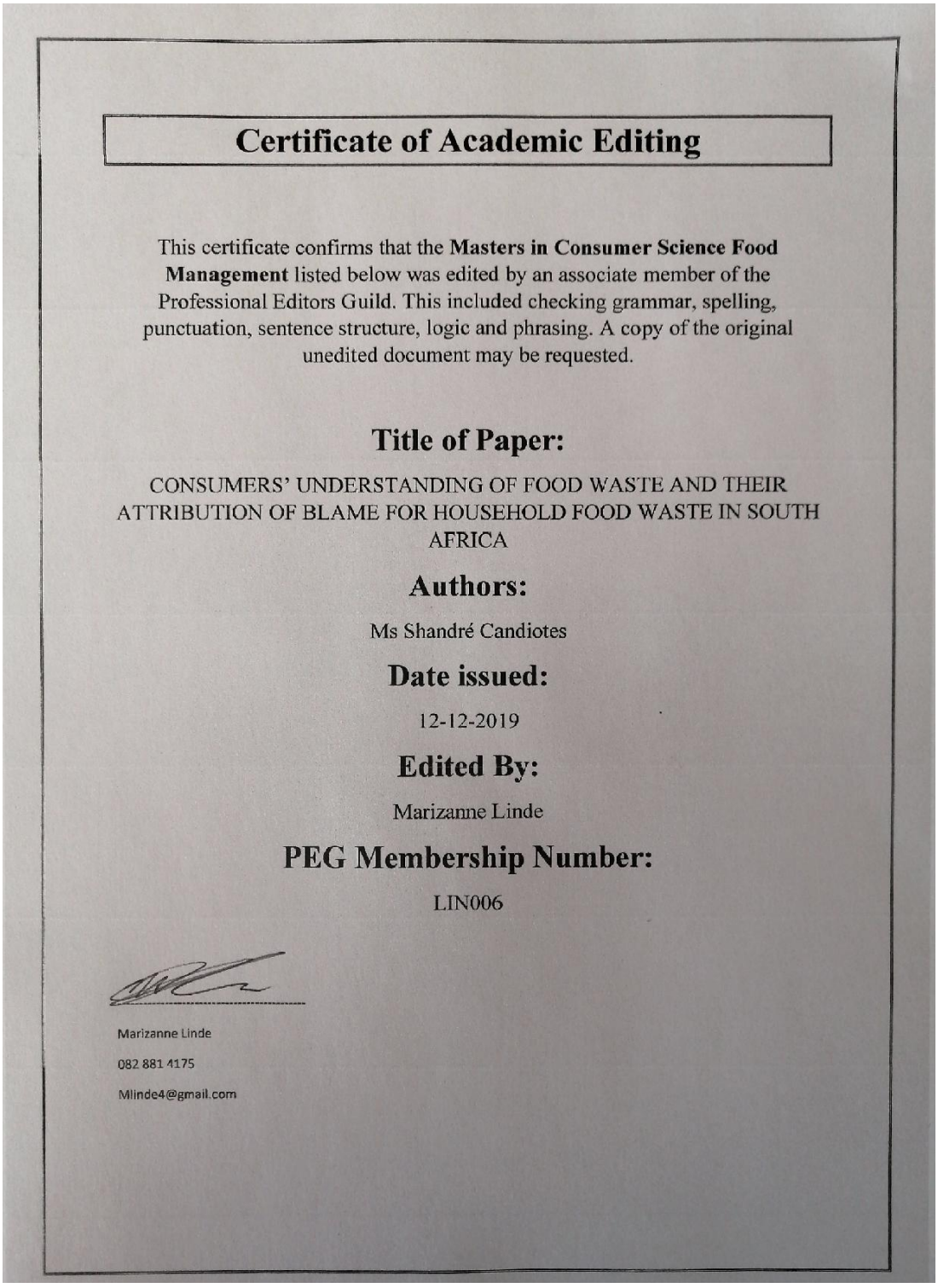
South African Association for Food Science & Technology (SAAFoST) 22nd Biennial International Congress and Exhibition Century City Conference Centre, Cape Town
Congress theme: A hunger for change: innovations, solutions and emerging technologies 3-6 September
Paper presentation on Food waste: Time to shift the blame
Chair for the Environmental Sustainability and GM Foods session

Seventh International Conference on Food Studies Roma Tre University in Rome
Special Focus: Food Systems - Design and Innovation 26-27 October
Paper Presentation on: Consumers' understanding of food waste and their attribution of blame for household food waste in South Africa

South African Association for Food Science & Technology (SAAFoST) Birchwood Hotel and Conference Centre, Johannesburg
Congress theme: Food Science and Technology for the 21st Century technologies 1-4 September
Paper presentation on: Food waste from farm to fork in South Africa

Addendum D

LANGUAGE EDITING CERTIFICATE



Certificate of Academic Editing

This certificate confirms that the **Masters in Consumer Science Food Management** listed below was edited by an associate member of the Professional Editors Guild. This included checking grammar, spelling, punctuation, sentence structure, logic and phrasing. A copy of the original unedited document may be requested.

Title of Paper:

CONSUMERS' UNDERSTANDING OF FOOD WASTE AND THEIR ATTRIBUTION OF BLAME FOR HOUSEHOLD FOOD WASTE IN SOUTH AFRICA

Authors:

Ms Shandré Candiotes

Date issued:

12-12-2019

Edited By:

Marizanne Linde

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