Optimising food loss and waste measurement practices in the South African grocery retail sector

by

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Declaration

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Summary

Food loss and waste (FLW) has economic, environmental, and reputational implications for retailers. According to South Africa's FLW Voluntary Agreement, to move towards achieving Sustainable Development Goal (SDG) 12.3 (reduce FLW by 50% by 2030) the grocery retail sector's primary response should be to develop a baseline for tonnes of FLW in operations by destination. Without accurate quantification systems in place, the retail sector cannot track progress against targets and identify hotspots. The Voluntary Agreement encourages retailers to use the World Resources Institute's FLW Accounting and Reporting Standard. It is widely used for quantifying food throughout the supply chain. This research study aimed to determine the appropriateness of the FLW Standard and its complementary reporting template as a tool to accurately quantify FLW for South African retailers.

The research procedure involved using data from a major South African retailer to populate the FLW Standard's reporting template. Qualitative and quantitative FLW secondary data was used for a 3-month trial period across all the retailer's stores in South Africa. This data was used to identify areas for improvement and to investigate measures that can be taken to reduce FLW in this stage of the food supply chain.

It was found that the FLW Standard provides a reliable and consistent methodology for measuring, reporting, and managing FLW. Limitations and challenges were discussed- such as capturing product weight data and streamlining data from contracted waste collectors. The reporting tool was praised for encouraging transparency and guiding the retailer in implementing measurement best practices.

Based on the success of the case study it was concluded that the use of this FLW Standard and its reporting template will support South African retailers in their efforts to make progress against the SDG 12.3 target. The study also succeeded in contributing to the knowledge gap pertaining to FLW quantification in the South African retail sector. Several recommendations were made to improve the reporting template for better FLW data optimisation, such as using the results of the reporting template to build a business case for FLW reduction initiatives. Tool plugins linking FLW tonnage to a carbon footprint and other embedded resource statistics are a possible future addition that can be made. It will be beneficial for the retail sector to move towards mandatory FLW reporting; however, retailers should be cognisant that efforts focused on tackling the causes of FLW should be conducted in parallel.

Opsomming

Voedselverlies en -vermorsing (FLW) het ekonomiese, omgewings- en reputasie-implikasies vir kleinhandelaars. Volgens Suid-Afrika se FLW Vrywillige Ooreenkoms, om nader aan die bereiking van SDG 12.3 (verminder FLW met 50% teen 2030) te beweeg, moet die kleinhandelsektor se primêre reaksie wees om 'n basislyn te ontwikkel vir tonne FLW volgens bestemming. Sonder akkurate kwantifiseringstelsels in plek, kan die kleinhandelsektor nie vordering teen teikens volg en brandpunte identifiseer nie. Die vrywillige ooreenkoms moedig kleinhandelaars aan om die World Resources Institute se FLW Accounting and Reporting Standard te gebruik. Dit word wyd gebruik om voedsel regdeur die voorsieningsketting te kwantifiseer. Hierdie navorsingstudie het die doel gehad om die toepaslikheid te toets van die FLW Standaard en sy komplementêre verslagdoening templaat as 'n instrument om FLW akkuraat vir Suid-Afrikaanse kleinhandelaars te kwantifiseer.

Die navorsingsprosedure behels die gebruik van data van 'n groot Suid-Afrikaanse kleinhandelaar om die FLW Standard se verslagdoeningstemplaat in te vul. Kwalitatiewe en kwantitatiewe FLW sekondêre data is oor 'n proeftydperk van 3 maande ingesamel. Hierdie data-insamelingsproses is gebruik om areas vir verbetering te identifiseer en om maatreëls te ondersoek wat geneem kan word om FLW in hierdie stadium van die voedselvoorsieningsketting te verminder. Daar is gevind dat die FLW-standaard 'n betroubare en konsekwente metodologie bied vir die meting, verslagdoening en bestuur van FLW. Beperkings en uitdagings is bespreek – soos om produkgewigdata vas te lê en data van gekontrakteerde afvalversamelaars te stroomlyn. Die verslagdoeningsinstrument is geprys vir die aanmoediging van deursigtigheid en die leiding van die kleinhandelaar in die implementering van beste metingpraktyke.

Op grond van die sukses van die gevallestudie is tot die gevolgtrekking gekom dat die gebruik van hierdie FLW-standaard en sy verslagdoeningstemplaat Suid-Afrikaanse kleinhandelaars sal ondersteun in hul pogings om vordering teen die SDG 12.3-teiken te maak. Die studie het ook daarin geslaag om by te dra tot die kennisgaping met betrekking tot FLW-kwantifisering in die Suid-Afrikaanse kleinhandelsektor. Verskeie aanbevelings is gemaak om die verslagtemplaat te verbeter vir beter FLW-data-optimering, soos om die resultate van die verslagstemplaat te gebruik om 'n besigheidsgeval vir FLW-verminderingsinisiatiewe te bou. Dit is ook voorgestel om FLW-tonnemaat te koppel aan 'n koolstofvoetspoor of ander ingebedde hulpbronstatistieke. Dit sal voordelig wees vir die kleinhandelsektor verpligte FLW-verslagdoening in te stek. Kleinhandelaars moet egter daarvan bewus wees dat pogings wat daarop gefokus is om die oorsake van FLW aan te pak parallel met kwantifisering verbeterings uitgevoer moet word.

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Acronyms and abbreviations

CGCSA	Consumer Goods Council of South Africa
DC	Distribution Centre
DEA	Department of Environmental Affairs
DEFF	Department of Environment, Forestry, and Fisheries
the dtic	National Department of Trade, Industry & Competition
DU	Distribution Unit
EPA	Environmental Protection Agency
EU	European Union
FAO	Food and Agriculture Organisation
FLW	Food Loss and Waste
RTV	Return To Vendor
SA-EU	South Africa- European Union relations
SDG	Sustainable Development Goal
SKU	Stock Keeping Unit
WRAP	Waste and Resource Action Programme
WRI	World Resource Institute
ZAR	South African rand

Glossary

The following definitions are taken from the Food Loss and Waste Accounting and Reporting Standard (World Resources Institution, 2016) :

> ***Food loss and waste***: "the edible parts of plants and animals that are produced or harvested for human consumption but that are not ultimately consumed by people"
>
> ***Food loss***: "food that spills, spoils, incurs an abnormal reduction in quality such as bruising or wilting, or is otherwise lost before it reaches the consumer. Food loss is the unintended result of an agricultural process or technical limitation in storage, infrastructure, packaging, or marketing"
>
> ***Food waste***: "food that is still of good quality and fit for human consumption but that is not consumed because it is discarded—either before or after it spoils. Food waste is the result of negligence or a conscious decision to throw food away"

The reviewed data does not always distinguish between food loss and food waste. Therefore, in this paper FLW will be used to refer to the combined amount of food loss and waste.

The following terms have been defined according to how they were used in the retail setting:

> ***Destroyed stock***: this refers to FLW that is placed in a metal cage kept in the freezer space at the back end of each store. The cage is picked up by contracted waste collectors once full. This waste is typically made up of food that is not in a condition to be given to charities. Examples include products with torn packaging which poses a food safety risk, temperature-probed food, meat past its use by date, or fruit that is excessively bruised. Destroyed stock is also referred to by the retailer as 'waste sent for destruction' or 'back of store food waste'.
>
> ***Waste shop*****:** the waste shop is where food that is taken off the store shelves at the end of the day because it has reached its sell-by date is sold to staff. The food is made available to the staff at a reduced price.
>
> ***Donations*****:** donations refer to food that the retailer gives to charities. It comprises of redistributed surplus food that would have ended up as part of the 'destroyed stock' if it was not donated to charity. Donations are made up of the food in the waste shop that the staff does not buy, and which is still deemed safe to consume.

Tabel of Contents

List of Tables

List of Figures

1. Introduction

1.1 Background

Food loss and waste (FLW) has economic, environmental, and reputational implications for retailers. It is estimated that globally about one-third of food, which approximates to 1.3 billion tons, is lost annually (Nikolicic et al., 2021). Although the retail industry has a lower percentage of FLW in comparison to other parts of the food value chain (Brancoli *et al.,* 2017), it still has a substantial influence on FLW produced in the supply chain. The FLW generated by retailers has an immense environmental impact as they are positioned nearer the end of the supply chain. Addressing the FLW challenge in retail is therefore viewed as a promising road to improving ethical consumption and production practices whilst reducing resource use in alignment with SDG 12.3: "by 2030, halve per capita global food waste at the retail and consumer levels and reduce food losses along production and supply chains, including post-harvest losses" (United Nations, n.d.). In order to monitor progress towards achieving the SDG 12.3 target, it is vital to set a formal baseline (Parfitt & Jenkin, 2021). "What gets measured gets managed" is a slogan touted by the Waste and Resources Action Programme (WRAP) as quantifying FLW can help business leaders better understand and respond to how much, where, and why food is being lost or wasted.

Most South African retailers are signatories to the Champions 12.3 Group (which implies they are committed to contributing to the global achievement of SDG Target 12.3) as well as the Consumer Goods Council of South Africa (CGCSA) Voluntary Food Waste Agreement. The voluntary agreement was developed to support signatories in reaching the target of halving FLW at retail and consumer levels by 2030. It was initiated in 2018, with financial support from the SA-EU Dialogue Facility, the CGCSA, and the dtic. South Africa's FLW voluntary agreement encourages retailers to use the World Resource Institute's (WRI) FLW Accounting and Reporting Standard (https://flwprotocol.org/wp-content/uploads/2017/05/FLW_Standard_final_2016.pdf) and its complementary reporting template (FLW-Standard-Inventory-Reporting-Template_June-2016_update.xlsm (live.com)) as a quantification tool. The WRI released the FLW Accounting and Reporting Standard in June 2016, developed by a multi-stakeholder global team (World Resources Institution, 2016). This standard provides consensus for the first-time regarding definitions, reporting requirements, and guidance documents. This provides a reliable and consistent methodology for measuring, reporting, and managing FLW (Verghese *et al.,* 2018).

1.2 Problem statement

South Africa is an emerging economy where there is insufficient research on FLW (Xue *et al.,* 2017). Most retailers are currently not accurately measuring their FLW and therefore cannot effectively implement improvement interventions or track reduction progress. According to South

Africa's FLW voluntary agreement, the grocery retail sector's response should be to develop a baseline for tonnes of FLW in operations by destination whereby reduction targets can be tracked through the implementation of an effective FLW measurement system. A second response is to commit to adopting the food waste utilisation hierarchy – whereby feeding people is a top priority after which repurposing may follow and waste to landfill should be an absolute last resort (Environmental Protection Agency, 2022). Without accurate quantification systems in place, the retail sector cannot track progress against targets and identify hotspots. Furthermore, the appropriateness of the WRI's FLW Standard and its reporting template for South Africa's retail sector has not been investigated. In the literature review which follows, it is highlighted that the grocery retail sector is one of the actors in the supply chain where there is a gap in data and information regarding FLW quantification.

1.3 Research aim and objectives

This research study aims to determine the appropriateness of the FLW Accounting and Reporting Standard and its complementary reporting template as a tool to accurately quantify FLW for South African retailers. The study, therefore, has the objective of supporting grocery retailers to better measure and manage their FLW and to fill the knowledge gap about FLW quantification in the South African retail sector. This contribution is in line with SDG 12.3, thereby ensuring sustainable consumption and production patterns.

1.4 Research design

The research procedure involves using secondary data from a major South African retailer to populate the FLW Standard's reporting template. Qualitative and quantitative FLW data was collected over a 3-month trial period across all the retailer's stores in South Africa. This data collection process was used to identify areas for improvement and to investigate measures that can be taken to reduce FLW in this stage of the food supply chain. Based on the quality of data obtained and challenges that arose during the use of the FLW Standard's reporting template, FLW measurement best practices for the grocery retail sector are recommended.

1.5 Thesis outline

The research study is presented as follows: Chapter 1 introduces the study background, research objectives, and purpose of the study. Chapter 2 is a literature review of studies relating to FLW quantification in the retail sector, both in South Africa and globally. Chapter 3 outlines the methodological approach that was used to achieve the specific research objectives. The analysis of the case study can be found in Chapter 4. The final chapter presents a discussion of the analysis, recommendations and concluding remarks.

2 Literature review

2.1 Introduction

The multifaceted negative impacts of FLW are common knowledge. Wasting food has a triple negative effect on the economy, food security and climate change. From an environmental perspective, FLW represents resource inefficiency of land, water, energy and inputs. Producing food that will not be consumed leads to unnecessary carbon emissions. FAO estimated that the global carbon footprint of FLW is equivalent to 8% of global greenhouse gas emissions (Fao, 2013). In South Africa, FLW is related to 22% of the water footprint of agricultural production (Oelofse, 2019). High FLW also results in a loss of the economic value of the food produced, which is concerning given that many people live on the margins of food insecurity (Gustavsson & Cederberg, 2011).

In South Africa, there is a troubling contradiction between high FLW and rising food insecurity. Food and Agriculture Organisation (FAO) statistics show that the number of food insecure people in South Africa has increased from 23.7 million people in 2014-2016 to 26.3 million in 2018-2020(Food and Agriculture Organisation, 2021). Globally, 800 million people are going hungry on a daily basis (Amicarelli & Bux, 2021). A tension exists between the increase in consumption to meet the demands of our growing population and the challenge with increasing production of food (Gustavsson & Cederberg, 2011). Food production may have to increase by as much as 70% to feed 9 billion people in the world by 2050 if current production and consumption behaviour remains unchanged (World Wide Fund for Nature South Africa, 2017). Kummu *et al.* (2012) estimated that the nutritional energy lost globally because of FLW, equates to feeding approximately 1.9 billion people. If this loss is converted to calories, about one in four calories intended for consumption never ends up being eaten (Lipinski, 2013).

With estimates of FLW probably underestimated (UNEP, 2021; Hoehn *et al*., 2023) and insufficient data on FLW in lower-middle and lower-income countries in particular (Hoehn *et al*., 2023; Xue et al., 2017), the need for more countries in these regions measuring FLW across the supply chain, using standardised methods and bigger sample sizes has become critical (UNEP, 2021). A consensus regarding definitions and reporting requirements is also needed to ensure consistent methodology for reporting FLW (Amicarelli & Bux, 2021). To reduce FLW in supply chains, various initiatives have been launched, such as the donation of food or food waste valorisation (Nikolicic *et al.,* 2021). This research study's focus is on FLW quantification in retail. The literature review aims to give an overview of retail FLW quantification research globally as well as in the South African context. It will be made clear that there a standardised method for quantifying FLW is

lacking and that progress towards SDG 12.3 cannot be made without appropriate measurement of FLW.

2.2 Retail quantification of FLW globally

In the realm of FLW research the effects, causes, and opportunities for reduction have primarily been focused on. When it comes specifically to measurement methods of FLW in retail, the data is sparse and limited in scope (Cicatiello *et al.,* 2017). Studies often investigate the complete supply chain when analysing FLW (Le Roux, 2017). Throughout the food supply chain, wastage figures are generally based on estimates (Dlomo, 2021). Research in critical factors such as sparse data collection and complicated quantification is often lacking (Amicarelli & Bux, 2021). FLW in the retail sector is oftentimes dealt with in terms of the rate of “shrinkage”. This is a commonly used performance indicator that characterises the difference between inventories and sales (Cicatiello *et al.,* 2017). Only recently has the actual measurement of FLW at the retail stage started surfacing.

Amicarelli & Bux (2021) conducted a review of FLW quantification methodologies applied in empirical studies published in peer-reviewed journals. Out of their first 48000 results they only found 58 articles aligned with the aim of the review. This shows a deficiency of standardised methodologies and a lack of comparable results. Xue *et al.* (2017) also performed an extensive review of existing literature on FLW quantification, assessing the advantages and disadvantages of various methods. Xue’s team found that only recently academia, industry, government, and a range of stakeholders from various organisations have started to work together to improve FLW quantification and method standardisation.

Cicatiello *et al.* (2017) conducted a similar review as Amicarelli and Bux (2021), studying the different methods and results of empirical studies dealing with retail FLW quantification. Cicatiello *et al.* (2017) pointed out that the Nordic countries tend to have the most developed knowledge of retail FLW. In their study, it was found that the edible portion of unrecorded FLW accounted for 30% of the total FLW, which was higher than expected. The significant percentage of unrecorded FLW emphasises that there are gaps in waste recording procedures at the retail level and that an exhaustive recording of FLW is therefore needed to gather reliable data. It was found that unrecorded waste is highest for fresh products.

A study by Eriksson *et al.* (2019) aimed to identify aspects that make FLW quantification more effective as well as to establish the waste reduction payoff related to more ambitious quantification set-ups- with regards to duration, detail and completeness. Eriksson’s team used data from 735 catering units based in the Nordics. The team hypothesised that more ambitious data collection is directly correlated to higher quality information, which helps leaders make better decisions

regarding waste management. Their results showed that 61% of units decreased their FLW during the second half of the measurement time frame in comparison to the first half. This shows that proper quantification is an effective activity to reduce FLW. It was also found that stores using more automated measurement tools recorded more waste information and had a higher reduction in their food waste. Eriksson *et al.* (2019) additionally raised the point that quantification alone is not a guarantee of reduced FLW.

There are various challenges associated with FLW quantification that the literature reveals. A study by Xue *et al.* (2017) points out that there is often poor primary data and that several studies have to trust data from literature sources. Another challenge mentioned by their study is that the methods of measuring FLW and definitions related to FLW are different across studies. This makes a systematic verification of data between countries, stages, and commodities challenging. It is emphasised that to address these data gaps, the methods for FLW quantification should be standardised. Xue *et al.* (2017) notes that the FLW Standard provides a protocol that can be used by any entity and should be promoted widely. The FLW Standard is the first-ever global standard launched to measure FLW (Food Loss and Waste Protocol, 2016). It aims to be globally applicable and is designed to harmonize how waste is quantified and reported by providing a set of requirements and definitions (FUSIONS, 2016). This is beneficial for consistency, transparency and comparability. It can be used by countries and companies to quantify FLW across the food supply chain or at isolated points.

Other than the FLW Standard, which is used in this study, the FUSIONS (Food Use for Social Innovation by Optimising Waste Prevention Strategies) manual is another exhaustive and esteemed FLW quantification manual. FUSIONS has the aim of providing guidelines for a unified approach for European Union Member States on how to measure FLW in various stages of the food supply chain (FUSIONS, 2016). Its second outcome was to provide an estimate of FLW generated at the European level. It was developed in close collaboration with the team of experts that developed the World Resources Institute's, FLW Standard. Therefore the quantification methodologies are in line with the FLW Standard's approach, however with a more focused objective to support European Union Member States in their quantification journey to enable consistency between member states (FUSIONS, 2016).

The value of FLW quantification is made clear by a multitude of studies. Steen *et al.* (2018) pointed out that to reduce FLW, one must understand the exact problem to be solved. The importance of quantification is supported by a study performed by Eriksson, Strid, and Hansson (2012). A combination of recorded data and physical measurements was used to analyse the flows of fresh fruit and vegetables at six retail stores in Sweden. A positive correlation between unrecorded FLW and total FLW was found. (Eriksson, Strid & Hansson, 2012) concluded that a better recording of FLW in retail could be a helpful way to decrease the waste of fruits and vegetables. Accurate

quantification is therefore an important first step in this process of proper waste management. Without suitable quantification, the effect of FLW-reducing actions cannot be properly evaluated (Eriksson *et al.,* 2019).

2.3 Retail quantification of FLW in South Africa

Research on FLW in South Africa is mainly focused on reducing harvest and post-harvest losses and waste (Oelofse, 2019). The effects of FLW across the supply chain on cost, food security, and environmental sustainability have been studied by Nahman & de Lange (2013; 2015). Studies focussing on FLW in the South African retail sector have investigated the effect of consumer forces on retail food waste (du Toit, 2018); the supply chain factor's relationship with perishable FLW in retail (Le Roux, 2017) and food waste at the household level (Oelofse, *et al.,* 2018). Jere *et al.* (2021) did a review of FLW quantification methods and found that in developing countries not a lot of research has been done on FLW in retail. A limitation of the research of Jere *et al.* (2021) is the small scope of reach of their study. This research therefore supports Jere *et al.*'s (2021) recommendation to include retail FLW quantification in future areas of research.

A recent study by Oelofse *et al.* (2021) found that the total quantity of FLW across the value chain in South Africa amounts to 10 332 770 tonnes. This represents 34.3% of locally produced food or 45.4% of the available food supply in the food value chain being lost or wasted. South Africa's FLW implementation plan (Parfitt & Jenkin, 2021), co-led by the CGCSA, the National Department of Trade, Industry and Competition (the dtic), the Department of Forestry, Fisheries, and the Environment (DFFE) and co-funded by the European Union, states that accurate estimates of FLW by sector are not currently available for South Africa. Present estimates for each sector are based on averages and assumptions (Le Roux, 2017; Oelofse & Nahman, 2013) with 'significant uncertainty' (Parfitt & Jenkin, 2021). South African studies focusing on FLW all recommend the need for further research to quantify and value FLW along the food supply chain in South Africa (Oelofse & Nahman, 2013; Dlomo, 2021; Nahman et al., 2012).

The provisional 2020 baseline estimate given for the retail sector in the voluntary agreement's FLW implementation plan is 2 million tonnes (Parfitt & Jenkin, 2021). They based this on a gap analysis report by Nahman and De Lange (2013) and South Africa's State of Waste Report (Department of Environmental Affairs, 2018). However, in the most recent study by Oelofse *et al.* (2021), the updated estimates for FLW in retail is 6% of the country's FLW or 579 510 tonnes. This is significantly lower than the previous estimate by Nahman & de Lange in 2013, which estimated distribution losses to be at 20% of FLW in the supply chain. This difference is mainly because the early estimates used the assumptions in the Global Food Waste Assessment for sub-Saharan Africa (Gustavsson & Cederberg, 2011). South Africa is not a typical sub-Saharan African country (Oelofse *et al.,* 2020). In low-income countries, food is mainly lost in the first stages of the supply chain. In more developed countries, wastage is higher at the retail and consumer level

(Nikolicic *et al.,* 2021). South Africa has a GDP per capita higher than other sub-Saharan countries and is more industrialised, producing food at a larger scale. Another unique aspect is that South Africa's food supply chains are predominantly controlled by four big retailers (Oelofse *et al.,* 2021). Xue *et al.* (2017) argues that most existing studies on FLW are conducted in industrialised countries, with too few studies performed in developing countries.

A study by Le Roux (2017) aimed to quantify the FLW in retail and its relationship with various food waste drivers. This was a response to the call made by Nahman and de Lange (2013) to validate the assumptions made when working out the amount of FLW within the food supply chain. He built a model to determine the relationship between various supply chain factors such as shortages, specials, seasonality, shelf life and supply. Le Roux recommends that retailers must make FLW a key performance indicator. He also recommends using a predictive model like the one he developed to zone in on specific drivers of FLW. Le Roux again confirmed that FLW has to be accurately quantified to improve waste management practices. Le Roux's study is one of the few studies done on actual data collected at the retail level of perishables. Compared to the study by Le Roux, the scope of this study is larger and covers all provinces in South Africa and not only perishable products.

In South Africa, stakeholder pressure is increasingly being placed on retailers to reduce FLW because of its environmental impact. A study by Jere *et al.* (2021) found that green retailing practices are being used by several retailers to reduce FLW. This is mostly driven by FLW being a social and business risk**.** Much of this pressure is consumer-driven, however, the government has also put in place legislation to drive the process. An example of such South African legislation is the National Environmental Management Waste Act (2008) and National Waste Management Strategy (2020). The Western Cape government has additionally banned organic waste disposal to landfills by 2027 (Department of Environmental Affairs and Development Planning, 2022). They aim for a 50% reduction by 2022. This means that retailers have to ensure that their FLW is not ending up in landfill sites (Jere *et al.,* 2021)**.**

2.4 Building effective FLW quantification tools

The aim of effective FLW tools is that they will improve decision quality (Namany, Al-Ansari & Govindan, 2019). Somlai (2022) investigated how integrating these tools can help businesses make better organisational decisions to improve environmental performance with regard to FLW across the food supply chain. Somlai analysed different tools used for reducing FLW. He found that although complex tools have many advantages, finding a good balance between complex and simple tools improves uptake in the long run (Somlai, 2022). Badly designed tools restrict the potential to make a difference. The motive for improving quantification tools is that they hold great potential to create agency for strategic FLW actions. Somlai advocates for tools to be developed

collaboratively. This promotes the inclusion of evidence-based targets and socially responsible investments in the food supply chain.

Verghese *et al.* (2018) investigated a tool called DIRECT (Dynamic Industry Resource Efficiency Calculation Tool) which aims to support better FLW management. This specific tool places a lot of focus on co-designing between researchers and food manufacturers. Co-development of resource efficiency tools involves stakeholders from various disciplines participating in the process of design and acting as experts based on their experiences. There are multiple benefits of having various stakeholders, especially end users, drive the development of a tool through continual engagement. This interaction is mainly beneficial for knowledge sharing. Verghese *et al.* (2018) predicts that food sustainability issues in business will only become more acute in the future and that it is important that a quantification tool has practical outcomes and incorporates business-orientated value, such as relevant efficiency measures. The WRI's FLW Standard, which is used in this research paper, was developed in collaboration with various stakeholders (World Resources Institution, 2016) which is therefore in line with the recommendations of Somlai (2022) and Verghese *et al.* (2018).

Eriksson *et al.* (2019) highlights that more research is needed to identify the best combination between accurate FLW quantification in relation to resources invested. According to the FLW Protocol (World Resources Institution, 2016), there is usually a trade-off between resources used and consistency and completeness in waste quantification (Eriksson *et al.,* 2019). FUSIONS (2016) recommends measuring FLW in terms of weight as a good initial step that aids the evaluation of the economic value and environmental impact associated with FLW. For larger companies where electronic stock keeping is already in practice, FUSION recommends quantification methods based on scanning (FUSIONS, 2016). The research this study conducts involves a large retailer that can include FLW recording into their stock-keeping system.

2.5 Conclusion

FLW feeds into economic, environmental, and social concerns and is a symbol of the inefficiency and unsustainability of food chains (Nikolicic *et al.,* 2021). It is impossible for retailers to respond to the FLW crisis without developing a means of tracking FLW. FLW quantification is an important component of a retailer's competitive advantage and can strengthen food security. The retail sector can have a significant influence on FLW avoidance and reduction (Dlomo, 2021). This is because the retail sector is in a position to influence upstream as well as downstream losses relating to consumers, suppliers, and the redistribution of surplus food. This substantiates the notion that there is an urgent necessity to evaluate the magnitude of the problem and to eventually minimise FLW. The literature review indicates a significant concern regarding the lack of FLW data, especially in the retail sector. To move the retail sector towards achieving SDG 12.3, precedence sits in grasping the scale of FLW through the creation of dependable scientific data.

This study therefore aims to fill the knowledge gap on FLW quantification for the retail sector in South Africa.

3 Methodology

3.1 Introduction

This research methodology had the aim of testing the appropriateness of the FLW Standard (https://flwprotocol.org/wp-content/uploads/2017/05/FLW_Standard_final_2016.pdf) and its reporting template (FLW-Standard-Inventory-Reporting-Template_June-2016_update.xlsm (live.com)) in retail. The research followed a mixed-method approach by gathering qualitative and quantitative data. The first part of the research procedure was the collection of FLW data and a high-level overview of the flow of FLW. Following this, the data was reworked to achieve FLW in tonnage per destination. This was used to populate the FLW Standard's reporting template. Detailed bottom-up product category data, based on stock-keeping units (SKUs), was the main source of data. This methodology was designed to offer the best short-term balance between accuracy and ease of reporting without incurring additional costs to the retailer.

Figure 1 Screenshot of the introduction tab of the South African Food Loss and Waste Reporting Template

This reporting template is used alongside the guidance in the FLW Standard to record and report results. Figure 1 and Figure 2 provide a visual of the reporting template. This interactive excel tool includes both the required and recommended items outlined in the FLW Standard. Detailed guidance on implementing FLW quantification methods is described in the standard. The FLW Standard is therefore necessary to supplement the reporting template.

Food Loss and Waste (FLW) Reporting Template

Company name:	0
Name of person completing the report:	0
Date completed:	1900/01/00

Summary

Reporting period (start date):	1900/01/00
Reporting period (end date):	1900/01/00
Overall FLW in tonnes:	0,00
FLW as a % food produced / purchase and sold as intended by your organisation*:	No POM data
(Optional) Percentage of inedible parts included in total FLW tonnage:	

* this should be tonnes FLW ÷ tonnes (food product produced or sold as intended + FLW + food sent to other destinations).

If food tonnes cannot be measured, provide an alternative metric, such as % by value, and explain the method used.

Destinations for FLW (tonnes or %)*:	Quantity	Unit	Notes
Anaerobic digestion / codigestion	0,00	TONNES	
Composting / aerobic processes	0,00	TONNES	
Incineration / controlled combustion	0,00	TONNES	
Land application	0,00	TONNES	
Landfill	0,00	TONNES	
Sewer / wastewater treatment	0,00	TONNES	
Not harvested / ploughed in	0,00	TONNES	

Introduction | Company and Scope Info | Data entry | Assurance and Narrative | Reporting Template | Guidance | Definitio

Figure 2 Screenshot of the unpopulated Reporting Template tab

The reporting template seen in Figure 1 and 2 is also referred to in the FLW Standard as an inventory report. An inventory report should hold all the information required by a retailer's stakeholders to make their conclusions about FLW management. It is essential that this reporting template covers all the FLW within the scope selected in Figure 3. The FLW Standard also specifies that assumptions and references are included in the reporting template. This is to ensure transparency for reviewers and to increase credibility of data (World Resources Institution, 2016).

3.2 Study scope and timeframe

FLW data pertaining to all stores spread throughout South Africa belonging to a major grocery retail company was obtained. The reporting period is 3 months from March to May 2021. Three months were chosen as a test period to develop a first-pass baseline from which future FLW quantification targets can be measured against. Figure 3 shows the scope of the FLW data collection for the case study, using a template from the FLW Standard.

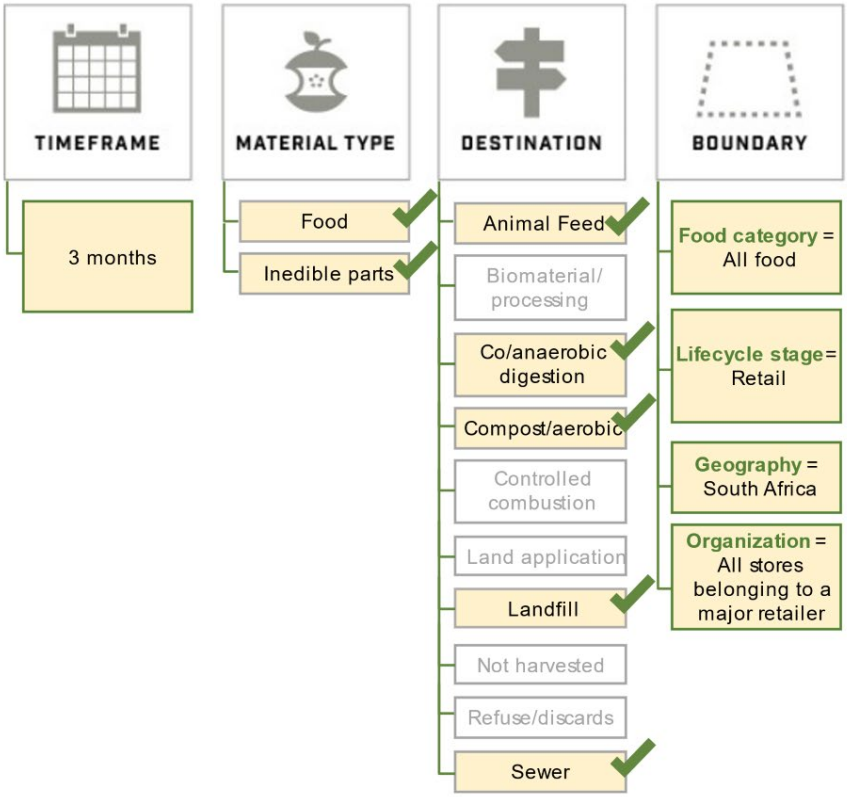

Figure 3 Scope of study laid out as per FLW Standard

The FLW Standard allows an entity to choose the combination of destinations and material types that it considers part of the FLW in its supply chain. Food is defined by the FLW Standard which is “any substance whether processed, semi-processed, or raw that is intended for human consumption”. “Inedible parts” is defined as “components associated with a food that, in a particular food supply chain, are not intended to be consumed by humans” (World Resources Institution, 2016). Ideally, results should be reported on an annual basis. It is important to define the scope of an inventory to allow for accurate comparison and tracking of FLW.

3.3 Qualitative data

Qualitative data was collected with the aim of identifying where the FLW data was held in the company and to understand the movement of FLW throughout the retail stage of the supply chain. This was necessary for capturing the correct FLW destinations and for documenting data sources and contact people for future measurement continuity.

A distribution centre and six stores of varying sizes were visited to observe FLW management practices. A clear picture of FLW practices in the store could be developed, as shown in Figure 4. The focus was placed on what happened to unsold stock and the various relationships store

owners had with their waste collectors. A high-level analysis of dealing with FLW from joint ventures found in the stores was also conducted. Joint ventures include cafés, coffee stations, sushi delis, meat counters, and fish counters. The waste from the joint ventures was often combined with the retail store's waste and it was, therefore, necessary to include them in the study.

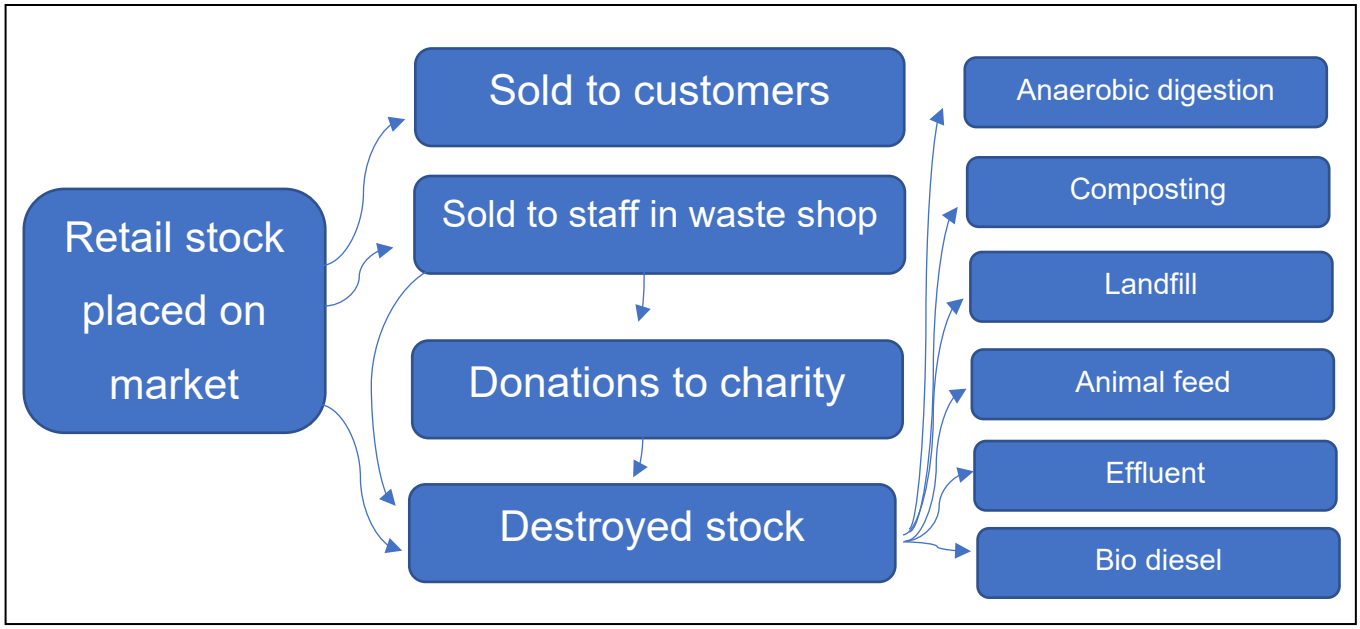

Figure 4 Diagrammatic representation of the flow of FLW in a typical retail store

Waste contractors across the nine provinces were contacted to determine the different destinations that destroyed stock from the retailer was sent to. This was necessary because the FLW Standard emphasises capturing the split between destinations (Parfitt et al., 2016). A compositional analysis of the destroyed stock cages was also performed. This was done with the help of the main waste contractor responsible for collecting destroyed stock cages. The compositional analysis was performed to strengthen assumptions made while working with the quantitative data. Lastly, as this retailer had not previously quantified FLW in tonnage per destination, a study was undertaken to determine which departments keep the information required and to collate the standard operating procedures pertaining to FLW in the business. For the success of the project, it was important to ensure that all the relevant business units were aware of the collection of FLW data.

3.4 Quantitative data

The FLW Standard asks for FLW to be given in tonnage. This is not a metric that the retailer had at hand and therefore the available data had to be reworked. The calculations to achieve FLW in tonnage were based on a mass balance. Using a mass balance approach is best practice in retail in the absence of other systems. The FLW Protocol (World Resources Institution, 2016)

recommends implementing “weight of unit times number of units”. The CGCSA also advocated for this in their retail quantification guide sent to retailers embarking on the process of FLW quantification. The mass balance approach used compares inputs (products placed on the market) and outputs (products sold to the consumer) alongside changes in levels of stock (World Resources Institution, 2016). It is a cost-effective method as it relies on existing data that is reanalysed and repurposed to produce FLW estimates. The aim was therefore to calculate total FLW with the following equation:

$$input - saleable\ product\ stock - donations = FLW\ to\ various\ destinations$$

This was done by performing a conversion of financial data and scanned data into FLW at the Stock Keeping Unit (SKU) level for all unsold products. The second step was to determine the destination split of the total FLW calculated. The retailer is set up to report movement at the SKU level but the system does not track the end destination per article.

The following data sets were collected:

- Sales per store (number of units and units sold in ZAR)
- Food surplus sold at the staff waste shop (number of units sold, units sold in ZAR, waste recovery at cost price)
- Reason codes inputted via a scanning device to food that has not been sold
- Stores by trading area size
- Number of destroyed stock cages collected per store per month
- Cooked chicken oil (Number of bins per store)
- Coffee cart and café FLW in tonnage (trial period data)

3.4.1 Determine the weight of each Stock Keeping Unit

The movement and sales of inventory were captured based on the product Stock Keeping Unit (SKU), which is a barcode that the staff scan. The SKUs do not have the product weight automatically linked to them. It was necessary to link the product weight with the SKU to calculate FLW in tonnage. Therefore, product weight had to be manually inputted for each SKU based on product records pulled from the operating system. Random weight products and produce products that range in weight were assigned a weight based on averages derived from databases (e.g.: loose apples that are weighed by the customer or a cut of steak purchased at the meat counter). Wherever possible net weight was used to exclude packaging.

3.4.2 Calculate weight of food sent for donations

Using the SKU code as the primary data point, a VLOOKUP function in excel was performed to capture the product weight per SKU (the product weight refers to the net weight which was manually gathered as per the previous step); the number of units that are not sold to customers

(referred to as 'waste unit ACTL' in Table 1) and the number of units sold to staff in the staff waste shop (referred to as 'Waste recov unit' in Table 1).

Table 1 Example of donation calculations in excel for March to May 2021

SKU Code	Product NET Weight (g)	VLOOKUP units sold	Weight of food sold (tonnes)	VLOOKUP Waste unit ACTL	VLOOKUP Waste recov unit	Units available for donation	Donation (kg)	Donation (kg) after 10% spoilage factor
25629	950	15631	14,85	-675	403	272	258,4	232,56

SKU net weight multiplied by units of food not sold in-store or to staff in the waste shop gives one the weight of food available to be donated or destined for other disposal routes. This retailer uses a spoilage factor of 10% to determine how much of the food technically available for donation ends up as destroyed stock.

3.4.3 Data triangulation of the 10% spoilage factor

The value obtained for 'destroyed stock' (food that is not sold to staff or donated to charities) is based on a 10% spoilage factor. This is an estimation that has been used for years by the retailer. It was therefore necessary to assess the accuracy of this value. This value was tested by extrapolating destroyed stock data provided by the retailer's waste collector responsible for the Western Cape. This waste collector consistently records the number of cages of waste collected from every store in the Western Cape. A sample of cages was weighed, and a compositional analysis was performed to be able to work out the amount of FLW each cage represents. The data for the Western Cape was then built up for all the stores in South Africa based on the size of each store in square meters. This produced a value for total FLW sent to various destinations (other than donations) which could be compared to the value given by the 10% spoilage factor.

3.4.4 Calculating the various destinations of FLW

The tonnage of food sent for donations was calculated based on financial data linked to each product SKU as described in section 3.4.2. This involved identifying food related inputs and outputs and accounting for changes in stock levels (Amicarelli & Bux, 2021). On a basic level, it is the amount of food sold to customers and the amount of food sold to staff in the waste shop, subtracted from the amount of food delivered. To work out destroyed stock FLW tonnage, a spoilage factor was used. The split of this FLW to other waste destinations was determined based on contacting waste collectors of all the retailer's divisions across South Africa to find out where they dispose of the FLW collected. Based on the number and size of stores in each division, the total FLW going to these waste collectors could be spilt into the various destinations.

A trial period of manually weighing FLW at cafes and coffee carts was implemented to quantify FLW here. For the coffee carts, the coffee puck before and after extraction was weighed. From this the waste for 1 kg of coffee could be calculated. For cafes, three different categories were used: waste to charity, out of date food, and production waste. Food going to these destinations was weighed manually with a kitchen scale for a trial period. FLW data for all the distribution centres belonging to this retailer were obtained from the various waste managers responsible for the distribution centres. Conversion factors were applied in cases where this data could not be obtained in tonnage, such as one case where food was macerated into effluent.

Tonnes of food produced or purchased and sold as intended by the retailer is known as ‘Placed on Market).‘’ (PoM) It was calculated in a similar way to how donations were calculated. Every SKU weight was multiplied by the number of units of that SKU that was sold. Shrinkage was also accounted for in this calculation. Shrinkage refers to loss of stock that is usually attributed with shoplifting or employee theft or human error.

3.5 Reporting template population and analysis

The recommended template for measuring FLW in South Africa is the FLW Standard’s reporting template. This reporting template has been slightly adapted by the CGCSA and WRAP to be more suitable to the South African context. The FLW data that had been collected and reworked as outlined in the previous sections was inputted into the standard. Company scope and information regarding the retailer’s assurance and narrative had to additionally be filled in.

The reporting template enabled this retailer to report FLW per destination and as a total % of operations in a standardised manner in accordance with South Africa’s voluntary agreement. The end result of this methodology was a first pass baseline for the retailer. With this analysis section and the experience of the population process of the standard, the appropriateness of quantifying FLW using this standard for retailers in South Africa could be reflected on.

4 Analysis

This section constitutes of various tables and figures that fed into the main data tab outcome of the FLW Standard's reporting template seen in the screenshot in

User note: this sheet is locked and cannot be edited. Please enter data in the "Data capture sheet" tab.

Food Loss and Waste (FLW) Reporting Template

wrap

WORLD RESOURCES INSTITUTE

Company name:	
Name of person completing the report:	Suzaan Hobson
Date completed:	2021/10/22

Summary

Reporting period (start date):	2021/03/01	
Reporting period (end date):	2021/05/31	
Overall FLW in tonnes:		454,89
FLW as a % food produced / purchase and sold as intended by your organisation*:		0,26%
(Optional) Percentage of inedible parts included in total FLW tonnage:		

* this should be tonnes FLW ÷ tonnes (food product produced or sold as intended + FLW + food sent to other destinations).

If food tonnes cannot be measured, provide an alternative metric, such as % by value, and explain the method used.

Destinations for FLW (tonnes or %)*:	Quantity	Unit
Anaerobic digestion / codigestion	246,28	TONNES
Composting / aerobic processes	40,19	TONNES
Incineration / controlled combustion	0,00	TONNES

Company and Scope Info | Assurance and Narrative | Data entry | Reporting Templat ...

Figure *5*. One cannot test the appropriateness of the tool without actual piloting of the tool itself with real data. The specific tables and figures included in this analysis section were incorporated into the report because they were used in the process of populating the reporting template. Details regarding background calculations and store data has been excluded to protect the identity of the retailer. Results shown are for three months from March to May 2021. This was used to create a first FLW baseline for the retailer. Results were based on a mass balance approach, explained in section 3.4 of the methodology.

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Food Loss and Waste (FLW) Reporting Template

WORLD RESOURCES INSTITUTE

Company name:	
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Company and Scope Info | Assurance and Narrative | Data entry | Reporting Templat ...

Figure 5 Screenshot of the FLW Reporting Template used by the retailer

User note: this sheet is locked and cannot be edited. Please enter data in the "Data capture sheet" tab.

Food Loss and Waste (FLW) Reporting Template

Company name:	
Name of person completing the report:	Suzaan Hobson
Date completed:	2021/10/22

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Company and Scope Info | Assurance and Narrative | Data entry | Reporting Templat ...

Figure ***5*** shows the interface of the FLW Standard's reporting template once the results were inputted. The retailer inputs data into the data entry tab. The information is pulled from the data entry tab into the summary tab seen above. These results can be used to set targets to continuously improve performance related to FLW. FLW in tonnage, split by destination, is a good starting point for a retailer to report and be transparent about their FLW efforts.

4.1 Reporting template data entry

Table 2 FLW Standard's reporting template data entry tab results for three months (March to May 2021)

gives a full outline of the various destinations this retailer sends FLW to. In the 'notes' column of

Table 2 FLW Standard's reporting template data entry tab results for three months (March to May 2021)

Inedible parts refer to part of a food not intended to be consumed. Inedible parts traditionally include components such as bones, rinds, pits, and peels. Packaging does not fall into this category. For this most meaningful FLW reduction target, it is useful to separately quantify inedible FLW. This study did not have the capacity to do so. In this study's scope seen in Figure 3, inedible FLW is included.

Total Material Discarded	Quantity for three months	Notes
Tonnes of food (and any included inedible parts) discarded	4145,74 t	
Material discarded as a proportion of food handled	2,38%	Total food discarded ÷ product sold as intended
Sum of material sent to non-waste destinations		
Redistribution for human consumption	3 660,34 t	Food donated to charities
Sent for animal feed	78,11 t	Food used as feed at pig farms
Total food sent to non-waste destinations	3 738,45 t	Sum of donations and animal feed
Food sent to other destinations as a proportion of food handled	2,1%	Other destinations ÷ product sold as intended
Destinations of FLW		
Anaerobic digestion / co-digestion	246,28 t	Process through which bacteria break down organic matter
Composting / aerobic processes	40,19 t	Drums with food waste sent to a nearby farm for composting
Landfill	120,42 t	Waste ends up on a landfill site
Sewer / wastewater treatment	12,00 t	Food gets macerated into effluent drainage
Other (including the production of biofuel products e.g. biodiesel, fuel pellets)	36,00 t	Chicken fat at the retailer gets used to produce biodiesel
Total FLW	454,89 t	
FLW as a proportion of food handled	0,3%	Total FLW ÷ product sold as intended

Table 2 FLW Standard's reporting template data entry tab results for three months (March to May 2021)

In

Table 2 FLW Standard's reporting template data entry tab results for three months (March to May 2021)

it is clear that 'redistribution for human consumption' is the main destination of this retailer's food sent to non-waste destinations. This was to be expected, as the retailer makes every effort to divert their food to this destination unless food safety becomes a concern. A primary focus area for this retailer is the tonnage of food sent to landfill or sewer. According to Figure 6, this is the least preferred option for FLW to be sent to.

Total Material Discarded	Quantity for three months	Notes
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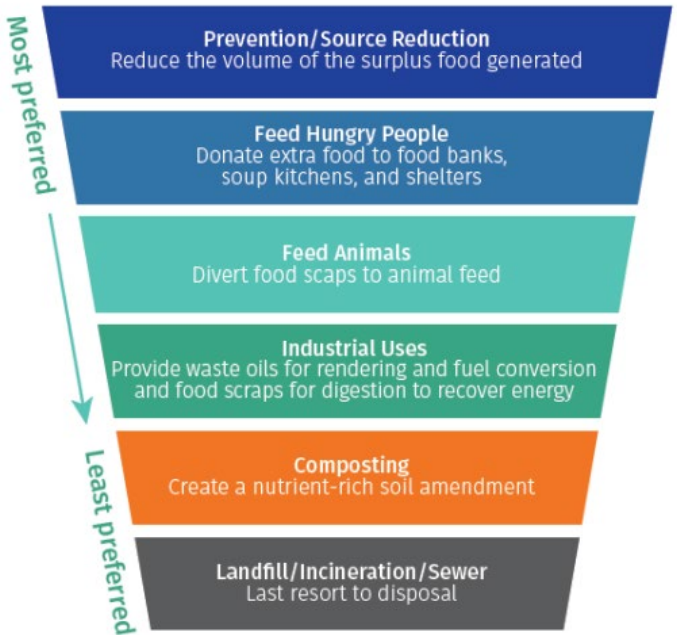

Figure 6 Food Recovery Hierarchy (Environmental Protection Agency, 2022)

The retailer aims to adopt the Food Recovery Hierarchal (Environmental Protection Agency, 2022) approach in dealing with FLW. This approach prioritises different methods for managing food surplus. The split of FLW by tonnage to the different destinations helps a retailer reach a good view on where focus should be placed so as to send food to destinations higher up on the Environmental Protection Agency's (EPA) food hierarchy.

	B	C	D	E	F
13					
14		**Quantification Methods & Uncertainty**			
15					
16		Data sources used in compiling inventory	Sales & wastage units report; Product specifications report; Distribution centre waste contractor reports; Destroyed stock waste contractor reports; coffee and café quantification trial data		
17		Guidance documents, or published data sources ref	CGCSA Guidance on the measurement tasks; WRAP's suggested methods for quantifying retailer food loss and waste		
18		Accounting for water addition / removal	Has not been accounted for		
19		Sampling & scaling of data, or other means of gap fi	Destroyed stock data scaled from waste contractors for Western Cape division to rest of South African stores. Café and coffee cart trials scaled for all stores.		
20		Summary of data uncertainties	Need to take cognisance of the impact of Covid-19 on sales and wastage figures. Product weight of random weight products (produce, meat & fish counters) were inputted based on reference values. Packaging was excluded in majority of calculations as NET weight was used, however for certain destinations the exclusion of packaging cannot be claimed. Destroyed stock based on estimated figures from waste collectors. Exact waste unit figures not available for joint ventures & cafes.		
21					

Figure 7 Screenshot of the 'Quantification Methods and Uncertainty' tab of the reporting template

A recommendation of the FLW Standard is to verify reporting data. To help the reviewer verify the data, narrative is added by the retailer. Therefore to support the interpretation of

an extract of the Assurance and Narrative tab in the reporting template can be found below in Figure 7. A retailer will always aim to anticipate and minimise different forms of uncertainty.

4.2 Waste contractor data analysis

A compositional analysis was done on the destroyed stock cages collected by one of the retailer's main waste collectors, as seen in Figure 8. Data for destroyed stock cages was corrected for non-food items and packaging found in these cages. Based on a compositional analysis of the destroyed stock cages, the packaging in the cages was found to be 30% of the total volume of the cage. This constituted of 25% plastic and 5% cardboard. The average weight of a destroyed stock cage was found to be 250kg. A compositional analysis of waste involves physically separating and weighing waste. It is ideal for mixed waste streams to distinguish between FLW and non-food

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Total FLW	454,89 t	
FLW as a proportion of food handled	0,3%	Total FLW ÷ product sold as intended

items or different food categories (Comission for Environmental Cooperation, 2019). Splitting FLW into food categories is a way to identify 'hotspots' to focus on for FLW reduction projects.

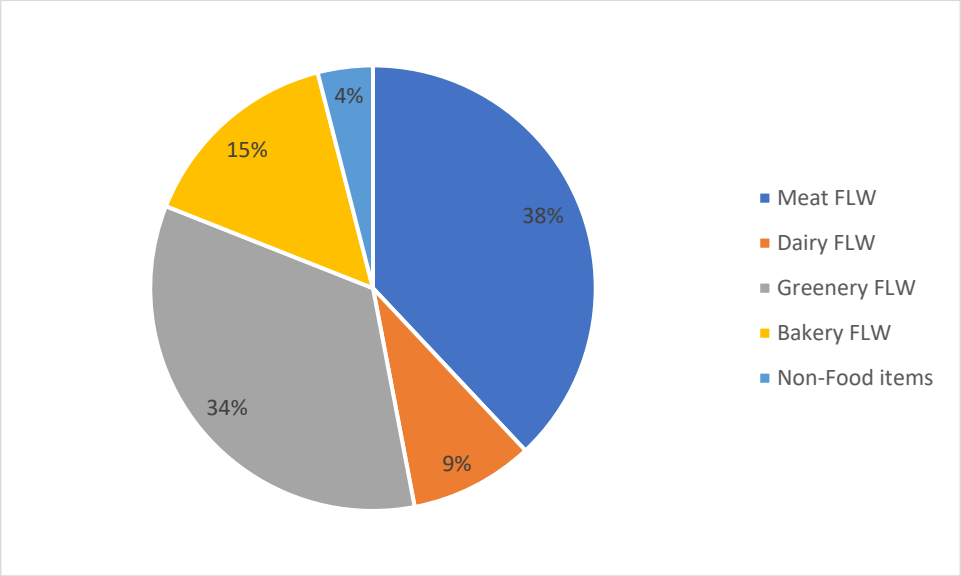

Figure 8 Compositional analysis of destroyed stock cages showing percentage breakdown of FLW categories

The retailer previously worked off a spoilage factor of 10% for the destroyed stock waste. This spoilage factor was evaluated against the secondary data collected from waste collector's records. The results below indicate the estimated factor of 10% is not far off the collected waste records data which provides a result of 8,7%.

Table 3 Triangulation of 10% spoilage factor for destroyed stock from March to May 2021

Data source	Destroyed stock (in tonnes for 3 months)	Spoilage factor
Western Cape waste collector data extrapolated for all stores in South Africa	371,25	**8,7%**
Use of the 10% estimated spoilage factor applied to SKU unit data	426,94	**10%**

Using existing information such as the waste collector's records of the number for destroyed stock cages is a cost-effective supplementation method to help quantify FLW.

4.3 Café and coffee cart results

The only viable option of collecting coffee carts and café's FLW was through a manual weighing process, followed by extrapolation for all stores in South Africa. Table 4 refers to coffee pucks. A

coffee puck is the round pound of coffee grounds residue that the staff remove from the coffee machine after making a coffee for a customer. Coffee grounds contribute minimally to total FLW of the retailer. It is however best practice to cover all avenues of waste flow. Knowing the tonnage of coffee waste can help the retail implement FLW diversion projects. For example, coffee grounds have the potential to be used as compost, adding organic material to the soil.

Table 4 Coffee cart waste

Coffee cart metrics	Coffee waste	unit
1 coffee puck before extraction	22	g
1 coffee puck after extraction	41	g
Waste from 1kg of coffee	1.85	kg
Total month coffee usage	74	kg
Total waste for the month	136.9	kg
Total waste for 3 months	4105	kg
For total coffee carts over 3 months	**184,73**	**tonnes**

Table 5 shows the tonnage of café FLW for the months of March to May 2021. Cafes produce a small fraction of FLW in comparison to the food products on the retailer's shelves. This is because only a few of the larger stores have a café and the café uses products off the retailer's shelves to make the food on their menu.

Table 5 Café waste quantification

Categories of café FLW	Single store for one Week (kg)	All stores for three months (tonnes)
Surplus food given as donations	6,91	8,60
Out of date	4,94	6,15
Production Waste	1,21	1,50
	13,06	**16,26**

The surplus food, which would generally be on-the-counter bakery items such as muffins or croissants, is collected by the same charity that collect's the store's FLW. 'Out of date' refers to food that is no longer good to serve from a food safety perspective. This would typically include premade products kept in the fridge. Production waste refers to burnt orders, wrong orders, or offcuts.

4.4 FLW contribution by reason codes

It is of future interest for the retailer to know what the largest contribution of FLW is according to the reason codes staff give when products are scanned off shelf. All products are scanned when

they leave the store shelf. In most cases it is scanned at the payment counter when a customer buys the product. The instances where this does not occur is broken down as a percentage of all unsold food below. From Table 6, it is clear that food reaching its use by date is the largest reason for food not being purchased by customers. The majority of “stock expired at location” gets sent to the staff waste shop. If the staff do not buy it, it goes to a charity. Damaged food, items probed for temperature check and products exposed to a fridge breakdown (power failure) are not fit to be sold at the staff shop and are typically placed directly in the destroyed stock cage and sent to the destinations of FLW seen in

.

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Other (including the production of biofuel products e.g. biodiesel, fuel pellets)	36,00 t	Chicken fat at the retailer gets used to produce biodiesel
Total FLW	454,89 t	
FLW as a proportion of food handled	0,3%	Total FLW ÷ product sold as intended

Table 6 Unsold food represented by % contribution of reason codes given when food SKU is scanned out

Reason codes for food waste	% Contribution
Stock Expired at Location	90,61%

Own Damages Sales Floor	5,98%
Own Damages Packaging	1,47%
Items for Temperature Check	0,80%
Eaten Damaged Stock Received from the DC	0,69%
Own Damages Odds	0,15%
Power Failures	0,10%
Goodwill Exchange	0,07%
Damaged Items in an Undamaged DU	0,04%
Testers	0,04%
Own Damages Visual	0,03%
Red Alert Items Returns	0,01%
RTV Rejected	0,01%

The percentage contribution of the reason codes in Table 6 is useful for identifying operational and financial savings related to FLW. Own damages sales floor refers to products in the store area that are most likely damaged by staff or customers dropping products and own damages packaging is a product that is not in a condition to be sold to a customer because the packaging is ripped or dented. A temperature check is done every day by probing a freezer product to test the internal temperature. The rest of the categories are miscellaneous, contributing a small percentage to FLW.

5 Discussion and conclusion

5.1 Introduction

The purpose of this discussion is to, in light of the literature review, reflect on the analysis section as well as the methodological process performed to discern whether the use of the FLW Standard and its complementary reporting template is an appropriate means of quantifying FLW for the South African retail sector. The discussion aims to provide an unbiased overview of the strengths and weaknesses of the tool. Recommendations for future improvements and guidance to retailers planning on undertaking the same process are also included.

A single large retail group in South Africa was used as the data source. These findings can therefore not automatically be extrapolated to other retailers. However, it is anticipated that the analysis is comparable because the major retailers in South Africa are selling comparable products and are increasingly focusing on a similar customer base. The South African Advertising Research Foundation (SAARF) developed the Living Standard Measures (LSM), which is used as a means of segmenting the South African consumer market into ten groups based on a measure of household wealth. Three of South Africa's four major retails cater for LSM 6-8 which is middle to upper class (Ngqinani & Ntloedibe, 2020). The investigated retailer pledges to the SDG 12.3 target, committing to a 50% reduction of FLW by 2030. Within this context, measuring FLW is a priority for the retailer to determine baseline food quantities and to have an indication of whether reduction targets are met.

Before presenting the details of this quantification tool, it is important to point out that the main aim of FLW management is prevention by targeting the source of FLW in the first place, over and above focusing on FLW reduction strategies and measurement methods. However, the latter aids in identifying hotspots and is necessary for putting reduction targets in place. As discussed in length in the literature review, proper FLW quantification creates a unique opportunity for a retailer to improve their FLW outcomes and consequently their environmental performance. Retailers are incentivised to measure and report their FLW to also enhance social impacts, align themselves with international initiatives and boost brand reputation. Investing in FLW management helps a retailer minimise inefficiencies which yield financial returns. For every R1 a retailer invests in FLW reduction, it gives a 14-fold return (Hanson & Mitchell, 2017). Although there is a gap in historical financial data from developing economies Hanson & Mitchell's study, it shows the financial benefits of taking action is often outweighed far by the costs. Monitoring the quantity of FLW generated is essential to forming proactive measures to prevent FLW (Dlomo, 2021). The use of the FLW standard's reporting template was implemented by this retailer as a first step in the direction of understanding what is wasted, how much is wasted and when waste occurs.

5.2 Entities to be included in the FLW Standard population process

Populating the FLW Standard requires collecting the right data to input into the excel template. Several entities within a retailer structure should be included in the process of collecting data to ensure that it is as complete as possible. A learning from the process of populating the FLW Standard's reporting template is that it is not a one-man job. Firstly, the right people in the company must be on board with the FLW measurement project. This is because data often sits in various departments of a company. FLW measurement advances are slowed if top leadership do not support the drive for improving reporting capabilities. Du Toit (2018) supports this notion by stating that supply chain management teams should make FLW quantification a priority and additionally make it a mandatory key performance indicator. Coupled with this is the importance of capturing FLW reporting needs in the company's IT (Information Technology) development plan, preferably among other high-priority needs. IT systems that improve sustainability capabilities within a company are often not given budget priority in comparison to other business units. A positive outcome of the tool is that the retailer in this case study put forward the FLW recording needs for the company after the process of filling out the tool. The FLW standard, therefore, encouraged the retailer to put systems in place to better record their FLW.

Another group to include is the waste collectors contracted to dispose of back-of-store waste- specifically the destroyed stock cages elaborated on in the glossary. The major retailers in South Africa have stores spread across all nine provinces and therefore have many different waste collectors. The problem that arises is that the different waste collectors have various ways of capturing the data on the waste collected. For example, Figure 8 shows a compositional analysis of the destroyed stock cages collected by one of the retailer's main waste collectors. A waste compositional analysis allows the retailer to collect very detailed information about different food categories found in the waste sent to destinations other than landfill. Not all the waste collectors were however willing to perform a compositional analysis. Some contractors keep impressive waste records and others only keep book of invoices sent. Unfortunately, records of FLW in tonnage sent to waste contractors across South Africa is currently not centralised at the retailer that took part in the study. In the past, the tracking of this back-of-store waste was seen to be beyond the retailer's sphere of control and no longer their responsibility. However, in the process of putting together the retailer's first FLW baseline, it became clear that a retailer's waste collectors need to be effectively managed in order to accurately populate FLW destinations and tonnage split into the FLW Standard.

An additional motivation for retailers to become more involved with their waste contractors is that the Western Cape Department of Environmental Affairs announced a 100% ban on organic waste to landfill by 2027 (Department of Environmental Affairs and Development Planning, 2022). This means that retailers must put structures in place to ensure that no FLW from their operations goes

to landfill. Even in the other provinces where a ban has not been announced, it remains best practice according to the food recovery hierarchy (Environmental Protection Agency, 2022) to not send any food to landfill. There are various interesting alternatives to send FLW to aside from landfill, composting and animal feed. Inseco (https://inseco.co.za/) is a South African start-up that uses insects to convert waste food into proteins, oils, and fertilizer. The global insect protein market shows a lot of growth potential. Inseco uses FLW to produce an alternative source of protein, which is an essential form of nutrition key to meeting the food demands of the future (Inseco, n.d.). Retailers sending their FLW to companies such as Inseco contribute to a circular economy model.

Several South African retailers have joint ventures as part of their larger stores. Usually for practical reasons, these joint ventures make use of the same waste disposal channels as the retailer. The retailer does not record the joint venture's wastage units. This is because it is coupled with sensitive financial information. It would however be beneficial if these joint ventures were to share their FLW data with the retailer so that the retailer can acquire a holistic picture of the FLW exiting their store. Ideally data should be streamlined, and joint ventures should be eager to collaborate with retailers on finding the best FLW solutions. In this study, a trial FLW weighing period was conducted for the cafes and coffee carts as seen in Table 4 and Table 5. These results were used to put together the first 3-month baseline of FLW for the retailer, however, for a full year baseline ideally more stores should be sampled or all the joint ventures should contribute data.

A fourth entity a retailer should ideally include in the process of FLW data collection is the charities that their surplus food is donated to. This relationship can be beneficial because the charities often weigh the food collected independently on their side too. Figure 6, the food recovery hierarchy, shows that redistribution of food is a top priority step. This weight data can be used by the retailer for data triangulation of their own calculations for food sent to charities. It is additionally important to ensure that charities are punctual and reliable. Charities that are late results in food unnecessarily being discarded and possibly ending up in a landfill site.

This study's scope focused on South African major retailers. A retailer is however also partly responsible for the actions of their suppliers as it is their products that appear on the retailer's shelves. Suppliers are not intended to be included in a retailer's data input of the FLW Standard's reporting template, however it is recommended that the retailers undertaking the quantification of FLW take the initiative to encourage suppliers to report their FLW using the FLW Standard as a guideline. Retailers have a big influence on the supplier base. A retailer should be setting the example and offer support to the suppliers that attempt to accurately capture their FLW. The retailer in this study communicated their FLW targets with all their suppliers, strongly encouraged them to sign the South African FLW Voluntary Agreement and suggested resources to help support the supplier in this journey.

5.3 Reflections on the appropriateness of the tool

This section reflects on the resultant data from actual implementation of the tool, as presented in Chapter 4 (Analysis).

5.3.1 Limitations and challenges experienced populating the FLW Standard

It is of interest to note that this was the first time the retailer in the study calculated their FLW in tonnage and therefore the methodology was based on the resources available at the time. Other retailers and companies were simultaneously attempting to populate their FLW in tonnage in accordance with the CGCSA's voluntary agreement. Challenges discussed below are not necessarily flaws in the FLW Standard but are more often connected to the practicalities of collecting the required data. They are incorporated into the discussion as it is likely that other retailers will face similar hurdles.

A first unique data caveat worth mentioning is that during the time that this data was collected South Africa was in an adjusted level 1 related to the Covid 19 pandemic, however the country exited level 3 on the first day the data collection started. These levels refer to the severity of restrictions put in place by the government to try slow down the spread Covid 19 infections, with level 5 being the strictest. This could have had an impact on the amount of FLW measured in the stores and also in the cafes. This was inputted into the reporting template's 'Quantification Methods and Uncertainty' tab in Figure 7. Cafés and coffee carts were trialled during a time that people were still reluctant to eat out. Cafes were found to be at 70% capacity in comparison to their how full they were pre-pandemic. This was corrected for in the results to reflect cafés and coffee carts at full capacity.

In the methodology it was explained that the retailer scans all food that leaves the store shelf. The method of measuring food based on scanning is most useful within the wholesale, retail, and market sector where food is in packaging and hence has a barcode (FUSIONS, 2016). This method is less suitable for food without a label which can be scanned. Where scanning is used, the information captured often requires a conversion to attain the weight wasted. This is achieved by utilising the weight of each food item combined with the product barcode detail retrieved from the scanning device. This type of weight information is usually stored in a database or some type of stock-management programme. Alternatively, it can be inputted manually in the case of such a database not being available. In the case of this specific retailer, it was applied manually. Section 3.4.1 in the methodology elaborates on this. However, the capturing of product net weight and cleaning up of the data per article posed a challenge to this retailer.

Generating the data for product net weight contents is a cumbersome process, yet it becomes invaluable information for measuring the effect of FLW interventions. The product net weight data

set used in this study was calculated and was therefore proxies of real weight because it is not possible to accurately capture the net weight of random weight products. An example of these types of products would be fruit weighed by the consumer or a cut of meat from the butcher counter. Even though this data set is imperfect, it was crucial to the process of being able to translate the financial data into FLW in tonnage as outlined in the methodology. It is therefore important that a retailer wishing to populate the FLW Standard goes through a similar process and possibly investigates a more automated way of capturing product weights in relation to units sold. A second point on product weight is to capture the net and not the gross weight. It is particularly beneficial to separate the weight of packaging from the weight of FLW. According to the FUSIONS (2016) framework, the weight of a food product should exclude the weight of packaging. This is generally accepted by FLW frameworks, including the FLW Standard. Most retailers should regardless have both forms of weight (net and gross) on their records.

Another challenge experienced was assessing the variation in data quality. There were differences in the resourcing and commitment to waste reduction amongst stores. There were also different accuracy levels of data provided by waste contractors and the retailer's distribution centres. This is a common challenge and can be improved by getting leadership structures on board with supporting the drive for accurate FLW quantification. For this retailer, a solution for ideal FLW quantification is that their products should be scanned a second time after it has been taken off the shelf. The first time is linked to the reason codes as to why the product is removed (i.e. out of date or package damaged). The proposed second time would then theoretically indicate if the product was bought at the staff shop, given as donations, or got collected by waste contractors. This will help determine an exact split to the destinations seen in Figure 4 Diagrammatic representation of the flow of FLW in a typical retail store) and it will ensure even better data accuracy and less variation. The current scanning system does not track the end destination per article. The preliminary cost to develop such a system can be expensive, however it can be based on an existing sales data system (Comission for Environmental Cooperation, 2019).

As the population of the FLW Standard's reporting template was a first attempt at a FLW baseline for the retailer, they did not have the capacity to differentiate between edible and inedible FLW. The study scope in Figure 3 specifies that inedible food was also included in the study. The aim was to be able to use the reporting template to quantify FLW as a whole. Further breaking it down into edible and inedible FLW is categorised as a future focus area. Splitting FLW into these two categories is helpful for policymakers in guiding policy interventions to ensure the best possible use of food resources. This additionally supports the drive for a circular food system and aids the most efficient application of the waste hierarchy. FLW quantification studies analysed by Corrado & Sala (2018) found that eighty percent of studies analysed accounted for both edible and inedible FLW, whilst a study by Bräutigam, Jörissen & Priefer (2014) regarded only the edible portions.

Splitting FLW into edible and inedible categories is a priority in the long term as it will improve data comparability. It is however a challenging subject to improve due to the various culturally sensitive interpretations of food classified as inedible. An example of this in South Africa would be chicken feet, which is consumed in certain supply chains and not in others. Edible and inedible FLW categories is therefore dependant on culture, availability, and price.

Two caveats to point out is that data analysed in this study and conclusions deduced may not automatically represent the FLW experienced at medium and small retailers as this retailer is in a larger size class. Additional research is thus required on the smaller as well as less formal food value chain. Secondly, this study was conducted over a three-month period of data collection. A longer timeframe for data collection is beneficial as it provides a larger sample of data which helps correct for possible errors and it gives a more accurate representation of FLW in a retail business. The conclusions based off the three months of data collected during this study would therefore be strengthened by collecting data over a longer period. Assumptions from this study cannot be made on the seasonality of FLW.

5.3.2 In praise of the FLW Standard

The use of the FLW Standard by South African retailers to measure FLW is recommended. This is based on the ease of population and a variety of advantages using this standardised method offers. Standardisation of methods for quantification helps reduce gaps and inconsistencies (Barco et al., 2019). The proper implementation of this reporting template by retailers is a start to ensuring accuracy of reporting and can be used to measure the effects of FLW reduction interventions implemented by retailers. The FLW Standard's quantification approach is compliant with many different country's measurement and reporting guidelines. Having a standardised tool streamlines large scale FLW measurement efforts. It enables large entities such as WRAP or the WRI to offer assistance to companies using this standardised method through the resources they have created and made publicly available.

The FLW Standard was designed to be participatory and collaborative, which encourages ownership and boosts widespread buy-in. In South Africa's case, much of this participatory involvement is driven by the CGCSA. Regular signatory meetings are held. During these meetings, flaws and uncertainties regarding the tool are discussed. This enables a flow of feedback, and it ensures that the tool is not purely an academic workhorse but rather a user friendly, industry applicable tool. In Chapter 2's literature review it was pointed out that effective tools should be developed collaboratively (Somlai, 2022). A positive of the FLW Standard is that it motivates retailers to work less in silos when it comes to quantifying FLW because they are encouraged to share their best practices. It is advantageous for retailers to be increasingly transparent regarding

their FLW learnings. Ultimately all parts of the supply chain are working towards the same SDG goal and therefore should not be competitive with FLW knowledge gained.

The ‘Assurance and Narrative’ section of the reporting template is valuable as this encourages the retailer to not only state their commitments but also to elaborate on their FLW management plans. An extract of this can be seen in Figure 7 in the analysis section. This instigates conversations within the company to finalise FLW targets and to sign off on a FLW roadmap before submitting the results of the FLW Standard. This section also motivates companies to publicly report their FLW as a form of accountability and it encourages retailers to set a robust and comparable baseline.

The use of the FLW Standard enabled the retailer in this study to improve the accuracy of the spoilage factor (Table 3) they use internally to help determine the FLW being sent to the various FLW destinations. The use of this spoilage factor was explained in more detail in the methodology. Traditionally the retailer’s financial department used a spoilage factor estimation of 10%. A priority as part of accurately populating the FLW Standard was thus to test this spoilage factor to accurately be able to do a split of waste to the various destinations. Through a data extrapolation process using the waste contractor data for all stores in the Western Cape, as explained in the methodology section 3.4.3, it was found that the spoilage factor is 8,7%. This was a first attempt at reviewing this spoilage factor and it is positive that this value is not far out from the 10% previously used by the retailer. This is an example of how the use of the FLW Standard encouraged the retailer to reanalyse previous estimations in an effort to step up their FLW reporting accuracy.

The FLW Standard’s reporting template is accompanied by a robust quantification guide and a set of helpful resources and case studies. By using the tool, retailers are led to follow the food hierarchy seen in Figure 6 whereby distributing food to people is top priority and sending food to landfill is a last resort. The screenshots of the interface in Figure 1 and Figure 2 represent how user friendly the reporting template is. The FLW Standard and the guidance documents accompanying can also be used as educational material for retailers to ensure their FLW practices align with the actions recommended globally.

5.4 Recommendations for improving the FLW Standard

Through the use of the FLW Standard and the population process of the reporting template, the standard was scrutinised as to aspects which could be improved. This section of the discussion aims to put forward recommendations for the improvement of the FLW Standard. Some of these recommendations can be seen in the light of a future wish list for a holistic FLW quantification tool. Somlai (2022) explains how constantly developing and deploying effective tools can be used to inform company leaders for reducing FLW. Retailers are increasingly cashing in on environmental

value-creation by using digital platforms to manage environmental tensions. It is therefore important that these quantification tools stay topical and aim for continual improvement.

- Carbon footprint

  An effective tool is a tool that shows the interconnections between various sustainability objectives. One area that the retailer could benefit from is incorporating a plug-in to generate metrics for the carbon footprint resulting from sending FLW to the various waste destinations. FLW ending up in landfill sites is a major contributor to greenhouse gases (Moult *et al.*, 2018). Emissions caused by the disposal of FLW vary depending on the disposal option used. Carbon tax and transactions of carbon credits is an upcoming field in South Africa. It will therefore be an additional benefit to a business to be able to translate their FLW improvements into improving their carbon credit status. Many major retailers have also set out a net zero goal for carbon reductions.

- Business case

  Another helpful addition would be to use the results from the FLW standard to build a business case for the company as to why focus should be placed on the reduction of FLW. People, planet, and profit are the 'three Ps' which are often used to measure a business's success, of which profit is often the main driving force for business decisions. A recommendation would therefore be to couple the results in the tool with the rand value of FLW. The retailer in this study performed this as a standalone calculation, however it could be a worthy addition if incorporated into the tool. The nature of this calculation is more complicated than simply applying a blanket plug-in value for all retailers, however even an estimation of the financial burden of FLW can be used to shock businesses into action.

- Reason codes

  Most retailers apply a reason code to products scanned off the shelf. These reason codes can be seen in Table 6 in the analysis section. Reason codes are inputted for every product scanned out of the store. These reason codes have the potential to be better used for tracking the causes of FLW or for focused improvement interventions. The FLW Standard does not provide opportunity for a retailer to input the cause of FLW, so it would therefore be interesting to incorporate this into the FLW standard to have a more holistic picture as to why food is wasted. This is perhaps beyond the current scope of the quantification tool; however, it can be seen as a recommendation for future versions. The main causes of retail FLW, as seen in Table 6**Error! Reference source not found.**, relate either to product damage or product that is 'out of date'. 'Out of date' products can be explained partly by a surplus in store (possibly through poor ordering or unforeseen local factors) or a lack of product mark down policies to clear the products within date. Store forecasting is an area

that is continually being improved. To achieve a more detailed insight into store FLW, a retailer could expand the range of codes that products are scanned out to. Another high-level addition is splitting retailer FLW into different production categories (i.e.: bakery, grocery etc). This can help the retailer with waste hot-spotting projects, and it could potentially be helpful to see if more of one category always goes to landfill. Figure 8 shows the results of a manual compositional analysis for a typical destroyed stock cage. Increased detail and accuracy of categories is a next step for the retailer.

- FLW Value Calculator incorporation

  Modern FLW tools should have an 'actionable potentiality'. This refers to tools for measuring FLW that can improve decision quality by offering insight into the environmental, economic, and social impacts of FLW and their interrelations (Namany *et al*., 2019). A recommendation this study makes is to advocate for the inclusion of the FLW Value Calculator into the FLW Standard. Somlai (2022) analysed The FLW Value Calculator -not to be confused with the FLW Standard (https://www.flwprotocol.org/why-measure/food-loss-and-waste-value-calculator/). Somlai pointed out that the calculator complements the FLW Standard as it enables the user to describe and convey the scale and relevance of FLW in terms other than weight. This information can be used to show how FLW reduction efforts provide nutritional and environmental value. It also eases understanding the impacts related to FLW of different types of food. The retailer in the study can also use this value calculator when considering which FLW streams to prioritize. A gap noted using the FLW Standard was not being able to compare the environmental and nutritional impact of various actions aimed at reducing FLW.

- Relationship with FLW collectors

  In this study FLW destination records from waste collectors were collected manually. This is not preferable, because for complete FLW quantification a retailer should have consistent records on where their waste collectors send the waste. It is recommended that an interactive system is set up whereby the destinations of FLW waste collectors make use of can be inputted. This database can then be constantly updated if FLW destinations change. The spoilage factor calculated in Table 3 and the destination splits found in Table 1 will then have an even greater level of accuracy. Retailers have a responsibility of knowing where their FLW ends up and it is becoming increasingly important for complete FLW reporting. A second relationship to improve on is that which the retailers have with the charities that collect the donated food. For the South African context, I would recommend working with an organisation such a Food Forward to streamline the food donation process. This is one of the largest food distribution organisations in the country

and are therefore very experienced with effectively linking community organisations to retail supply chains (https://foodforwardsa.org/). It is important to work with organisations that are equally committed to addressing FLW challenges.

- Control measures

  To bolster quantification efforts in the South African retail sector, there may be a requirement to bring in control measures to quantify FLW. These control measures could entail mandatory reporting of FLW amounts to peripheral organisations with a standardised follow-up procedure. At this stage in South Africa no company is obliged to measure their FLW. Currently the South African Voluntary Agreement does encourage retailers to report their FLW. They are doing a good job at helping to standardise quantification. An area that the South African voluntary agreement has already improved is the creation of a better information hub. This can be used by companies that measure their FLW to share best practices and learn from other companies. In the future more pressure should possibly be put on companies to take part in these initiatives and make use of tools such as the FLW Standard. Lastly, it is recommended that once a retailer has populated the FLW Standard's reporting template an independent FLW knowledge expert is pulled in to perform a third-party review. This is to ensure that bias or minor errors do not occur. This study's data was reviewed by a South Africa FLW accounting expert that has also worked alongside other stakeholders that are part of the South African FLW Voluntary Agreement.

5.5 Conclusion

This study sought to make a contribution to the knowledge gap pertaining to FLW quantification in the South African retail sector, with a specific focus on the appropriateness of the FLW Standard (World Resources Institution, 2016) and it's reporting template (FLW-Standard-Inventory-Reporting-Template_June-2016_update.xlsm (live.com)). The ability of the retailer to for the first time accurately achieve total tonnage of FLW by destination supports that the FLW standard and its complementary reporting template as an appropriate means of quantifying FLW for the South African retail sector.

It was found that the FLW Standard provides an adequate framework for retailers to guide the collection and analyses of FLW data. This form of quantification helps lay the groundwork for delivering company FLW policies and implementing systems to minimise the gap between target setting and actionable delivery. The retailer in this study originally implemented the use of the FLW Standard due to an encouragement to do so by the South African FLW Voluntary Agreement. Prior to the study, the retailer's standard way of reporting FLW was in monetary value. After this preliminary three-month baseline period of reporting FLW using the reporting template, accurate

FLW results in tonnage by destination was achieved. The retailer went on to capture data in accordance with the FLW Standard for a second baseline period. This is a testament to the appropriateness of the FLW Standard's reporting template for South African grocery retailers.

Adhering to a quantification guide such as the FLW Standard is essential for any retailer to set and reach FLW reduction targets because the standard provides guidance on what to measure and how to measure it. The reporting template was designed by a convergence of academic and industry groups and reviewed by WRAP and the CGCSA to be applicable to the South African context. Retailers using it overcome the challenge of navigating the variation in FLW quantification techniques and definitions. The FLW Standard's reporting template was found to be a suitable tool because it guided the retailer in the case study to implement measurement best practices. It was also found to be flexible enough to accommodate retailers that do not yet have perfect FLW data capture systems in place. The FLW Standard gives retailers the freedom to establish the scope of the FLW inventory they aim to capture while simultaneously adhering to standardised definitions and methodologies as guidance.

The quantification of FLW with the aim of improved data measurement and monitoring is only the first step to addressing retail FLW. The use of the FLW Standard is essentially a means to an end. Gathering accurate quantitative data helps paint the full picture of FLW so that initiatives can be appropriately implemented. Efforts focused on tackling the causes of FLW should be conducted in parallel. Tool plugins linking FLW tonnage to embedded resource statistics are a possible future addition that can be made to the FLW Standard. Food retailers should continue to actively engage researchers to partner with them in gathering scientific data to strengthen FLW quantification practices.

In the WWF's report on South Africa's food waste facts and future prospects (World Wide Fund for Nature South Africa, 2017), it was emphasised that there was a pressing need for a consolidated template for capturing and reporting FLW in South Africa. Looking back, it is positive to see that a relevant series of definitions has since been agreed upon and that one voluntary reporting agreement, the FLW Standard, is being used by many South African businesses. Different food chain actors meet at the retailer level. Retailers, therefore, have a large influence on suppliers as well as consumers. Accurate FLW quantification with the aim of developing an understanding of the issue, prioritising action, evaluating a solution, and monitoring targets will only become increasingly important in the coming years. Based on the success of the case study it can be concluded that the use of this FLW Standard and its reporting template will support South African retailers in their efforts to make progress against the SDG 12.3 target, which is intended to be achieved by a fast-approaching 2030.

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