Wholesale&Retail LEADERSHIP CHAIR

Cape Peninsula University of Technology

W&RSETA WHOLESALE AND RETAIL SETA
Skills Development for Economic Growth

"Collaboration opens the window to a world of opportunities."

Project 2: Waste Management Strategies and Practices in the Wholesale and Retail Sector in South Africa: Lessons from Global Best Practices

Lead Researcher: Prof. Lawrence Obokoh
Abiola Babatunde, Ehi Idoko, Princewill Okwoche, Dr Herbert Ntuli

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EXECUTIVE SUMMARY

The executive summary provides an advanced overview of the research conducted on sustainable waste management strategies within the Wholesale and Retail (W&R) sector, offering key insights and recommendations for stakeholders. The project aimed to address the pressing issue of waste generation in the W&R sector, particularly in South Africa (SA), by exploring current practices and identifying opportunities for improvement. This project adopted a qualitative research methodology, which included an extensive literature review, interviews with industry professionals, and a collaborative workshop to collect relevant data.

The research sought to understand the challenges and successes associated with sustainable waste management in the W&R sector. The data analysis process was conducted using NVivo and ATLAS.ti, software packages commonly employed in the systematic organisation and interpretation of qualitative data. Both tools allow researchers to code segments of text, audio, or video data based on themes, concepts, or categories. This coding process involves identifying patterns, similarities, and differences within the dataset. Once coded, the software facilitates data retrieval, comparison, and visualisation, enabling researchers to analyse and interpret the coded data to identify trends, insights, and relationships. Additionally, both NVivo and ATLAS.ti offer tools for qualitative data management, including memo writing, annotation, and linking, to support comprehensive and rigorous qualitative analysis.

Furthermore, NVivo and ATLAS.ti provide features for exploring relationships between codes and data segments, such as query functions and networks. Researchers can use these tools to generate reports, charts, and visualisations to communicate their findings effectively. Additionally, both software packages offer flexibility in data analysis, allowing researchers to iteratively refine their repurposing schemes and interpretations as they delve deeper into the data. Key findings from the study reveal the significant impact of waste generation on the environment, economy, and society, with factors such as overstocking, packaging waste, and consumer behaviour contributing to the problem. Insights from developed countries highlighted successful strategies such as supply chain optimisation, circular product design, and consumer education initiatives that could be adapted to the SA context.

Based on these findings, the project proposes a series of actionable recommendations for wholesalers and retailers, government agencies, and other stakeholders. These recommendations include investing in sustainable supply chains, redesigning packaging for end-of-life considerations, implementing in-store waste reduction measures, and prioritising education and training programmes. By adopting these

recommendations and fostering collaboration among stakeholders, the W&R sector in SA should mitigate waste generation, reduce environmental impact, and enhance long-term sustainability.

This executive summary serves as a guide for decision-makers and stakeholders seeking to drive positive change in waste management practices within the W&R sector. The findings from the concepts and case analysis review clearly highlight that the efficiency of waste management in the W&R sector is crucial for both environmental sustainability and financial viability. SA can refine its waste management strategies by drawing insights from global best practices. Currently, the country generates approximately millions of metric tonnes of waste annually from the W&R sector alone, with a significant portion ending up in landfills. Key strategies to manage waste include waste reduction through improved inventory management and packaging optimisation, which studies have shown can lead to a reduction of up to 30% in waste generation. The implementation of recycling programmes with separate bins for recyclable materials has been proven to increase recycling rates by as much as 50% in similar contexts. Composting organic waste from perishable goods presents a substantial opportunity, with estimates suggesting that up to 40% of waste in this sector is organic. Partnering with food banks for surplus food redistribution not only reduces waste but also addresses food insecurity, benefiting many stakeholders annually.

Advocating for an Extended Producer Responsibility (EPR) programme has proven successful in other regions, resulting in a decrease of up to 25% in overall product waste. Employee training on waste management and energy-efficient practices has been shown to increase employee engagement and efficiency by as much as 20%, leading to more effective waste management practices. Investment in energy-efficient technologies is not only environmentally beneficial but also financially prudent, with potential annual savings on energy costs. Monitoring waste metrics allows businesses to track their progress, with studies indicating that companies that monitor waste metrics are more likely to achieve their waste reduction goals. Collaboration among stakeholders, government entities, and local communities is essential for SA's W&R sector to contribute effectively to a circular economy. When working together, businesses can access resources and expertise, leading to more comprehensive and sustainable food waste management best practices. This collective approach not only mitigates ecological degradation but also optimises operational costs, guaranteeing the lasting sustainability of businesses and the broader ecosystem.

The proposed framework for sustainable food waste management strategies and practices in the SA W&R sector encompasses six key components. Firstly, closed-loop systems involve repurposing surplus food within the supply chain, addressing waste while combating food insecurity. Secondly, source reduction

strategies focusing on minimising waste generation through optimised inventory and expiry management should be prioritised. Thirdly, waste-to-energy initiatives to convert food waste into renewable energy, reducing landfill waste and greenhouse gas emissions, should be considered. Fourthly, collaborative partnerships that foster knowledge sharing and collective action among stakeholders are urgently needed in the W&R sector in SA. Fifthly, consumer waste management education and engagement initiatives to raise awareness and promote responsible consumption practices should be introduced. Lastly, policy and regulatory support to incentivise sustainable practices through supportive regulations and incentives should be implemented. By integrating these components, W&R businesses can develop holistic approaches to food waste management, contributing to environmental sustainability, social equity, and economic resilience.

Various opportunities emerge when sustainable waste management practices are implemented in the W&R sector. Firstly, policies enacted by international organisations and national governments, coupled with pressure from stakeholders such as consumers, are driving a shift towards repurposing sustainability. Secondly, financial incentives – such as cost reductions and revenue potential – play a significant role in motivating retailers to embrace and focus on green practices. Collaborative platforms for food waste management, such as the SA Alliance to End Plastic Waste and the SA Plastics Pact, offer retailers opportunities to collaborate with peers and stakeholders, working together towards common waste reduction goals. Lastly, education and awareness initiatives targeting both staff and consumers are instrumental in fostering a culture of waste reduction and recycling within the retail sector. By leveraging these drivers, retailers can effectively implement and sustain green initiatives, contributing to positive environmental outcomes and meeting the demands of increasingly eco-conscious consumers.

The project's key recommendations include the following:

Identify stakeholders who are involved in the waste management process in the W&R sector in SA.
In the waste management process within SA's W&R sector, several stakeholders play critical roles. Retailers and wholesalers are pivotal in waste generation, managing packaging waste, expired products, and damaged goods from their operations. Producers and manufacturers contribute by designing products with sustainability in mind, implementing eco-friendly packaging, and participating in recycling schemes. Waste management companies handle waste collection, transportation, sorting, and processing, ensuring compliance with environmental regulations. Recycling facilities play a vital role in recycling materials collected from the sector, thereby reducing the need for new resources. Government agencies establish waste management policies, issue permits, and enforce compliance with environmental laws. Non-governmental organisations (NGOs) may raise awareness and advocate for improved waste management practices. Lastly,

consumers influence waste management by making sustainable purchasing decisions, reducing packaging waste, and participating in recycling programmes. Collaborative engagement among these stakeholders is essential to implement effective waste management strategies that prioritise sustainability, environmental responsibility, and resource efficiency within the W&R sector.

Implement repurposed waste management strategies in SA's W&R sector.

Various waste management strategies are currently being implemented in the W&R sector in SA to tackle the challenges of waste food generation and disposal. These strategies encompass source reduction efforts, such as minimising packaging materials and optimising inventory management, alongside recycling programmes that target materials like cardboard, plastics, glass, and metals. Additionally, initiatives to reduce food waste through redistribution to charities, composting, and utilisation for animal feed are gaining traction. Some companies are also exploring waste-to-energy processes to convert organic waste into renewable energy sources. Moreover, EPR programmes are being advocated, holding manufacturers accountable for product lifecycle management. These strategies collectively aim to reduce waste generation, stimulate recycling, and lessen ecological impact, underscoring the importance of collaboration among stakeholders for effective implementation and long-term sustainability in waste management practices.

Identify board members and key stakeholders responsible for developing waste management strategies in SA's W&R sector.

In SA, the development of waste management strategies in the W&R sector is a shared responsibility among governmental bodies, industry associations, NGOs, and individual businesses. Government departments, such as the Department of Environment, Forestry, and Fisheries (DEFF) and municipal authorities, lead the formulation of policies, regulations, and guidelines, set waste reduction targets, and ensure compliance with environmental laws. Industry associations collaborate with government bodies to develop sector-specific strategies, promote best practices, and advocate for supportive policies. NGOs contribute through research, advocacy, and public education to raise awareness and push for policy reforms. Individual businesses play a crucial role in implementing waste management strategies tailored to their operations, including waste audits, recycling programmes, and innovative initiatives such as waste-to-energy projects. Through collaborative efforts, these stakeholders aim to prioritise sustainability, environmental protection, and resource efficiency in the W&R sector, fostering comprehensive waste management approaches in SA.

Teams and oversight committees are responsible for implementing and evaluating waste management strategies in SA's W&R sector.

The implementation of waste management strategies in SA's W&R sector involves a collective effort among various stakeholders. While government bodies, such as municipal authorities, oversee regulatory compliance and policy enforcement, individual businesses within the sector bear direct responsibility for executing these strategies. This entails integrating waste reduction measures, implementing recycling programmes, and exploring innovative solutions, such as waste-to-energy initiatives. Additionally, industry associations provide support and guidance to businesses, facilitating the implementation process. NGOs also play a role by raising awareness, providing resources, and fostering collaboration among stakeholders. Through coordinated action, these entities work together to ensure the effective implementation of waste management strategies, promoting sustainability and environmental responsibility in the W&R sector.

Refocus programmes to address the challenges faced by the W&R sector in SA regarding the development and implementation of waste management strategies on a quarterly basis.

The W&R sector in SA should refocus on programmes that address the core challenges in developing and implementing best practices and strategies for waste management. A significant stumbling block is the lack of awareness and understanding among stakeholders regarding the importance of waste management and sustainable practices. Limited financial resources and infrastructure also pose barriers, particularly for smaller businesses, hindering their ability to invest in waste management initiatives. Additionally, the complexities of regulations and compliance burdens present challenges for businesses navigating waste management laws. Inadequate collaboration and coordination among stakeholders further exacerbate these issues, hindering the development of cohesive strategies. Moreover, cultural and behavioural factors, such as consumer attitudes towards waste, contribute to the difficulty of implementing effective waste management practices. Addressing these challenges requires concerted efforts from the government, industry players, NGOs, and consumers to foster awareness, provide support, and streamline regulatory frameworks for sustainable waste management in the W&R sector.

The waste management systems support the *gap* between what is being developed and implemented in SA and what is being developed and implemented in the developed world.

The gap between what is being developed and implemented in SA compared to the developed world primarily lies in the level of infrastructure, resources, and regulatory frameworks available for waste management. In the developed world, countries have established advanced waste

management systems supported by robust infrastructure for collection, recycling, and disposal, along with comprehensive regulations and policies to govern waste practices. They often have greater access to technology, funding, and expertise, enabling the implementation of innovative solutions such as waste-to-energy projects and circular economy initiatives. Additionally, public awareness and participation in waste management are generally higher in developed countries, leading to more widespread adoption of sustainable practices. In contrast, SA faces challenges related to limited infrastructure, funding constraints, and regulatory gaps, which hinder the development and implementation of efficient waste management strategies. There is a need for increased investment, capacity building, and policy support to bridge this gap and align SA's waste management practices with global standards. Collaboration with international partners and the adoption of best practices from developed countries can also facilitate progress in closing this disparity.

Identify benefits of sustainable waste management practices

The ability to identify sustainable waste management practices provides environmental benefits by reducing pollution, conserving resources, and mitigating climate change through waste reduction, recycling, and composting. Economically, these practices lead to cost savings, revenue generation from recycled materials, and job creation in the waste management sector. Socially, they improve public health by minimising exposure to hazardous substances and fostering community engagement in waste reduction efforts. Equitable access to waste management services ensures that all members of society benefit from cleaner living environments. Overall, these practices offer a comprehensive approach to addressing environmental challenges while promoting economic growth and social cohesion, creating healthier, more resilient, and sustainable societies for future generations.

Stakeholders Waste Management Policy framework and strategies to assist the W&R sector in improving its environmental footprint and its profitability.

A Stakeholders Waste Management Policy Framework and strategies in the W&R sector offer dual benefits: enhancing environmental sustainability and profitability. These strategies include waste reduction, recycling, and composting, which minimise waste sent to landfills, conserve resources, and lower GHS emissions. Cost savings arise from optimised resource use, reduced disposal costs, and revenue generation from recycled materials. Moreover, adopting sustainable practices enhances brand reputation, attracts eco-conscious consumers, and drives sales. By complying with regulations and mitigating risks, businesses safeguard their operations while

demonstrating environmental stewardship. Integrating these strategies positions W&R businesses for long-term success, contributing to environmental conservation, social responsibility, and financial viability in a sustainable manner.

In conclusion, citizens play a pivotal role in advancing best practices for effective food waste management through various programmes, actions, and behaviours. By adopting strategies such as meal planning, portion control, and creative use of leftovers, individuals can significantly reduce food waste at the source. Donating surplus food to food banks, shelters, and community organisations not only addresses food insecurity but also diverts edible items from landfills, maximising their value.

Composting food scraps is another impactful step that reduces methane emissions while enriching soil health, promoting sustainable environmental practices. Citizens can further contribute by supporting local food recovery initiatives, whether through volunteering, donating, or facilitating the redistribution of surplus food for human consumption or animal feed, thus reducing waste on a community level.

Advocating for policy changes is equally essential, with citizens urging for food waste reduction targets, standardised date labelling, and other measures to streamline waste prevention across the supply chain. Additionally, raising awareness about the ecological, societal, and economic impacts of food waste through educational campaigns and community events fosters a culture of sustainability and shared responsibility.

By actively participating in these actions, citizens can play a significant role in mitigating food waste, preserving resources, reducing GHG emissions, and building more resilient and sustainable food systems.

DEFINITION OF KEY CONCEPTS

- Wholesale & Retail (W&R) sector: For this project, the W&R sector includes wholesalers and retailers that sell consumer goods, such as (but not limited to) food, clothing, and household items. This also includes e-commerce retailers.
- **Waste:** Refers to packaging and food waste generated within the W&R sector.
- **Sustainable waste management**: A systematic, environmentally responsible approach aimed at minimising waste generation, promoting recycling and resource recovery, and reducing the environmental impact of waste disposal. It also considers social and economic factors to ensure long-term sustainability.
- **Food loss**: Wastage of food occurring before it reaches retail shelves, including waste generated during production, processing, and transportation (Harvard, n.d.).
- **Food waste:** Refers to the loss of consumable food at the retail or consumption stage (Harvard, n.d.).
- **Global best practices:** A set of proven guidelines for preventing, handling, and disposing of waste, successfully implemented in developed countries, with evidence of their effectiveness.
- **Waste food management:** The process of handling, minimising, and properly disposing of food waste to reduce its ecological impact and maximise resource efficiency.
- **Waste food management strategy:** Aims to mitigate the ecological, social, and economic impacts of food waste, including greenhouse gas emissions, resource depletion, and food insecurity, while promoting sustainable practices throughout the food supply chain.
- **The food supply chain**: An interconnected system of activities involved in producing, processing, transporting, distributing, and supplying food products from their origin to consumers, encompassing the journey from farm to table.
- **Warehouse:** A commercial facility for storing goods and merchandise. It serves as a central location for inventory management, order fulfilment, and distribution activities within a supply chain or business operation.
- **Logistics:** The process of planning, implementing, and coordinating the movement and storage of goods, services, and information from their point of origin to their point of consumption. Logistics ensures efficient and timely delivery through coordination across various stages of the supply chain.
- **Waste reduction:** The process of minimising waste generation at its source to reduce the amount of waste entering the waste stream. Strategies include implementing efficient production processes, reducing packaging, reusing materials, and promoting responsible consumption. Waste

reduction conserves resources, minimises environmental pollution, and supports sustainable practices.

- **W&R:** An abbreviation for Wholesale and Retail, referring to the sector of the economy involved in the large-scale purchase and sale of goods for resale or consumption. This sector includes wholesalers who sell goods in bulk to retailers, who then sell them to consumers, playing a vital role in the distribution and supply chain.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

3Rs	Reduce, Re-use, Recycle
COVID-19	Coronavirus
CSE	Collaboration and Stakeholder Engagement
CSIR	Council for Scientific and Industrial Research
DEFF	Department of Environment, Forestry, and Fisheries
DHET	Department of Higher Education and Training
EC	European Commission
EPA	Environmental Protection Agency
EPR	Extended Producer Responsibility
ERP	Enterprise Resource Planning
ETWM	Education and Training in Waste Management
FAO	Food and Agricultural Organisation
FGD	Focus Group Discussion
FLW	Food Loss and Waste
FMI	Food Marketing Institute
FUSIONS	Food Use for Social Innovation by Optimising Waste Prevention Strategies
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GIPL	global intervention practices level
GMA	Grocery Manufacturers Association
HDPE	High-Density Polyethylene
HLPE	
IndWMPs	Industry Waste Management Plans
ISWM	Integrated Solid Waste Management
LCA	Life Cycle Assessment
LDPE	Low-Density Polyethylene
NEMWA	National Environmental Management: Waste Act
NGO	Non-Governmental Organisation
NRA	National Restaurant Association
NWMSS	National Waste Management Strategy

PET	Polyethylene Terephthalate
PP	Polypropylene
PS	Polystyrene
PVC	Polyvinyl Chloride
SA	South Africa
SDG	Sustainable Development Goal
UN	United Nations
UNEP	United Nations Environment Programme
UNICEF	United Nations Children's Fund
UK	United Kingdom
USDA-ERS	United States Department of Agriculture Economic Research Service
USEPA	United States Environmental Protection Agency
W&R	Wholesale and Retail
W&RSETA	Wholesale and Retail Sector Education and Training Authority
WCG	Western Cape Government
WFD	Waste Framework Directive
WFRA	Food Waste Reduction Alliance
WMI	Waste Management Infrastructure
WMM	Waste Management Model
WMSS	Waste Management Systems Support
WRAP	Waste and Resources Action Programme
WRI	World Resources Institute
WRS	Waste Reduction Strategies
ZECC	Zero Energy Cold Chamber

CHAPTER 1: INTRODUCTION TO THE RESEARCH STUDY – WASTE MANAGEMENT STRATEGIES AND PRACTICES IN THE W&R SECTOR

1.1. Introduction and Background

A substantial portion of the world's population suffers from insufficient food supply, with approximately 13% experiencing malnutrition (Raworth, 2018). Meanwhile, an estimated 30-50% of food is wasted globally throughout the supply chain and after consumption. Research suggests that redirecting just 10% of this wasted food could end global hunger (Raworth, 2018). Additionally, reducing food waste would prevent 8–10% of greenhouse gas emissions generated by decomposing food in landfills worldwide (United Nations [UN], 2022). Food waste has severe environmental and socio-economic consequences, making it a critical global issue. This urgency is reflected in the United Nations Sustainable Development Goal (SDG) to "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" by 2030 (UN, 2015). However, with Sub-Saharan Africa simultaneously reporting the highest levels of food loss and insecurity (UN, 2022), this challenge is particularly pertinent within African policy spaces.

Aligning with global efforts to reduce food waste, local policies are intensifying pressure on retailers to cut down their waste. For instance, the Western Cape Government (WCG) introduced a policy mandating a 50% reduction in organic waste sent to landfills by 2022, aiming for a 100% reduction by 2027 (WCG, 2021). This is part of a broader set of initiatives in South Africa to decrease landfill-bound waste, driven by the limited lifespan of landfills and the escalating challenges in managing them. Thus, there is increasing pressure on retailers to minimise waste generation and, where inevitable, redirect waste through recycling and reuse.

The COVID-19 pandemic has had varied effects on global economies and human behaviour, including household food waste patterns. Findings on this issue are mixed: some studies report improved food waste behaviours and intentions among households (Qian, Javadi & Hiramatsu, 2020; Iranmanesh et al., 2022), while others show an increase in food loss and waste (FLW) due to disruptions in eating habits caused by lockdown policies (Aldaco et al., 2020). In the retail sector, while initial household stockpiling may have temporarily reduced waste, income shocks from the pandemic likely led to increased waste for certain products (Ellison & Kalaitzandonakes, 2020). As lockdown restrictions eased, shifts in household demand also influenced waste generation within retail. The pandemic's disruption of food supply chains underscores the need for effective food waste management strategies in a post-COVID-19 context.

Although 75% of food waste in South Africa (SA) occurs before food reaches retail shelves, the retail industry still plays a significant role in waste reduction through its procurement, sorting, and store management practices (De Vries et al., 2017). This project explores waste management strategies and practices within SA's Wholesale and Retail (W&R) sector, integrating insights from global best practices to develop a guide for retailers aiming to achieve sustainable waste management.

1.2. Problem Statement

Approximately 10 million of the 31 million tonnes of food produced annually in SA is wasted, with one-fifth of the nation's water resources lost in the process (De Vries et al., 2017). The energy lost in the production of wasted food is estimated to amount to R1 billion annually (De Vries et al., 2017). For a country where 26% of households are hungry and an additional 28.3% are at risk of hunger, these figures are disheartening. The prevalence of food insecurity amidst abundance is troubling, to say the least.

Furthermore, the disposal of food in landfills generates methane and carbon dioxide, exacerbating climate change. As a result, both global and local policies aim to reduce food waste. In the retail sector, food waste primarily arises from overstocking and the expiration of produce (Ellison & Kalaitzandonakes, 2020). Therefore, the objective is to eliminate food surplus and, where not feasible, to alleviate food insecurity by diverting food that cannot be sold.

The SA retail sector significantly contributes to food waste generation, as illustrated in Figure further 1 below, being responsible for 20% of food waste. Through procurement policies, this sector can influence food waste in earlier stages of the value chain. Naidoo and Gasparatos (2018) identify economic benefits as the primary driver of corporate environmental sustainability among SA retailers. Consequently, given that food waste adversely impacts profitability and increases energy consumption, alongside the potential for enhanced profits due to a positive brand image from sustainable waste management, retailers are keen to adopt food waste minimisation strategies. The goal is to reduce food surplus and, where it exists, to mitigate food insecurity.

The COVID-19 pandemic exerted a significant influence on supply chains, consumer incomes, and the hospitality industry, among others. The lockdown resulted in supply chain disruptions, the temporary closure of restaurants, and the uncertainty surrounding the impact of the disease prompted panic-buying among SA consumers (Njomane & Telukdarie, 2022). Collectively, these factors led to an initial increase in demand within retail stores, resulting in shortages and, by extension, reduced waste (Omoruyi, Dakora & Oluwagbemi, 2022). However, as lockdown measures were eased, consumer demand behaviour also

changed. The global relaxation of lockdown restrictions consequently led to adjustments within supply chains. From the perspective of retailers, while some lockdown-related realities may have altered (such as household stockpiling behaviour), certain impacts of COVID-19 may have persisted, including diminished demand stemming from income shocks and heightened health consciousness among consumers, which has led to shifting preferences. It is therefore imperative to investigate current practices aimed at ensuring sustainable waste management in a post-COVID-19 environment.

Furthermore, the SA economy has been adversely affected by the power crisis resulting from issues with the national provider, Eskom. Increased load-shedding in SA post-COVID has exacerbated food waste due to failures in the cold chain, as freezers are unable to operate optimally during power outages. Consequently, food perishes before its sell-by date, and retailers encounter difficulties in storing bulk purchases until they are sold due to limited refrigeration capacity when generators are in use. This situation intensifies the food waste crisis and underscores the need to comprehend current practices and offer guidelines based on global best practices that can enhance waste management within the retail sector.

1.3. Rationale and Significance of the Project

Significance refers to the importance of a project, including its potential to add to the body of knowledge. While previous studies have investigated household waste management behaviour during and after lockdown (Njomane & Telukdarie, 2022) and supply chain factors affecting retailers in a post-COVID-19 world (Omoruyi et al., 2022), there is a research gap regarding food waste management strategies within the retail sector in a post-COVID-19 context. This gap is particularly relevant in SA, where frequent power failures worsen the food waste crisis, making this study especially pertinent.

Furthermore, studies show significant potential for North-South knowledge transfer in solid waste management (Asevedo, Scavarda, Caiado & Fuss, 2021; Mmereki, Baldwin & Li, 2016). There is potential for improvement in waste management strategies and outcomes through the adoption of global best practices. This project aimed to create guidelines for sustainable waste management among SA retailers based on these practices. Additionally, the recommendations were adapted to suit the nuances of the SA context, incorporating feedback from key industry stakeholders throughout the project.

1.4. Aim and Objectives of the Project

Aim

This project aims to explore waste management strategies and practices within SA's W&R Sector, integrating insights from global best practices to develop a comprehensive guide for retailers to achieve sustainable waste management in a post-COVID-19 world.

Objectives

The objectives of this project are to:

- Establish the current state of food wastage and loss in the W&R sector in SA.
- Conduct an exploratory project on sustainable waste management strategies and practices that are being implemented in developed countries such as the United States of America (USA), Canada, Germany, the United Kingdom (UK), and Australia.
- Identify and recommend sustainable waste management strategies and practices that the SA W&R sector could potentially adopt in a post-COVID-19 environment.

1.4.1. Research questions

- What is the current state of food wastage and loss in the SA W&R sector?
- What sustainable waste management strategies are being implemented in developed countries?
- What lessons from global best practices can be adopted in the SA W&R sector in a post-COVID-19 environment?

1.5. Conceptual and Theoretical Framework

Several conceptual and theoretical frameworks can inform the development of waste management strategies in the W&R sector. Below, we provide an overview of these frameworks, each offering a foundation for designing effective waste management strategies:

- **Circular Economy:** The circular economy framework emphasises a shift from the traditional "take-make-dispose" model to a regenerative system. It promotes the continuous use and circulation of resources through waste prevention, product reuse, recycling, and resource recovery. Applying circular economy principles within the W&R sectors can help minimise waste generation, optimise material flows, and support sustainable consumption and production patterns.
- **Life Cycle Assessment (LCA)**: LCA is a tool used to evaluate the environmental impacts of a product or service across its entire life cycle, from raw material extraction to disposal. By

analysing the ecological implications at each stage, LCA can inform waste management strategies in the W&R sectors. It can help identify hotspots in the life cycle where waste is generated and guide efforts to reduce waste through design improvements, packaging optimisation, and supply chain optimisation.

- **Extended Producer Responsibility (EPR)**: EPR is a strategic framework that places the obligation for managing a product's waste on the producers rather than solely on consumers or local authorities. It encourages producers to take responsibility for the entire life cycle of their products, including waste management. Implementing EPR in the W&R sectors can incentivise product design for recyclability, promote take-back and recycling programmes, and drive the adoption of sustainable packaging practices.
- **Social and Behavioural Theories**: Social and behavioural theories can provide insights into the motivations and behaviours of individuals, businesses, and communities in waste management practices. For example, the *theory of planned behaviour* explores the influence of attitudes, subjective norms, and perceived behavioural control on waste management decisions. These theories can inform strategies to promote behaviour change, foster waste reduction practices, and encourage participation in recycling and waste diversion initiatives.
- **Stakeholder Theory**: Stakeholder theory emphasises the importance of engaging and considering the interests of various stakeholders in decision-making processes. In the context of waste management in the W&R sector, stakeholders may include suppliers, customers, employees, local communities, waste management service providers, and regulatory authorities. Stakeholder theory can guide strategies that foster collaboration, communication, and shared responsibility among stakeholders, leading to more effective waste management practices.

These frameworks provide a conceptual and theoretical foundation for developing waste management strategies in the W&R sectors. They offer guidance on sustainability principles, environmental assessments, producer responsibility, behavioural change, and stakeholder engagement. When applying these frameworks, it is imperative to consider the specific context, local regulations, and industry practices to ensure effective and tailored waste management strategies.

1.6. Literature Review

Waste management in the W&R sector is crucial for reducing environmental impact, promoting sustainability, and improving overall operational efficiency. Various best practices have emerged globally, offering valuable lessons for waste management strategies. The literature on waste management practices is divided into five segments based on the stakeholder inputs and waste management strategies:

1.6.1. Waste reduction and prevention strategies

Waste reduction and prevention are the first aspects of waste management to consider in this project. Studies have shown that efforts to minimising waste generation at the source is an efficient way of addressing waste management challenges (Minelgaitė & Liobikienė, 2019; Khan, Havukainen & Horttanainen, 2020; Ram, Kumar & Rani 2021; Mbadugha, Osumba & Shakantu, 2021; Srivastava, Rajak, Ilyas, Kim & Pathak, 2022; Lu, Shou, Wang, Jackson & Kempes, 2022; Harbiankova & Kalinowski, 2023; Tauš, Šimková, Cehlár, Krajnáková & Drosda, 2023). Waste minimisation is attainable by optimising inventory management, reducing packaging materials, and promoting sustainable product design (Mbadugha et al, 2021; Srivastava et. al, 2022; Lu et. al, 2022; Harbiankova & Kalinowski, 2023).

1.6.2. Recycling and resource recovery

Another strategy widely adopted by most developed countries and some developing countries with well-established waste infrastructure is recycling and resource recovery. Implementing effective recycling programmes is essential for diverting waste from landfills (Antoni & Marsetti, 2019; Kooner et al., 2020; Almeida, Sousa & Campos, 2021; Domenech & Borrion, 2022; Pitak, Denafas, Baltušnikas, Praspaliauskas & Lukošiūtė, 2023; Đurić, Serjun, Mladenovič, Pranjić, Milačič & Ščančar, 2023). Establishing collection systems for materials such as paper, cardboard, plastics, and metals facilitates recycling and resource recovery (Almeida et al., 2021; Domenech & Borrion, 2022; Pitak et al., 2023). In developed countries, implementing such systems has been shown to increase recycling rates by 8–14% (Antoni & Marsetti, 2019) and reduce waste generation by over 4% (Antoni & Marsetti, 2019). Additionally, collaborating with local recycling facilities and waste management companies is essential to ensure proper disposal and processing across regions.

1.6.3. Food waste management strategies

The adoption of waste management strategies often depends on the type of waste. For example, food waste management can be unique and requires a different approach. The W&R sectors frequently deal with perishable goods, leading to significant food waste. Studies have revealed that implementing strategies to prevent food waste, such as improved inventory management, donation programmes, and composting, can help reduce environmental impact and support social responsibility (Audet & Brisebois, 2019; Rosenlund, Nyblom, Ekholm & Sörme, 2020; Guarnieri, Aguiar, Thomé & Watanabe, 2021; Oishi, 2022; Grīnberga-Sālīte & Svirbule, 2022; Mokrane, Buonocore, Capone & Franzese, 2023; Gao, Jia & Guo, 2023).

1.6.4. Adoption of reverse logistics and product returns

Studies have empirically demonstrated the effectiveness of managing product returns and reverse logistics in minimising waste streams (Neto & Correia, 2019; Pan, Xie & Feng, 2020; Chan, Man, Fang & Campbell, 2020; Flygansvær, Samuelsen & Støyle, 2021; Monnagaaratwe & Mathu, 2022; Pereira, Antunes & Barreto, 2023; Elrabay'a, Marchenko & Osetskyi, 2023). Adopting reverse logistics and product returns includes establishing efficient systems for product refurbishment, repair, or resale, which can reduce the need for disposal and contribute to a circular economy approach (Chan et al., 2020; Flygansvær et al., 2021; Monnagaaratwe & Mathu, 2022; Pereira et al., 2023.

1.6.5. Collaboration and stakeholder engagement

Collaboration and stakeholder engagement are crucial in addressing the waste crisis, as extensively documented in waste management literature (Ghosh, 2020; Bao, Lu & Hao, 2021; Roy, Berry, Orr & Dempster, 2022; Pattra, Thawng & Chaiwong, 2023). This research will incorporate a global perspective review of these aspects. Engaging stakeholders – including suppliers, customers, and local communities – is vital for effective waste management. Collaborative initiatives may involve sharing best practices, raising awareness, and promoting a culture of sustainability across the supply chain (Silva, Weins & Potinkara, 2019; Ghosh, 2020; Bao et al., 2021; Roy et al., 2022; Pattra et al., 2023). Another approach frequently cited in the literature for prioritising waste management strategies based on environmental impact is the waste management pyramid, also known as the waste hierarchy. This conceptual framework ranks waste management strategies in order of environmental preference, guiding decisions toward more sustainable practices. The waste management pyramid typically consists of levels from most to least preferred.

1.7. Research Paradigm, Approach, Design, and Data Collection Methods

1.7.1. Paradigm/philosophy

The research paradigm employed in this project is constructivist/interpretive, as it emphasises authenticity and trustworthiness in exploring nuanced perspectives within the context of waste management strategies in a specific industry. Unlike the positivist approach, which prioritises external validity and objectivity, the interpretive paradigm allows for the consideration of diverse viewpoints and nuances. This is particularly relevant in investigating industry-specific practices, where understanding the perspectives of stakeholders is essential. As highlighted by Park, Konge, and Artino (2020), positivism focuses on identifying causal relationships through quantitative methods, which may not suit the exploratory nature of this industry project.

Epistemologically, the project aligns with interpretivism, which views reality as constructed by social actors and their perceptions. Unlike positivism, which relies on observation and event regularities, interpretivism acknowledges the subjectivity of knowledge acquisition and values subjective understanding. Furthermore, the pragmatist perspective, incorporating elements of both interpretivism and positivism, is also considered. The framework guiding this project stems from ontological and epistemological assumptions. Ontologically, it recognises the existence of global best practices in waste management, which influence the potential for improvement in strategies and outcomes. Epistemologically, the project seeks to understand the requirements and factors influencing the implementation of these practices.

The interpretivist approach facilitates a subjective understanding of both technical and non-technical factors, allowing for a deeper exploration of the implementation process and the development of an enterprise technical architecture framework. Through qualitative data analysis and interpretation, the project aims to uncover insights into why and how certain waste management practices are adopted, contributing to the overarching goal of enhancing waste management strategies within the industry.

1.7.2. Research approach

The research design is qualitative, comprising both primary and secondary approaches. The secondary research included a review of the literature in the area and an analysis of research reports, databases, and online articles from key stakeholders within the sector. The primary research involved an electronic survey and a focus group discussion (FGD) with key stakeholders across the W&R sector, industry association representatives, and non-governmental organisations (NGOs).

1.7.3. Research design/strategy

This was a cross-sectional project involving participants from the W&R industry. Specifically, the secondary research provided an extensive exploratory study and literature review on sustainable waste management strategies and practices in the W&R sector in the developed world. A systematic literature review was conducted within the field of sustainable waste management in retail, utilising the Scopus database and Google Scholar to identify scientific studies, conference proceedings, and online articles outlining global best practices for minimising and preventing food waste in the retail industry. Studies were critically analysed through a meta-analysis, presenting evidence on the current state of literature in the field. The findings guided the development of recommendations for a technology-driven approach to waste management in a post-COVID-19 world.

On the other hand, the primary research investigated the implementation of technology-driven sustainable waste management solutions in SA's W&R sector. By surveying managers responsible for waste management in these stores, we gathered information on the state of food wastage and current waste management efforts within the industry. Additionally, the research reviewed proposed waste management guidelines to assess the suitability of identified global best practices in SA's W&R industry, accounting for contextual nuances. Following the survey, a focused analysis was conducted, identifying key patterns through a thematic analysis of the responses.

Furthermore, a FGD was held involving key stakeholders within the industry. This FGD served two purposes. First, it provided an overview of the current waste management practices in the industry. It examined the extent of implementation of sustainable practices aimed at minimising and avoiding food wastage from the perspective of stakeholders who oversee the activities within the industry. This complemented the self-reported waste management practices we obtained from the survey, and together, they provided an accurate indication of the current practices within the industry.

Second, the FGD provided valuable feedback on our recommendations based on global best practices identified in the literature review. The expertise of the participants allowed them to assess the potential effectiveness of these practices within the SA context, thereby strengthening our recommendations. Consequently, the research report was revised to incorporate their comments. Following the meeting, an amended draft was also shared with focus group members to confirm their agreement with the changes made based on their suggestions. Drawing on both primary and secondary research, we developed guidelines to support retailers in achieving sustainable waste management in a post-COVID-19 world.

1.7.4. Demarcation/delimitation of project

This research focused on SA. While the secondary research explored best practices in developed countries, the fieldwork was limited to the SA context. Global best practice guidelines were assessed for their suitability within SA before being recommended. Thus, the project's scope is specifically SA.

1.7.5. Research methods/processes

1.7.5.1. Population

The population for this project consists of wholesalers and retailers within SA. Although the total population size is unknown to the researcher and quite large, this project relied on the database compiled by the Wholesale and Retail Sector Education and Training Authority (W&RSETA). This database is

regarded as the largest and most accurate compilation of contacts within the sector and was therefore utilised for the study.

1.7.5.2. Data collection instruments

The research employed a standardised questionnaire and an interview guide. The standardised questionnaire gathered information from retail store managers regarding the extent of food waste and the implementation level of technology-driven sustainable waste management solutions in SA's W&R sector. The interview guide was used in the FGD with key industry stakeholders. This FGD served two purposes: first, it supplemented survey data on current waste management practices by providing insights from stakeholders overseeing industry activities; second, it offered feedback on our recommendations based on global best practices identified through systematic case reviews. The participants' expertise allowed them to assess the likely effectiveness of these practices within the SA context, thereby enhancing the robustness of our recommendations.

1.7.5.3. Data collection/fieldwork

The sample was accessed electronically to ensure a representative sample from across SA, as budgetary constraints made a physical survey impractical. Consequently, an electronic survey was administered, eliminating the need for fieldworkers. However, the FGD was conducted in person within the Cape Town area.

1.7.5.4. Data repurposing and analysis

Data repurposing and analysis in NVivo and ATLAS.ti involve a systematic process of organising and interpreting qualitative data. Both software tools enable researchers to code segments of text, audio, or video data based on generated themes, concepts, or categories. This repurposing process entails identifying patterns, similarities, and differences within the data set. Once coded, the software facilitates data retrieval, comparison, and visualisation, allowing researchers to analyse and interpret the coded data to identify trends, insights, and relationships.

Additionally, both NVivo and ATLAS.ti provide tools for qualitative data management, including memo writing, annotation, and linking, to support comprehensive and rigorous qualitative analysis. They also offer features for exploring relationships between codes and data segments, such as query functions and network analysis. Researchers can utilise these tools to generate reports, charts, and visualisations to communicate their findings effectively.

Moreover, both software packages offer flexibility in data analysis, enabling researchers to iteratively refine their repurposing schemes and interpretations as they delve deeper into the data. Overall, NVivo and ATLAS.ti serve as robust platforms for qualitative data analysis, empowering researchers to uncover rich insights and generate meaningful interpretations from their qualitative data sources.

1.7.6. Units of analysis

A 'unit' can be defined as "a single undivided entity or whole" (Chenail, 2012:266). In research, a project's 'unit of analysis' represents the entity to which the data is applied. Given the volume of data, it was essential to divide the analysis into distinct units. Based on the research objectives, which focus on developing a waste management framework, the most suitable units for analysis were logistics, systems, requirements, and governance. These units were further subdivided into two sections each. Table 1.1 illustrates the units of analysis for this project.

Table 1.1: Units of analysis

Technical	**Non-technical**
• Waste Management Infrastructure (WMI)	• WRS policy requirements
• Waste Management Systems Support (WMSS)	• WRS governance

1.7.7. Ethical consideration

Informed consent was obtained prior to participation, and participants were free to leave the survey at any time and for any reason (Lekše Godec & Prosen, 2023; Krishnan & Wahab, 2019; Mlambo, Silén & McGrath, 2021). We further ensured that the collected data were de-identified to remove any information that could easily be used to identify respondents before public distribution. Thus, responses were kept confidential and used anonymously solely for research purposes.

1.8. Chapter Outline

Chapter 1: Introduction

This chapter provides a detailed overview of the project background, research problem, and objectives, setting the tone for the rest of the report.

Chapter 2: Literature Review

This chapter establishes the context and policy framework of the project. It reviews global best practices and explores sustainable waste management practices currently implemented in SA.

Chapter 3: Case Project Analysis

This chapter examines the design of waste management strategies and best practices through structured analysis of specific waste management initiatives. It explores the intricacies, challenges, and outcomes of these initiatives in real-world settings.

Chapter 4: Methodology

This chapter outlines the research design, data collection instruments, and approach to data analysis.

Chapter 5: Results and Discussion

This chapter presents the findings from the survey and focus group discussions, examining their implications. It emphasises the challenges in waste management and institutional initiatives within the W&R sector.

Chapter 6: Recommendations

Based on global best practices and survey results, this chapter provides recommendations for retailers, government, and other stakeholders to enhance sustainable waste management.

Chapter 7: Conclusion

The final chapter summarises the research objectives and key findings, presents recommendations, and discusses the study's limitations. It also suggests areas for further research.

1.9. Research Plan

In Phase 1, the focus was on laying the groundwork for the waste management projects. This included conducting a thorough literature review on sustainable waste management in the W&R sector, developing research objectives and methodology, and obtaining ethical approval. Subsequently, data collection commenced through interviews with industry professionals, along with an exploratory project on waste management practices in developed countries. Workshops and focus groups were initiated to gather initial insights from stakeholders.

In Phase 2, the emphasis shifted towards synthesising and analysing waste management data metrics, followed by discussions of the findings, culminating in the development of a draft report with

recommendations. This phase also involved refining the report based on stakeholder feedback, preparing presentations for dissemination, and finalising the research report.

Phase 3 focused on disseminating research findings through various channels, such as conferences, workshops, and academic publications. Additionally, efforts were made to evaluate the impact of the waste management research output, engage in further collaboration opportunities, and develop training materials based on the findings. These phases concluded with the completion of administrative tasks and planning for knowledge mobilisation activities to ensure sustained impact beyond the project's completion.

1.10. Limitations of the Research

This research endeavor sought to provide comprehensive insights into sustainable waste management strategies and practices within SA's W&R sector. However, certain limitations warrant acknowledgement (Trein Meyer & Maggetti,, 2019; Mphoswa, 2023; Karia, 2021; European Investment Bank, 2023).

Firstly, the project was geographically focused on SA, which may limit the generalisability of its findings to regions with different socio-economic and cultural landscapes.

Secondly, the reliance on interviews and FGDs for data collection, despite rigorous participant selection and data triangulation, may introduce bias or subjectivity.

Thirdly, the dynamic nature of the W&R sector and the evolving landscape of sustainable waste management strategies and practices imply that the findings may have temporal limitations and may not capture emerging trends and developments in the field (Madrid-Guijarro & Duréndes, 2023; Dania Kehinde & Bala, 2007; Raulinajtys-Grzybek & Karwowski, 2021).

Fourthly, resource constraints and time limitations may have impacted the depth and breadth of the research, potentially leading to overlooked aspects, or missed opportunities for exploration.

Finally, while stakeholders from retail, policy, and waste management sectors were engaged, some perspectives may have been underrepresented, impacting the comprehensiveness of the analysis.

Acknowledging these limitations is essential for accurately interpreting the findings and guiding future research in this field.

1.11. Conclusion

The summary chapter encapsulates the key findings and insights derived from the research conducted on sustainable waste management strategies and practices within the W&R sector. It serves as a comprehensive overview of the entire project, highlighting the main objectives, methodologies, and outcomes.

Firstly, the summary outlines the research objectives, which aimed to assess the current state of waste management in the W&R sector, explore sustainable practices in developed countries, and provide recommendations for the SA context. It then discusses the methodologies employed, including an extensive literature review, interviews with industry professionals, and a collaborative workshop with stakeholders.

Next, the chapter delves into the main findings of the project. It emphasises the prevalence of waste generation in the W&R sector and identifies key drivers such as overstocking, expiration of produce, and consumer behaviour. The summary also highlights successful waste management strategies observed in developed countries, such as supply chain optimisation, circular product design, and consumer education initiatives.

Furthermore, the summary presents evidence-based recommendations tailored to the SA W&R sector. These recommendations encompass various areas, including supply chain management, packaging redesign, in-store waste reduction measures, and staff training programmes. The chapter accentuates the import of concerted efforts between retailers, government agencies, and other stakeholders in implementing these recommendations effectively.

Overall, the summary chapter offers a concise yet comprehensive overview of the research findings and offers valuable insights for stakeholders seeking to enhance sustainable waste management practices within the W&R sector in SA.

CHAPTER 2: LITERATURE REVIEW

2.1. Introduction

The literature on sustainable waste management strategies and practices encompasses various strategies aimed at addressing different aspects of waste generation and disposal within the W&R sector. Waste Reduction and Prevention Strategies focus on minimising waste generation through measures such as optimising inventory management, reducing packaging, and implementing sustainable procurement practices. Recycling and Resource Recovery strategies emphasise the importance of diverting waste from landfills by promoting recycling programmes, composting organic waste, and recovering resources from discarded materials. Food Waste Management Strategies target the significant issue of food wastage by implementing measures such as donation programmes, composting food scraps, and optimising food inventory management. The adoption of Reverse Logistics and Product Returns involves efficiently managing the return of products to the supply chain, thereby reducing waste and maximising resource utilisation. Collaboration and Stakeholder Engagement strategies highlight the importance of including all relevant stakeholders, such as suppliers, customers, and local communities, in waste management efforts to foster collective responsibility and achieve sustainable outcomes.

2.2. Framing the Context

Sustainable waste management in the W&R sectors is crucial for reducing adverse environmental impacts, promoting sustainability, and improving overall operational efficiency. Various best practices have emerged globally, offering valuable lessons for waste management strategies. The literature on waste management practices is divided into five segments based on stakeholder inputs and waste management strategies:

- Waste Reduction and Prevention Strategies
- Recycling and Resource Recovery
- Food Waste Management Strategies
- Adoption of Reverse Logistics and Product Returns
- Collaboration and Stakeholder Engagement

Naidoo and Gasparatos (2018) suggest that the primary influences behind retail companies' environmental sustainability efforts are the environmental regulations set by national and international organisations, as well as the pressure exerted by internal and external stakeholders, such as customers, senior management,

and the media, which can affect profit margins. The adoption of sustainable retail practices often results in decreased expenditures and enhanced income for the retailer (Parker et al., 2019) through:

- Increasing efficiencies along the product supply chain,
- Reducing unnecessary packaging and product waste,
- Reducing the use of electricity and other utilities, and
- Providing a new marketing avenue to attract consumers who are conscious about sustainability.

Furthermore, waste management practices can be summarised in the five points classified in the literature.

2.2.1 Waste reduction and prevention strategies

Waste reduction and prevention are the primary aspects of waste management to consider in this project. Studies have shown that efforts to minimise waste generation at the source are an effective approach to addressing waste management challenges (Minelgaitė & Liobikienė, 2019; Khan et al., 2020; Ram et al., 2021; Mbadugha et al., 2021; Srivastava et al., 2022; Lu et al., 2022; Harbiankova & Kalinowski, 2023; Tauš et al., 2023). Waste minimisation can be achieved by optimising inventory management, reducing packaging materials, and promoting sustainable product design (Mbadugha, Osumba & Shakantu, 2021; Srivastava et al., 2022; Lu et al., 2022; Harbiankova & Kalinowski, 2023).

2.2.2 Recycling and resource recovery

The next strategy adopted by most developed countries and some developing countries with well-developed waste infrastructure is recycling and resource recovery. Implementing effective recycling programmes is essential for diverting waste from landfills (Antoni & Marsetti, 2019; Kooner et al., 2020; Almeida et al., 2021; Domenech & Borrion, 2022; Pitak et al., 2023; Đurić et al., 2023). Establishing collection systems for materials such as paper, cardboard, plastics, and metals facilitates recycling and resource recovery (Almeida et al., 2021; Domenech & Borrion, 2022; Pitak et al., 2023). Setting up a collection system increases the availability of recyclable materials by 8–14% in developed countries (Antoni & Marsetti, 2019) and reduces waste generation by over 4% (Antoni & Marsetti, 2019). Other efforts adopted include collaboration with local recycling facilities and waste management companies, which is crucial for proper disposal and processing across countries.

2.2.3 Food waste management strategies

The adoption of waste management strategies often depends on the type of waste. For example, food waste management can be unique and requires a different approach. The wholesale and retail sectors frequently

deal with perishable goods, which leads to significant food waste. Studies have revealed that implementing strategies to prevent food waste – such as improved inventory management, donation programmes, and composting – can help reduce environmental impact and support social responsibility (Audet & Brisebois, 2019; Rosenlund et al., 2020; Guarnieri et al., 2021; Oishi, 2022; Grīnberga-Sālīte et al., 2022; Mokrane et al., 2023; Gao et al., 2023).

2.2.4 Adoption of reverse logistics and product returns

Studies have empirically demonstrated the effectiveness of managing product returns and reverse logistics in minimising waste streams (Neto & Correia, 2019; Pan et al., 2020; Chan et al., 2020; Flygansvær et al., 2021; Monnagaaratwe & Mathu, 2022; Pereira et al., 2023; Elrabay'a et al., 2023). Adopting reverse logistics and product returns include establishing efficient systems for product refurbishment, repair, or resale, which can reduce the need for disposal and contribute to a circular economy approach (Chan et al., 2020; Flygansvær, Samuelsen & Støyle, 2021; Monnagaaratwe & Mathu, 2022; Pereira, Antunes & Barreto, 2023).

2.2.5 Collaboration and stakeholder engagement

Finally, collaboration and stakeholder engagement are essential for addressing the waste crisis, as extensively documented in the waste management literature (Ghosh, 2020; Bao et al., 2021; Roy et al., 2022; Pattra et al., 2023). Engaging suppliers, customers, and local communities is crucial for effective waste management. Collaborative initiatives may include sharing best practices, raising awareness, and fostering a culture of sustainability throughout the supply chain (Silva et al, 2019; Ghosh, 2020; Bao et al., 2021; Roy et al., 2022; Pattra et al., 2023).

2.3 Waste Management Pyramid

An established approach in the literature for prioritising sustainable waste management strategies and practices is the waste management pyramid, or waste hierarchy (Dania et al., 2007; UN, 2022; Krishnan & Wahab, 2019; Andrianda, Chenyun & Yongmin, 2021). This conceptual framework ranks waste management strategies based on their environmental impact, providing a structured hierarchy to guide decision-making and encourage more sustainable practices. The waste management pyramid typically consists of levels ordered from most to least preferred. Figures 2.1 to 2.3 illustrate various forms and types of waste hierarchy pyramids.

Waste Management Pyramid

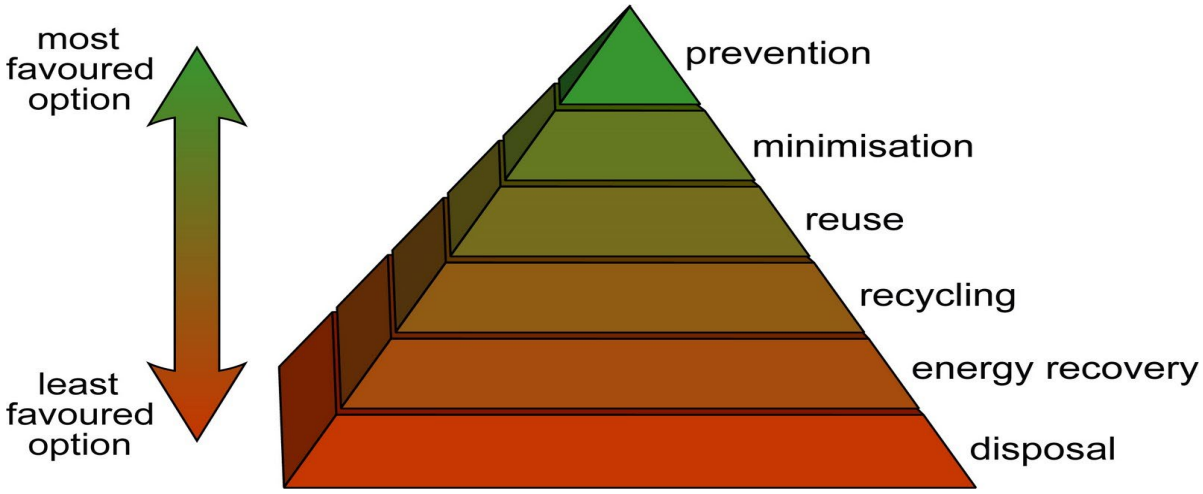

Figure 2. 1: Waste management pyramid

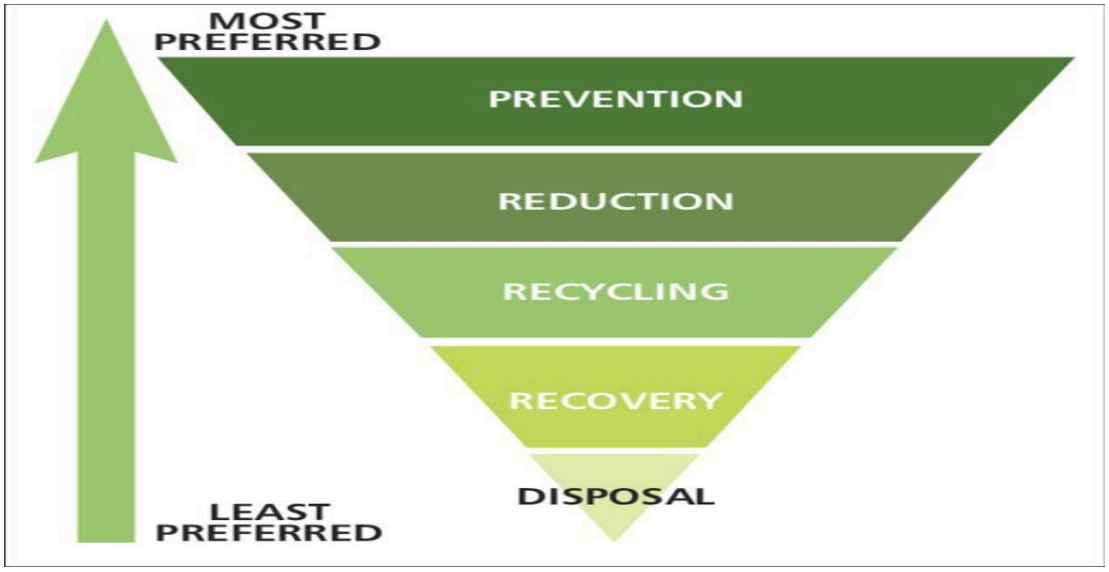

Figure 2. 2: Waste management pyramid

2.2.1 Historical development of waste management hierarchy

In the early 1970s, significant shifts in waste management practices emerged in Europe. Catalysed by the 1973 oil crisis and the 1972 Report to the Club of Rome, which highlighted an impending shortage of essential materials, society began re-evaluating how "waste" was perceived and managed (Kemp & van Lente, 2011). In 1979, Dutch politician Ad Lansink introduced a priority list – later known as "Lansink's Ladder" – which became official policy in 1981 (Raven, 2007). According to Kemp and van Lente (2011),

this hierarchy prioritises "waste prevention" first, followed by "reuse (of products)", "recycling (of materials)", "incineration (with energy production)", and finally, "landfilling".

"Lansink's Ladder" now serves as a foundational model for waste prevention frameworks widely integrated into modern waste management laws, programmes, initiatives, and strategies. According to their environmental effect, the current framework is a five-tier hierarchy of waste management and treatment solutions (UK Department of Energy and Climate Change and Defra, 2011). It offers guidelines for effective garbage collection and treatment, as well as waste management planning (Neubauer, 2007). This paradigm helps to clarify the potential effects of management techniques on materials throughout their lifespan (US Environmental Protection Agency [USEPA], 2009). However, the hierarchy is often adapted based on specific contexts, with various expert groups and organisations modifying its stages to broaden or narrow its focus – all with the overarching goal of waste avoidance.

The USEPA oversees the hierarchy in the country. The Resource Conservation and Recovery Act (Ue, 2019; Biswas, 2021), the main statute governing the nation's removal of solid and dangerous waste, governs how the EPA functions. In accordance with this law, the EPA encourages waste-reduction approaches such as trash avoidance, recycling, and composting. In terms of environmental preference, the agency has rated waste management alternatives from "source reduction" (including reuse) to "treatment and disposal", with "recycling", "composting", and "energy recovery" falling in between (Figure 2.3 (United States Environmental Protection Agency [USEPA], 2012b).

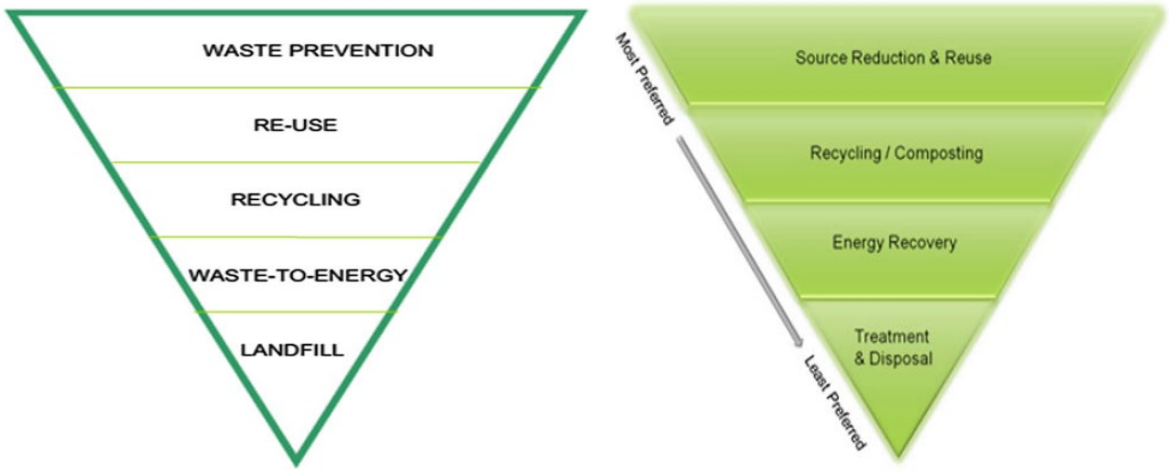

Figure 2.3: Waste management hierarchy

Source: (USEPA, 2012b; Filho & Kovaleva, 2015)

The diverse initiatives of the United Nations Environment Programme (UNEP) also aim to adhere to the waste management hierarchy outlined by the International Solid Waste Association (UNEP Division of Technology, Industry and Economics International Environmental Technology Centre, 2010). Described by the association as a crucial conceptual and political instrument for prioritisation, this hierarchy can assist in formulating waste management strategies aimed at reducing resource consumption and protecting the environment (ISWA, 2009; Filho & Kovaleva, 2015). Furthermore, the waste management hierarchy serves as a foundational principle for the Integrated Solid Waste Management (ISWM) strategy (Figure 2.3). This strategic framework is employed for managing various types of waste: prioritising waste prevention and reduction, facilitating segregation, promoting the principles of Reduce, Reuse, and Recycle (the 3Rs), ensuring secure waste transportation, and integrating treatment and disposal techniques with an emphasis on optimising resource utilisation efficiency (UNEP, 2011; Filho & Kovaleva, 2015). Aligned with the Thematic Strategy on Waste Prevention and Recycling (Commission of the European Communities Communication COM (2005) 666, 2005), the European Union's waste policy has increasingly prioritised waste prevention (Waste and Resources Action Programme [WRAP], 2012). The waste management hierarchy, along with its various stages (see Figure 2.3), is clearly outlined in the Waste Framework Directive (WFD).

2.3.1 Similarities and differences in the waste management hierarchies

All entities utilising the waste management hierarchy agree on the most and least desirable waste management alternatives. A primary emphasis within waste management is placed on "waste prevention, avoidance, and reduction" as foundational components (USEPA, 2012b; ISWA, 2009; UNEP, 2011; WRAP, 2012; Directive 2008/98/EC 2008). However, this level is defined differently by various institutions. According to the WFD, "prevention" refers to actions taken before a substance, material, or product becomes waste, with the objectives to:

- Reduce the quantity of waste, including through product reuse and the extension of product lifespan.
- Minimise the negative effects of generated waste on the environment and human health, and
- Decrease the presence of harmful substances in materials and products (Regulation 2008/98/EC, 2008).

The EPA's definition also places a strong emphasis on waste reduction techniques, including giving away goods, purchasing in bulk, and reducing packaging (USEPA, 2012b). The ISWM method simultaneously distinguishes between "prevention" and "reduction" stages (Figure 2.3) (UNEP, 2011). The outcomes from

this step are vital, as they promote resource preservation (WRAP, 2012). However, the difficulties of quantifying something that, by definition, never existed make this idea challenging to apply (European Commission [EC], 2010).

'Preparing for re-use' is the next step in the WFD hierarchy (Figure 2.3). The directive distinguishes between "re-use", which refers to any action where goods or components that are not waste are reused for the purpose they were designed for, and "preparing for re-use", which refers to recovery operations that check, clean, or repair products or components of products that have become waste and prepare them for reuse without any other pre-processing. In this regard, the WFD's waste management hierarchy differs significantly from other organisations' frameworks. While the ISWM approach's waste management hierarchy does not include "re-use" as a separate stage (Figure 2.3), the EPA integrates the "source reduction" and "re-use" phases (Figure 2.1) (UNEP, 2011).

According to Directive 2008/98/EC (2008), "recycling" is a set of processes that involves gathering recyclable items that would otherwise be regarded as garbage, sorting them, and reprocessing them into goods, materials, or substances for original or other purposes. The 'recycling' and 'composting' steps are merged in the EPA's version of the hierarchy (Figure 2.1). Additionally, the Agency considers the composting of food scraps, yard waste, and other organic items to be one of the alternatives to "recycling". The concept emphasises the crucial role that consumers play in completing the recycling process by purchasing items created from recycled materials (USEPA, 2012b).

'Energy recovery' from waste is the next stage in every version of the hierarchy. The USEPA (2012b) describes it as "the conversion of non-recyclable waste materials into usable heat, electricity, or fuel through various processes, including combustion, gasification, anaerobic digestion, and landfill gas recovery".

The WFD considers "energy recovery" as one rehabilitation option among several. According to this definition, recovery is "an operation primarily resulting in waste serving a useful purpose by replacing other materials which would otherwise have been utilised to fulfil a particular function, and waste being prepared to fulfil that function, within the plant or the broader economy". The Directive (2008/98/EC 2008) lists several recovery processes, including the recycling or reclamation of metals and metal compounds, acid or base regeneration, oil re-refining or other oil reuses, and land treatment that improves agricultural or ecological conditions.

All parties agree that the least desirable alternative is "disposal", which includes incineration and landfilling without energy recovery. 'Disposal' is defined by the WFD as "any operation which does not qualify for recovery, even if the operation's secondary consequence is the reclamation of substances or energy" (Directive 2008/98/EC, 2008). The EPA also considers the possible future uses of capped landfills as recreational areas, such as parks, golf courses, and ski slopes (USEPA 2012b; Filho & Kovaleva, 2015). Methane collection and its use as fuel to produce energy are also included in these options.

2.3.2 Waste management problems in developing countries

The inadequate waste management practices give rise to significant environmental hazards for the general population (Biswas, 2021; Ufua, Olujobi, Tahir, Abdulasis, Matthew & Osabuohien, 2022; Menon & Hartz-Karp, 2019). These hazards primarily stem from insufficient regulation and weak enforcement of waste policies. Various factors contributing to ineffective management practices prompt numerous federal and national entities to implement new infrastructure aimed at addressing the challenges associated with the handling and disposal of hazardous and unstable waste (McAllister, 2015).

Waste management practices encompass many managerial procedures that prioritise avoidance, waste reuse, recycling, and composting. The choice of waste management strategies depends on the economic and technical considerations associated with the specific type of waste being managed. The practices predominantly employed in developing nations include open burning, open dumping, and recycling (Rias, Iqbal & Jamil, 2023). These methods are unsustainable and unprofessional, exacerbating environmental issues related to improper waste management. They include various types of waste such as municipal solid waste, electronic waste, health waste, and industrial waste. The unprofessional handling of waste by waste pickers poses significant threats to the environment and human well-being.

However, it is worth noting that while certain advanced practices are being implemented in emerging nations, the least developed countries continue to face a deficit in technological advancements (Biswas, 2021; Ufua et al., 2022; Zhang, 2020). The economic growth of a nation serves as a prominent indicator of waste management techniques, while the behaviour of the population emerges as the primary determinant for achieving effective waste management practices (Ameen et al., 2023). This sub-section highlights the tactics that have been widely implemented by developing countries.

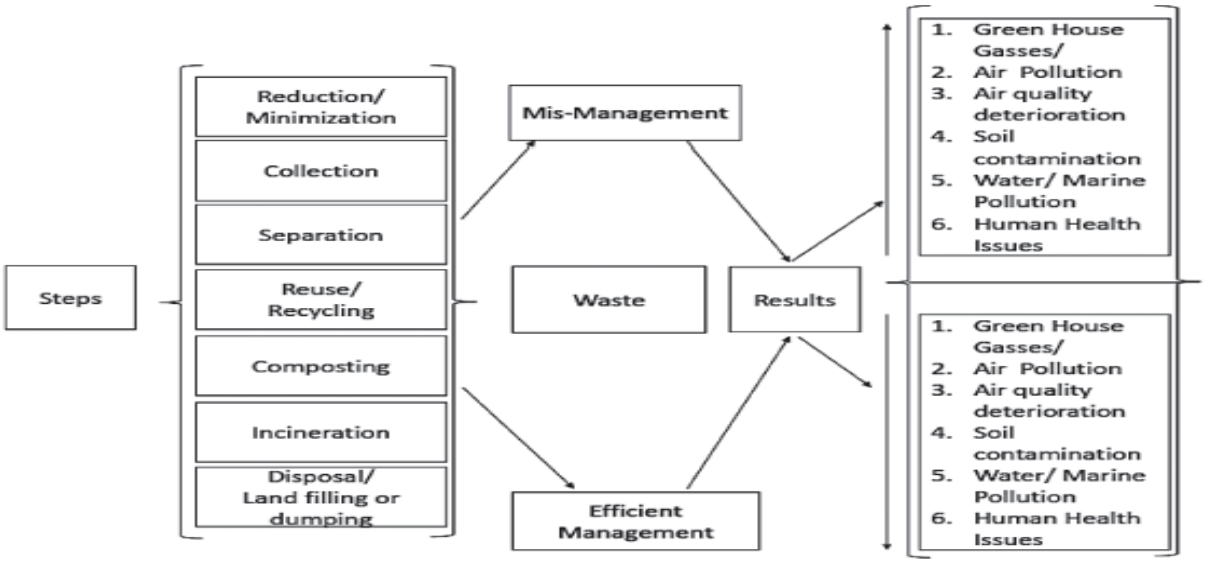

Figure 2. 4: Current scenario of waste production, management, mismanagement, and results on the global environment.

Source: Adapted from Ameen et al. (2023).

Figure 2.4 illustrates the current situation, depicting the different stages involved in the treatment and disposal of waste. The process encompasses several stages, namely reduction, collection, separation, recycling, composting, incineration, and disposal or dumping. Mismanagement at various stages contributes to the escalation of greenhouse gas emissions, air pollution, degradation of air quality, soil contamination, water pollution, and adverse impacts on human health. However, implementing effective solutions can lead to a significant reduction in these negative outcomes.

2.3.3 Types of waste produced in developing countries

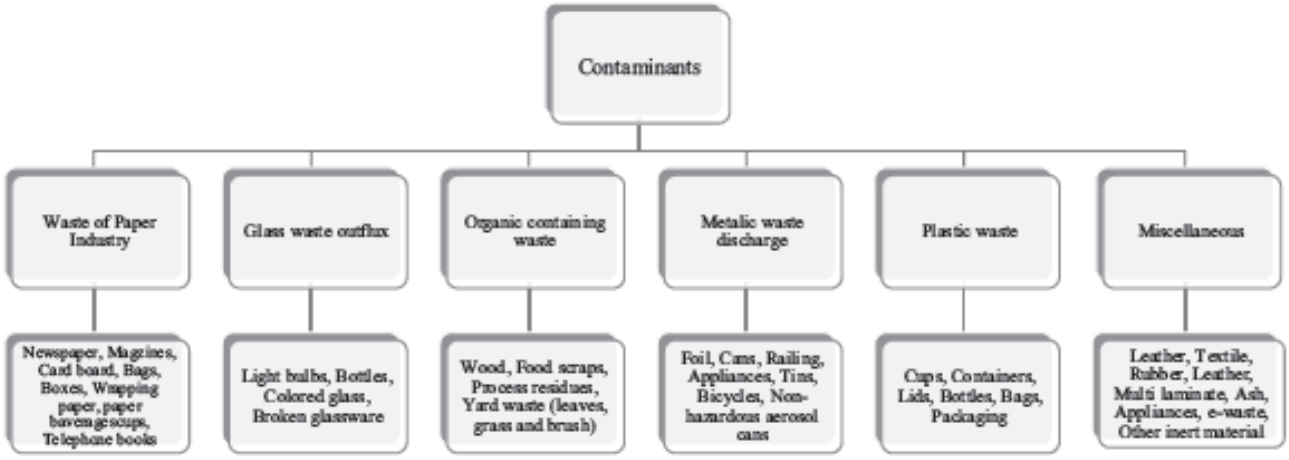

Figure 2. 5: Type of waste and their sources

Source: Adapted from Ameen et al. (2023).

In underdeveloped nations, the predominant method of garbage treatment involves either burning or open disposal, which gives rise to numerous environmental and health consequences (Ferronato et al., 2016). Waste treatment technologies, such as incineration and landfilling across various waste fractions, have been shown to harm soil, water, and air quality, resulting in widespread pollution. Waste recycling is often carried out informally to reduce the volume of garbage in water bodies and open dumps (Sasaki et al., 2014), though this practice poses considerable health and occupational risks (Singh, 2018; Gutberlet, 2013). Hazardous waste production is primarily observed in industrialised countries, while emerging countries typically produce mixed waste. In developing nations, the informal sector – marked by small, highly competitive, labor-intensive enterprises – has become a significant contributor to hazardous solid waste generation (Vaccari & Perteghella, 2016).

Table 2.1: The waste management through open burning / landfill burning and incineration in some developing countries.

Country	Description/impacts	Reference
Tanzania	60% of domestic waste is disposed by burning the waste daily	(90)
Lebanon	Based on recent data, there are 941 open dumps in the country, on an average once in a week, more than 150 of these dumps are openly burned	(91)
Mexico	In rural communities, 92% of waste is either disposed by uncontrolled burning in the backyards or dumped unofficially. In general, nearly 24% of municipal solid waste is subjected to open burning	(92)
India	The case study areas (10 metropolitan cities) generated 43% of total solid waste of India. No justifiable data is available regarding open burning of wastes but in case 20% of the MSW is burned, the emission of pollutants by it exceeds daily intake limit.	(93)
Palestine	Out of 133 MSW treatment sites in Westbank region, 116 sites operates through open dumping leading to open air burning	(94)
Ethopia	More than 22% of urban waste is imdiately treated with burning in all public areas	(95)
India	The daily mass of municipal solid waste burned is expected at 90-1170 kg/km^2day^{-1} and 13-1100 $kg/km^2 day^{-1}$	(96)
Pakistan	54,850 tons of compact waste is being produced daily in city areas, < 60% of this produced solid waste is being gathered accurately	(97)
Nigeria	The study concluded that about 54.2% solid waste generated is treated through open air burning	(98)
Nepal	Of 319 waste piles studied in the survey and t137 (i.e., 43%) waste heaps were observed to be dynamically burning in diverse ways of the city and sub-city area	(99)
Lebanon	Open burning is predominant outside Beirut and Mount Lebanon	(100)
SriLanka	Study found that, of the 76% of households without collection coverage, 69% burn all their plastic waste	(101)
Uganda	About 74.1% of uncollected waste being burnt openly.	(101)

Source: Ameen et al. (2023)

2.3.4 Augmentation of waste mismanagement in developing countries

More than half of the world's population now resides in urban areas (Biswas, 2021; Ufua et al., 2022; Zhang, 2020). The rise of megacities is a result of rapid urban development and global expansion, which is crucial for understanding urban complexities and developing effective management strategies (Singh, 2008; Rias et al., 2023).

The mismanagement of urban complexities is often driven by several factors. Key catalysts include population growth, rapid urbanisation and industrialisation, unsuitable public attitudes, and a lack of governmental interest, particularly regarding budget allocation. These factors exert pressure on urban development, leading to social fragmentation and the emergence of unnatural social dynamics. This rapid urbanisation can also result in inadequate infrastructure and improper management of urban complexities.

Waste mismanagement in megacities is directly linked to the failure of proper administration of these municipal developments (Figure 2.4.3). Therefore, it is crucial to examine the elements responsible for poor urban administration, which are also proportionately responsible for waste mismanagement (Matter, et al., 2015).

Waste management is a global concern, as noted by Hasan, Subhani, and Osman (2011). Mismanagement on a large scale leads to environmental pollution, social exclusion, and economic instability. Addressing this global issue requires comprehensive and integrated evaluations and strategies. However, it is essential to distinguish between the similar and differing factors that contribute to waste mismanagement in developed and developing nations. Certain factors prompting this issue require comparable approaches, whereas others are specific to developing countries, demanding a sustainable yet unique methodology, as highlighted by Triassi et al. (2015), Kötter (2004), and Rias et al. (2023). Various obstacles hindering waste management in urban and rural areas encompass social, financial, economic, technological, and governmental challenges.

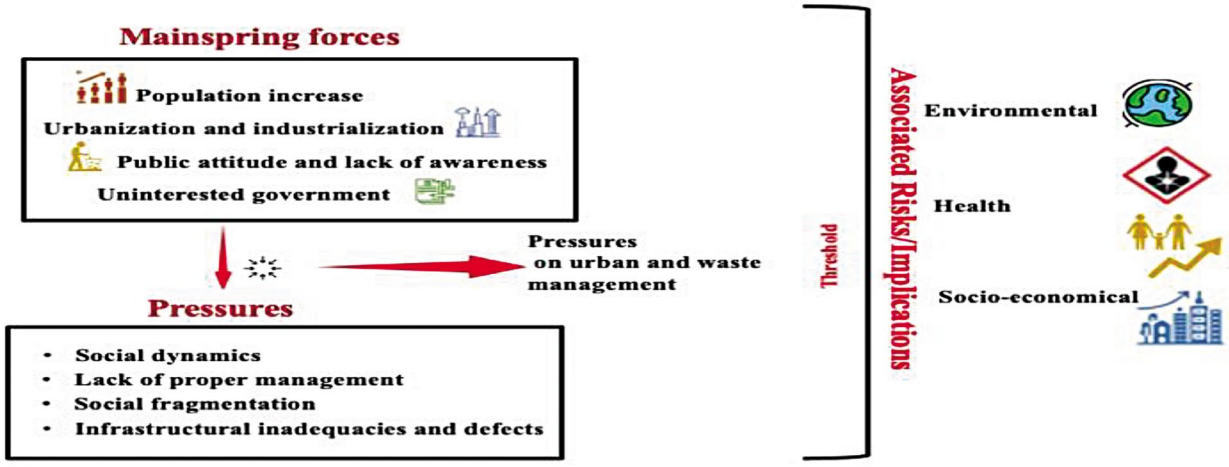

Figure 2. 6: Driving forces and pressures leading to poor waste management and risks associated.
Source: Ameen et al. (2023).

2.3.5 Factors affecting waste mismanagement

Improper waste management is a global issue requiring significant human intervention (Zhang, 2020). Without such efforts, there can be detrimental impacts on the environment, socio-economic conditions, and individuals' physical and mental health. Key contributing factors include the lack of advanced management technologies, insufficient government funding, poor enforcement of sanitation laws, gaps in policies and strategies, unfavorable public attitudes, and limited education and awareness (Ferronato, 2017;

Ramachandra et al., 2018; Factbook, 2013). These challenges can be organised into categories, as shown in Figure 2.7.

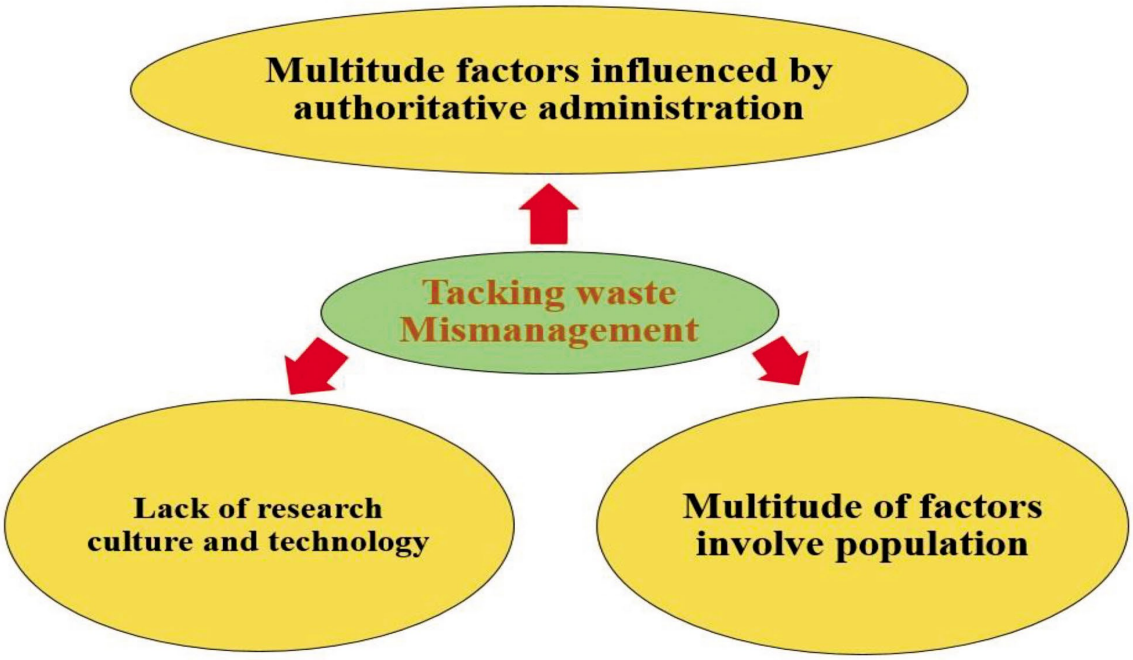

Figure 2. 7: The key areas to address the mismanagement of waste disposal in developing countries. Source: Ameen et al. (2023).

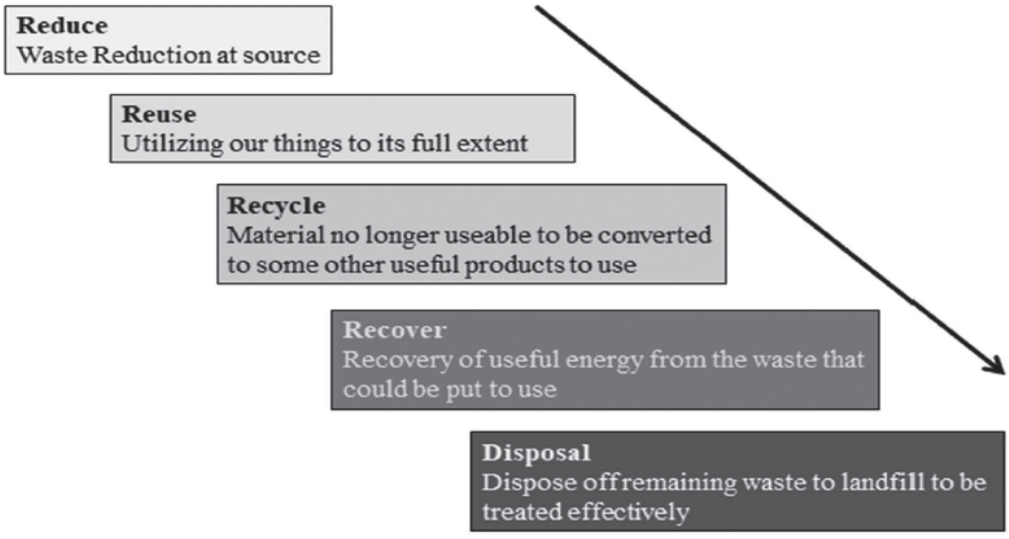

Figure 2. 8: Waste hierarchy

2.3.6 Rs to reduce waste generation

Developed countries have promoted waste diversion strategies since the 1990s with the catchphrase "*Reduce, Reuse, Recycle*," commonly known as the 3Rs (Scott, 2015). The first two Rs are prioritised from an environmental standpoint because they address waste-related issues through prevention. Minimisation and reuse techniques also save money, reduce the amount of waste that goes to landfill, are energy-efficient, and help to preserve the environment (Friedland et al., 2011).

2.3.6.1. Reduce

In this case, "*Reduce*" is the most desirable of the three approaches, as it combats the creation of waste. 'Waste minimisation' and 'waste prevention' are other terms for this. There are numerous techniques to reduce waste production. Source reduction is one strategy that aims to minimise waste by addressing it during the manufacturing process itself. As a result, source reduction maximises energy efficiency by producing fewer output materials and eliminating labour-intensive disposal procedures. Economic benefits also arise from using fewer resources. This strategy is effective for waste disposal at both individual and corporate levels (Dias-Farina et al., 2020).

In the W&R sector, managers can reduce waste by sourcing farm produce from local farmers and restocking only the necessary quantity of products. Ordering locally shortens transportation time, minimising potential damage in transit that can lead to waste. Additionally, by limiting stock to quantities likely to be sold by the sell-by date, waste can be further reduced. A second strategy is to design products that are easy to compost, repurpose, and repair. Third, introduce a fee for consumers who dispose of solid waste on public property, while offering free collection services for reusable and recyclable items. Fourth, adopt cradle-to-grave accountability laws, as seen in several industrialised nations, requiring manufacturers to reclaim various used products, including vehicles and electronic devices. Fifth, promote a shift from car usage to mass transit and bicycles for urban transportation (Gichamo & Gökçekuş, 2019).

2.3.6.2. Reuse

Instead of engaging in waste disposal, the concept of "*Reuse*" involves cleaning and utilising materials in a way that allows an object to undergo multiple cycles within a system for an extended duration. Implementing waste reduction strategies (WRS) results in lower pollution levels, minimised resource use, cost savings, and contributes to economic growth through the creation of employment opportunities. Producing new materials does not require additional energy or resources. One possible method of reusing a used letter envelope is writing new information over the existing content. In this context, the duration of the envelope's presence within the system is extended, while waste creation decreases. The act of reuse

often involves restoring a pre-existing material, which incurs costs in terms of monetary resources, time, labour, and energy consumption. When a disposable polystyrene cup is reused multiple times, the process includes cleaning the cup and generating wastewater, which incurs energy costs. Reuse is a prevalent and effective practice widely adopted in many developing nations (Ferronato et al., 2023). In northeastern Thailand, the government has constructed 19 Buddhist temples using a significant quantity of beer bottles. The use of vibrant recycled bottles enhances the aesthetic appeal of the temples while also allowing natural light to infiltrate the interior spaces. According to Lew (2020), the practice of repurposing bottle caps to create mosaic artwork has also been observed.

2.3.6.3. Recycling

Recycling is a process in which discarded waste items are systematically sorted and transformed into raw materials, which are subsequently utilised in the production of new goods. In impoverished nations, waste recycling is often undertaken informally as a means of survival. Various push factors, primarily economic, compel individuals from disadvantaged backgrounds to engage in rubbish-picking activities. Waste pickers represent vulnerable segments of society, including unemployed individuals, the disabled, recent migrants, women, children, and the elderly. These individuals reside in environments characterised by a lack of safety and cleanliness. Their typical work settings involve open dumps and streets, where they frequently come into contact with various forms of solid waste. This regular exposure to such materials presents significant health hazards. According to Lew (2020), the recycling rate for materials in poor countries is a mere 16% within the waste stream.

For instance, in the city of Lahore, an estimated 27% of garbage is informally recycled. Currently, there is a lack of functional waste disposal facilities that adhere to established recycling protocols. This urban area does not exemplify effective governance or efficient practices in waste management. Nevertheless, waste pickers collect discarded paper, which is then recycled by the pulp industry. In Indonesia, recycling is responsible for a reduction of around 10% in the overall quantity of waste generated. According to Dhokhikah and Trihadiningrum (2012), scavengers in Iran also play a crucial role in reducing solid waste.

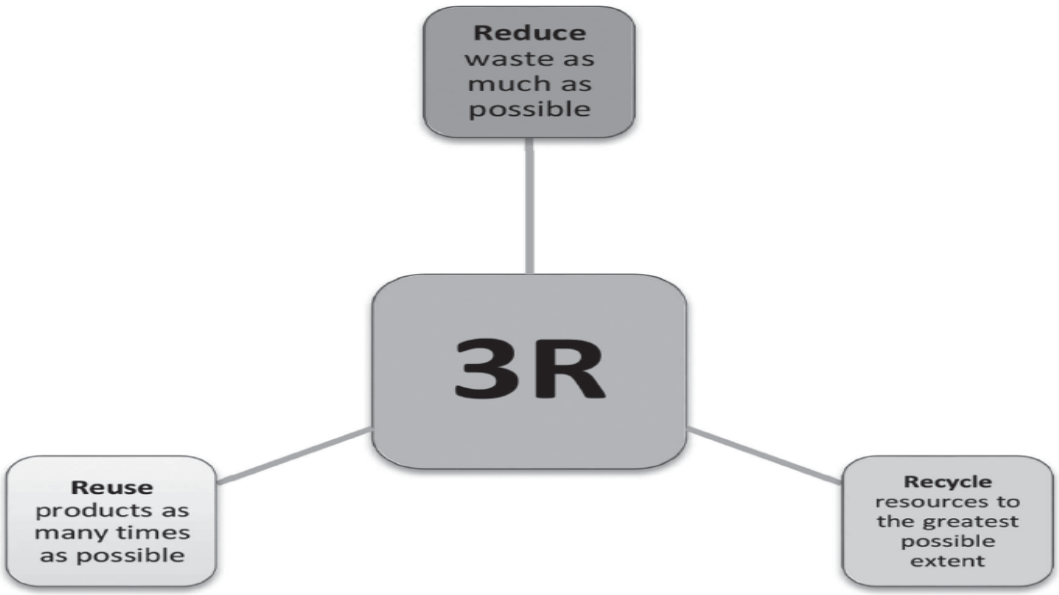

Figure 2. 9: The concept of 3Rs

2.3.7 Types, sources, and potential environmental impact of food loss and waste

In 2019, approximately 690 million people, or about 8.9% of the global population, were experiencing hunger (Arora & Mishra, 2022). The COVID-19 pandemic was expected to significantly exacerbate this issue, with an estimated additional 82–132 million people predicted to face malnutrition by the end of 2019 (Food and Agricultural Organisation [FAO] and United Nations Children's Fund [UNICEF], 2020).

Approximately one-third of the food produced globally for human consumption is either lost or wasted, which is a concerning statistic (Gustavsson et al., 2011). This FLW has significant negative impacts on the environment, economy, societal values, and public health (Abiad & Meho, 2018). Over 2 billion people worldwide are affected by micronutrient deficiencies (Serafini et al., 2015).

In 2019, 144 million children under the age of 5 were stunted, with over 90% of these children living in Asia and Africa (FAO and UNICEF, 2020). Given the crucial role of FLW in achieving sustainability and eradicating hunger, numerous governmental and non-governmental organisations, as well as academic institutions, have initiated research projects in recent years to quantify and address FLW across various countries. For instance, in 1997, the United States Department of Agriculture Economic Research Service (USDA-ERS) initiated the Loss-Adjusted Food Availability Data Series. This dataset comprises FLW data encompassing the volume, value, and caloric content of approximately 200 commodities from three distinct stages of the agri-food chain: from farm to retail, during retail, and at the final consumption stage.

In the UK, an entity known as the Waste and Resources Action Programme (WRAP) was established to reduce FLW. Since 2007, it has released a series of studies examining FLW across the agri-food chain (WRAP, 2008; 2009). The FAO has also issued several reports addressing global FLW (Gustavsson et al., 2011; Food, 2014).

The Food Use for Social Innovation by Optimising Waste Prevention Strategies (FUSIONS) project (2012–2016), funded by the EC Framework Programme 7, is committed to making Europe more resource-efficient by significantly minimising food waste through social innovations (Östergren et al., 2014; FUSIONS, 2016). In 2015, another EC-funded initiative known as Resource Efficient Food and Drink for the Entire Supply Chain (2015–2019) was launched, focusing on eradicating avoidable food waste and boosting food supply recovery. This project involved 26 partners from 12 European nations and China.

In 2016, the first global standard for measuring FLW was introduced through a collaborative effort by major international organisations, including the World Resources Institute (WRI), World Business Council for Sustainable Development, FAO, UNEP, and WRAP (Hanson et al., 2016).

In its 74th session last year, the United Nations General Assembly officially designated September 29 as International Day for the Awareness of FLW. Given that food waste constitutes a worldwide issue, multiple nations are addressing this concern across community, institutional, and scholarly spheres. However, the lack of a universally accepted definition for FLW and proper measurement techniques makes the management of FLW a challenging task.

2.4. Conceptualisation of Food Loss and Waste (FLW)

FLW can occur at various stages in the food supply chain, from farming to eventual consumption in households or the food service sector (cf. Figure 2.4.6). In underdeveloped countries, food is often lost during agricultural production and processing stages. In contrast, in more developed countries, food is primarily discarded – and significantly wasted – at later stages in the agri-food supply chain, even when it remains suitable for consumption (HLPE, 2014).

"*Food*" can be defined as any material, whether prepared, partially prepared, or uncooked, that is intended for human consumption (Sadler, Grassby, Hart, Raats, Sokolović & Timotijevic, 2021). The terms "food waste" and "food loss" refer to food that is not ingested. However, understanding the concept of FLW is complex due to the unclear interpretations of FLW in academic writings. This confusion arises from various terminologies (Schneider, 2013) such as food loss, biowaste, food waste, kitchen waste,

postharvest waste, and food and beverage waste. These varied terms are applied inconsistently by different authors. Several organisations have reported distinctions between food loss and food waste in the literature (FAO, 2011; Parfitt et al., 2010), but these terms are not consistently interpreted in relation to food loss and food waste.

The variation in definitions among multiple organisations is based on their unique objectives for measuring FLW. For instance, an organisation focused on improving food safety may define FLW as only including inedible components. Conversely, an organisation seeking to reduce greenhouse gas (GHG) emissions from a waste management perspective might include both edible and inedible parts in its FLW definition. The absence of universally accepted definitions for FLW complicates efforts to accurately quantify FLW, conduct broad research, and set policy objectives. Various organisations employ different FLW definitions, as shown in Table 10.1. The definitions of FLW used in this chapter (Figure 2.10) are those provided by HLPE (2014).

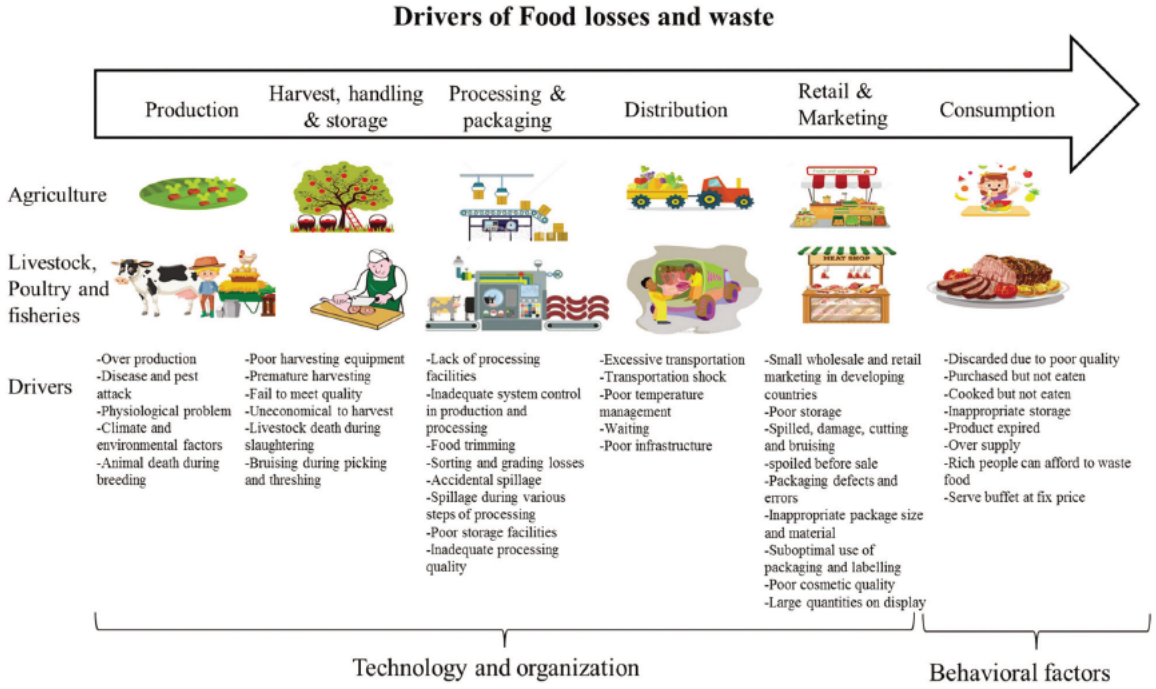

Figure 2. 10: Drivers of food losses and waste in the agri-food chain

These are identified as substances that were once edible and not typically regarded as inedible. Preventing such foods from becoming waste is generally achievable (Anon, n.d.). In the processing sector, avoidable food waste includes damaged stocks and unused food items. This type of wastage typically occurs due to factors like excessive buying, inadequate preparation, poor storage, and serving larger portions. Instances

of this include an apple or half a package of cheese, or even an entire tray of lasagna left untouched daily at a buffet. Other examples might be a slice of bread, leftover food on plates, pizza, coffee, meat, or an unpeeled banana.

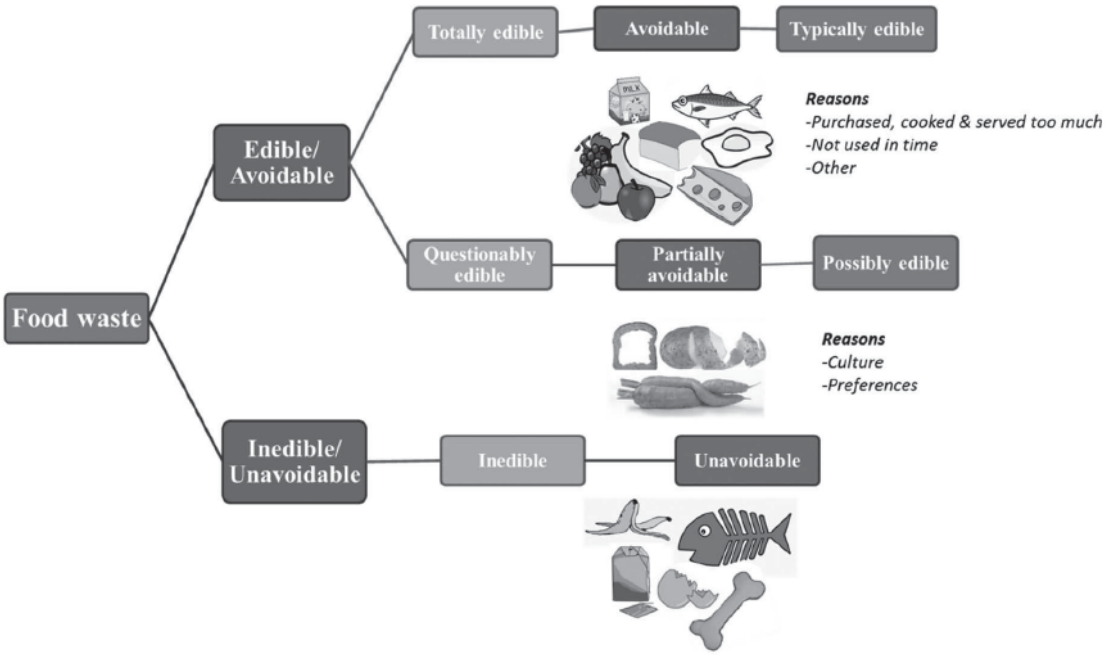

Figure 2. 11: Food waste types according to food edibility

2.4.1. Plastic waste: Sources, accumulation, and potential impacts

While plastic is a beneficial material that simplifies daily life, its waste is becoming a rapidly escalating global issue (Fidelity Services Group, 2021; EC, 2011; KfW Group, 2024). This problem is particularly pronounced in developing countries where plastic use is extremely high and waste management practices are inadequate. Its resistance to decomposition makes it a formidable environmental challenge (UN Environment, 2018). The seven main types of plastic materials commonly in use are:

- Low-density polyethylene (LDPE)
- Polystyrene (PS)
- Polyethylene terephthalate (PET)
- Polyvinyl chloride (PVC)
- Polypropylene (PP)
- High-density polyethylene (HDPE)

Plastic pollution primarily originates from six major sources, including (1) food wrappers and containers, which account for 31% of plastic waste pollution; (2) bottle and container caps, contributing 15.5%; (3) plastic bags, causing about 11.2% of pollution; (4) straws and stirrers, at 8.1%; (5) beverage bottles, responsible for 7.3% of pollution; and (6) takeout containers, contributing 6.3% of plastic pollution (Ameen et al., 2023).

Plastic waste can be categorised by size into macro, meso, and microplastics. Microplastics (plastic pieces ≤ 5 mm in size) result from the degradation of larger plastics or are used in abrasives such as cosmetics. These microplastics are considered more impactful and dangerous compared to macro or larger plastic waste (Ameen, et. al, 2023).

2.4.2. Plastic pollution

Plastic pollution refers to the introduction or accumulation of plastic waste items, such as bottles, bags, and containers (KfW Group, 2024; Anon, n.d.). It is considered one of the most significant challenges of our time, primarily due to the non-degradable nature of plastic. Currently, there is a significant focus on addressing plastic waste in the oceans. The existence of plastic waste was first reported about 50 years ago, in 1972 (Carpenter & Smith, 1972). Quantifying the extent of plastic waste is a complex task. Estimates suggest that countries like Norway and Switzerland generated around 24.9 megatons of plastic waste (Mudgal et al., 2011), though assigning it to specific sources is challenging. Estimating the amount of plastic waste in the oceans is even more difficult. Plastic pollution has numerous harmful effects on humans and other living organisms, both on land and in water systems, as the waste emits various toxic chemicals. In marine environments, one of the most reported impacts is wildlife entanglement in plastic debris. Other impacts include changes to ocean habitats and the introduction of invasive species via plastic waste.

2.4.3. Plastic pollution impact and side effects

Plastic has become an integral part of our lives, with our global dependence on it reaching unimaginable levels (Transnet, 2022). Its durability is a double-edged sword, making it both highly useful and simultaneously damaging. The indefinite lifespan of plastic, coupled with its degradation process, heightens concerns surrounding its usage. As a result, plastic is pervasive; it can be found in water bodies, soil, forests, and even within animals and humans. Plastic pollution is emerging as a pressing environmental issue, impacting all living species. Furthermore, the rapid surge in plastic production exacerbates climate change. Current estimates warn that if this trend persists, by 2050, plastic could emit

an enormous volume of GHGs into the atmosphere, potentially jeopardising our goal of limiting global warming to below 1.5 °C (Kühne, Bartsch, Tate, Higson & Habet, 2022).

2.4.4. Impact on marine environment

The consequences of plastic pollution on the marine environment are significant (Ramsundra & Mason, 2023; Biswas, 2021). Estimates suggest that around 10 million tonnes of waste are discarded into water bodies annually. It is generally believed that there are five large areas of consolidated plastic waste in the Pacific (both South and North), Atlantic (both South and North), and Indian Ocean; however, plastic waste is spread across the entire global marine ecosystem. The presence of microplastics in the aquatic environment is widely documented. As Obbard et al. (2014) reported, the concentration of microplastics in Arctic ice cores ranges from approximately 38 to 234 particles per cubic metre. Barnes et al. (2010) noted the presence of microplastics in Arctic and Antarctic surface waters. Lechner et al. (2014) found that a single river contributed more than 1,500 tonnes of microplastics to the Black Sea each year. Sruthy and Ramasamy (2017) examined Vembanad Lake in India, finding microplastics in sediment ranging from 96 to 496 particles per square metre. Furthermore, a project in Wuhan, China, showed that urban freshwater samples contained microplastics ranging from 1,660 to 8,925 pieces per cubic metre (Wang et al., 2017). In summary, plastic is pervasive in the aquatic environment.

Given the established prevalence of microplastics, there is concern that an increased abundance could lead to heightened bioavailability and, consequently, a greater likelihood of encounters and ingestion by animals. Floating plastic debris poses a constant threat to fish and birds, as they may mistake it for food or become tangled in it. Among various forms of plastic waste, packaging is particularly harmful to marine life. Estimates suggest that around 2,249 aquatic species have interacted harmfully with plastic waste. Marine animals not only ingest plastic debris but also consume toxic additives present within the plastic itself. According to the IUCN Red List of endangered species, out of 120 marine animals, 54 are known to have been entangled in plastic debris or to have ingested plastic waste (Plastic Atlas, 2019).

2.4.5. Impact on terrestrial environment

The effect of plastic pollution on the terrestrial environment is somewhat under-researched compared to its aquatic counterpart, even though plastic is distributed just as pervasively on land as it is in water bodies (Mokgalo, 2020; Biswas, 2021; Ugland, Anderson, Bevilacqua & Somerfield, 2022). Soil, a critical component of the terrestrial environment, is under significant stress due to plastic contamination. The prevalence of microplastics in soil disrupts the soil-water balance and subsequently impacts essential soil

functions such as water retention capacity, soil porosity, soil structure, and microbiota, all of which are integral to soil fertility (de Sousa Machado et al., 2018). According to scientists, studies on the damaging effects of plastic on terrestrial environments lag about ten years behind those focused on oceanic microplastics. In reality, plastic pollution in soils is estimated to be 4 to 23 times higher than in the marine environment. Studies have indicated that of the 400 million tonnes of plastic waste generated annually, one-third somehow ends up impacting the terrestrial environment (Plastic Atlas, 2019).

Sewage sludge, commonly used as fertiliser worldwide, is a primary source of microplastics depositing into soils, particularly agricultural fields, thereby adding hundreds of thousands of tonnes of microplastics. For example, in Portugal, 87% of sewage sludge is applied to agricultural lands either directly or through composting (Alvarenga et al., 2016). In Germany, after three years of sewage sludge application, sampled soils showed the presence of 5 tonnes of microplastics per hectare, which were dispersed by wind and detected in distant areas (Piehl et al., 2018). In Europe, sewage sludge contributes to a deposit of approximately 0.43–0.63 million tonnes of microplastics per year (Nissetto et al., 2016).

2.4.6. Impact on human health

The rising concern now revolves around the introduction of microplastics into the human food chain through the consumption of both land-based and marine food sources. These plastics can be ingested through food and drink, potentially leading to harmful health effects. Microplastic contamination has been found in tap water, with 83% of sampled cases showing contamination (Kosuth et al., 2017), and in bottled water, where 93% of examined samples revealed contamination (Mason et al., 2018). Based on estimates from the University of Newcastle, an individual might ingest about 5 grams of plastic per week, equivalent to the weight of a credit card. A project in Canada suggested that a person consuming bottled water might ingest around 130,000 microplastic particles annually, while someone drinking tap water might ingest approximately 4,000 particles. While these figures are alarming, the potential impacts on human health remain relatively unexplored (Plastic Atlas, 2019).

The most widely used plastic polymer, PET, is utilised in packaging, pipes, and plastic bottles, among other applications, and is considered a potential carcinogen (Li et al., 2016). Another study indicated that two other commonly used plastic polymers, PS and PVC, can cause reproductive abnormalities and cancer in rodents, invertebrates, and humans due to their toxic emissions (Wang et al., 2016). PS has also been shown to affect the cell structure and viability of human gastric epithelial cells (Forte et al., 2016). Multiple studies have demonstrated that inhalation of micro/nano-plastics can lead to serious human health issues (Rist et al., 2018; Chan et al., 2017). Several additives or chemicals, such as phthalates and bisphenol A,

are incorporated into plastics to achieve desired properties, and these added substances indeed pose potential risks to human health. Bisphenol A has attracted significant attention due to its disruptive effects on liver function, brain function, insulin resistance, the reproductive system, and foetal development (Srivastava & Godara, 2017; Galloway, 2015). Similarly, exposure to phthalates has been linked to birth defects and abnormal sexual development in humans (Cheng et al., 2013).

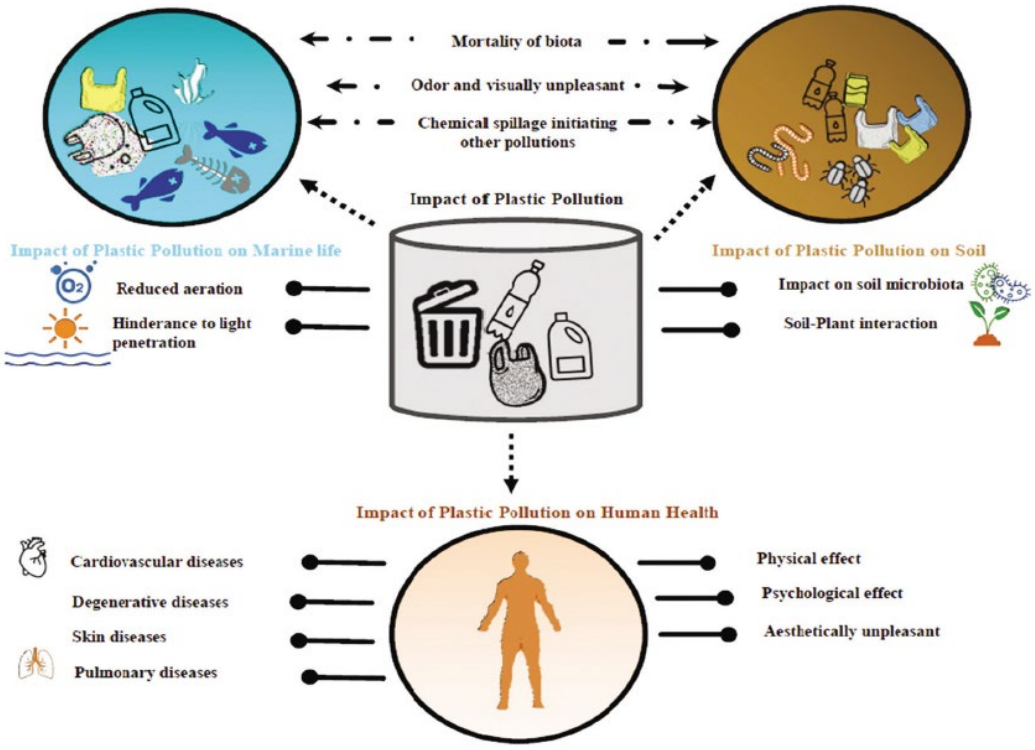

Figure 2. 12: Impact of plastic pollution on the ecosystem

Food waste in retail stores is primarily caused by the unpredictability of customer demand, in-store customer behaviour, management inefficiencies, and changing product quality standards (Teller, Holweg, Reiner & Kotsab, 2018). However, food waste has significant environmental, ethical, and profitability implications that store managers must consider when stocking perishable food products. Global best practices exist at various stages of the supply chain and in procurement and stock management within retail stores. Subsequent sections of this project will explore these global best practices and their applicability in the SA context in the post-COVID-19 technologically driven environment.

2.5. Conclusion

The literature review conducted for this project provided valuable insights into sustainable waste management strategies and practices within the W&R sector (Malgas & Sondi, 2021; Department of Higher Education and Training [DHET], 2013). It revealed a range of initiatives and approaches implemented in developed countries aimed at reducing waste generation, optimising resource use, and promoting environmental sustainability. Key findings highlighted the importance of collaborative efforts between retailers, government agencies, and other stakeholders to effectively address waste challenges. Additionally, the review identified various technological innovations and best practices, such as supply chain optimisation, waste tracking systems, and circular economy principles, as successful approaches to minimising waste and enhancing efficiency in the W&R sector. Furthermore, the literature emphasised the significance of consumer awareness and behaviour change in reducing food waste and promoting sustainable consumption patterns. Overall, the literature review underscored the critical role of sustainable waste management in mitigating environmental impacts, improving operational efficiency, and fostering long-term sustainability within the W&R sector. The project also recognised the global challenge posed by food waste, which significantly contributes to GHG emissions and adversely affects food security. It highlighted the importance of local and global initiatives in addressing this issue, including government policies and industry efforts. Moreover, the project emphasised the need for continued research and collaboration to develop efficient waste management strategies, particularly in light of the COVID-19 pandemic and its effects on waste generation and management practices.

CHAPTER 3: RESEARCH METHODOLOGY AND DESIGN

3.1. Introduction

Waste management methodology encompasses a systematic approach to handling, treating, and disposing of waste in an environmentally friendly and efficient manner. It involves processes such as waste generation and characterisation, waste minimisation, segregation and collection, recycling and resource recovery, composting and organic waste management, treatment and disposal, monitoring and compliance, and public awareness and education. By identifying sources of waste generation, categorising waste types, and implementing strategies to minimise waste – such as source reduction and product redesign – the overall volume of waste requiring management can be reduced. Segregation facilitates efficient collection and recycling, while composting organic waste diverts it from landfills and reduces methane emissions. Treatment methods like incineration or landfilling are employed for residual waste, with monitoring ensuring compliance with regulations and standards. Public awareness campaigns promote responsible waste management practices, fostering a culture of environmental stewardship. Overall, waste management methodology aims to minimise environmental impact, conserve resources, and protect public health through effective waste lifecycle management. Specific techniques may vary based on factors such as waste composition and regulatory requirements.

3.2. Philosophical Assumption

In qualitative waste management research, several philosophical assumptions underpin the approach taken to understanding and interpreting data. One primary philosophical assumption is interpretivism, which posits that reality is socially constructed and subjective, and that meaning is derived from individual experiences and perspectives. In the context of waste management, interpretivism allows researchers to explore the complex socio-cultural factors influencing waste generation, disposal practices, and perceptions of sustainability.

Another relevant philosophical assumption is constructivism, which emphasises the active role of individuals in constructing their understanding of the world. Within this paradigm, researchers recognise that participants' interpretations and meanings shape their attitudes and behaviours towards waste management practices. Additionally, critical realism is another philosophical assumption that may guide qualitative waste management research, emphasising the importance of understanding both the observable phenomena and the underlying causal mechanisms that influence waste management processes.

By embracing these philosophical assumptions, qualitative waste management research can provide nuanced insights into the socio-cultural, economic, and environmental dimensions of waste management practices, contributing to more holistic and sustainable solutions.

3.3. Methodology

This research approach aligned with the interpretive paradigm, emphasising authenticity and trustworthiness as essential for exploring the nuances of waste management strategies within SA's W&R sector. Unlike the positivist approach, which prioritises external validity and objectivity, the interpretive paradigm values individual perspectives, enabling a deeper understanding of complex phenomena within specific contexts (Aliyu, Bello, Kasim & Martin, 2014; Park et al., 2020). Therefore, the qualitative research method was deemed the most appropriate for this project, as it facilitated a holistic exploration of industry-specific practices and stakeholder perspectives. The research design entailed a cross-sectional project comprising both primary and secondary research approaches. Secondary research involved a systematic literature review of sustainable waste management strategies in the retail sector globally, drawing insights from scientific studies, conference proceedings, and online articles (Aliyu et al., 2014). This informed the primary research, which included an electronic survey and a FGD with key stakeholders in the SA W&R sector. The qualitative nature of the project allowed for an in-depth exploration of industry practices and stakeholder perceptions, aligning with the interpretive paradigm (Aliyu et al., 2014).

The project's population comprised wholesalers and retailers in South Africa, accessed via the database compiled by the W&RSETA (Aliyu et al., 2014). A stratified simple random sampling technique was used to select a representative sample of 13 participants from small, medium, and large enterprises within the sector (Aliyu et al., 2014).

Data collection instruments included a standardised questionnaire for the survey and an interview guide for the FGD (Aliyu et al., 2014). These instruments ensured consistency and reliability in data collection, allowing for a comprehensive analysis of waste management practices and stakeholder perspectives (Jagannathan et al., 2020; Low & Pain, 2022).

Data analysis involved thematic analysis of survey responses and FGDs, supplemented by a meta-analysis of literature findings (Aliyu et al., 2014). Qualitative data analysis software such as NVivo was used to manage and code the data, facilitating the identification of key themes and patterns (Aliyu et al., 2014). The qualitative nature of the analysis enabled a nuanced understanding of the research questions and objectives, aligning with the interpretive paradigm (Aliyu et al., 2014).

3.4. Research Approach

In the context of waste management strategy and global best practices, this research integrates deductive, inductive, and abductive reasoning methods. The qualitative research design includes both primary and secondary approaches. Secondary research involves reviewing existing literature, research reports, databases, and online articles from key stakeholders in the sector to gather insights into established waste management strategies and practices worldwide. This forms the basis of deductive reasoning, where existing theories and premises are assessed against collected data to confirm or refute hypotheses. On the other hand, primary research includes conducting an electronic survey and FGDs with key stakeholders across the W&R sector, industry associations, and NGOs. This primary approach aligns with an inductive reasoning method, commonly employed in qualitative research studies. Inductive reasoning involves formulating theories and propositions based on observations and patterns identified from the collected qualitative data. In this project, the inductive approach is utilised to develop a waste management enterprise, which serves as an untested theory derived from the subjective analysis of qualitative data.

Furthermore, the research integrates elements of the abductive approach, which combines deductive and inductive reasoning to refine or develop theories. This approach can modify or extend existing theories based on empirical observations and contextual constraints. The abductive approach aims to identify structures, connections, and contexts within the data, often leading to heuristic outcomes. Given its pragmatic nature, the abductive approach is well-suited for mixed methods research, which integrates both quantitative and qualitative methodologies. Therefore, the utilisation of these research approaches facilitates a comprehensive exploration and development of waste management strategies and practices within the wholesale and retail sector, considering both existing theories and empirical observations.

3.5. Research Design

Qualitative research design in waste management best practices involves systematically investigating qualitative data to comprehend the intricacies and contexts of waste management practices. The aim is to explore the social, cultural, economic, and environmental factors influencing waste generation, collection, treatment, and disposal. Key components include clearly defining research objectives to guide the inquiry, utilising various data collection methods, such as interviews and FGDs, to capture stakeholders' perspectives, employing purposeful sampling techniques to ensure diversity, conducting rigorous data analysis to identify themes and patterns, maintaining trustworthiness and rigour through techniques such as member checking and triangulation, upholding ethical considerations throughout the research process, and disseminating findings to stakeholders and policymakers. By adhering to this comprehensive qualitative research design, researchers can gain valuable insights to inform evidence-based decision-

making, contribute to the development of sustainable waste management strategies, and ultimately promote effective waste management practices.

3.6. The Objectives of the Project

The objectives of this project are to: (1) Assess the status of FLW within the W&R sector in SA. This involves examining the extent of FLW along the supply chain, from production to consumption, and understanding the factors contributing to this phenomenon within the SA context. (2) Conduct an exploratory investigation into sustainable waste management strategies and practices implemented in developed countries such as the USA, Canada, Germany, the UK, and Australia. This includes projecting the various approaches, policies, and initiatives adopted by these countries to manage waste effectively, particularly within the retail and wholesale sectors. By analysing these international practices, the project aims to extract valuable insights and lessons that could be applicable to the SA context. (3) Identify and propose sustainable waste management strategies and practices that the SA W&R sector could potentially adopt, especially in light of the COVID-19 pandemic. Considering the unique challenges posed by the pandemic, such as disruptions to supply chains and changes in consumer behaviour, the project seeks to recommend innovative and adaptable waste management solutions tailored to the post-COVID-19 environment. These recommendations aim to enhance the resilience and sustainability of the W&R sector in SA while also addressing broader environmental and social concerns related to waste management.

3.7. Data Collection/Fieldwork

Qualitative waste management data collection involves employing various methods to gather non-numerical information aimed at comprehensively understanding the intricacies of waste management practices. These methods include interviews with key stakeholders such as waste management officials and community members, FGDs to uncover collective attitudes, participant observation in waste management contexts to gain firsthand insights, document analysis of relevant reports and records, surveys with open-ended questions for broader perspectives, case studies to delve into specific initiatives, ethnographic research for deeper cultural and social insights, and visual methods like photography to capture perspectives visually. By utilising this array of qualitative data collection techniques, researchers can gain diverse perspectives, experiences, and contextual insights, thus facilitating a thorough comprehension of the multifaceted nature of waste management and contributing to the development of effective strategies in waste management practices. These documents are presented in Table 3.1 further below.

3.8. Data Analysis

The data analysis process was conducted using NVivo and ATLAS.ti, involving a systematic approach to organising and interpreting qualitative data. Both software tools enable researchers to code segments of text, audio, or video data based on themes, concepts, or categories (Fortbild et al., 2021; Kurniawan, 2021; Scheibelhofer, 2019; Jagannathan et al., 2020). This repurposing process involves identifying patterns, similarities, and differences within the data set. Once coded, the software facilitates data retrieval, comparison, and visualisation, enabling researchers to analyse and interpret the coded data to identify trends, insights, and relationships. Additionally, both NVivo and ATLAS.ti offer tools for qualitative data management, including memo writing, annotation, and linking, to support comprehensive and rigorous qualitative analysis. Furthermore, NVivo and ATLAS.ti provide features for exploring relationships between codes and data segments, such as query functions and network analysis (Fortbild et al., 2021; Scheibelhofer, 2019; Jagannathan et al., 2020). Researchers can use these tools to generate reports, charts, and visualisations to communicate their findings effectively (Jagannathan et al., 2020; Manoli & Hodgkinson, 2022; Schutt, 2011). Additionally, both software packages offer flexibility in data analysis, allowing researchers to iteratively refine their repurposing schemes and interpretations as they delve deeper into the data. Overall, NVivo and ATLAS.ti serve as robust platforms for qualitative data analysis, empowering researchers to uncover rich insights and generate meaningful interpretations from their qualitative data sources.

3.9. Units of Analysis

In this project, defining the units of analysis is essential for organising and analysing the data effectively. ‘Units of analysis’ refer to the entities to which data are applied for examination (Masilo, Masiya, & Mathebula, 2021; Massey, Arango, Hugo, Kouaouci, Pellegrino & Taylor, 1993; Marini, 2023). Given the large volume of data, it was necessary to categorise the analysis into distinct units. In line with the research objectives – primarily focused on architectural development as outlined in Chapter 1 – the analysis was organised around two main units: technical and non-technical.

These units were further subdivided to create a detailed analytical framework. Specifically, the technical units include WMI and Waste Management Systems Support (WMSS), while the non-technical units comprise WRS policy requirements and WRS governance. Table 3.1 outlines this breakdown, providing a structured approach for conducting the analysis and gaining insights into various aspects of waste management within the project context.

Table 3.1: Units of analysis

Technical Support	Non-technical Support
• Waste Management Infrastructure (WMI)	• WRS policy requirements
• Waste Management Systems Support (WMSS)	• WRS governance

3.9.1. Waste Management Infrastructure (WMI)

WMI constitutes a critical component in the broader ecosystem of WMSS (Jagannathan et al., 2020; Western Cape Economic Development Partnership, 2019; Transnet, 2022). It encompasses the physical structures, facilities, and assets involved in the collection, transportation, treatment, and disposal of waste materials. Within the WMI framework, various elements play pivotal roles, including waste collection points, sorting facilities, transfer stations, recycling centres, composting sites, and landfill sites. Each of these elements is strategically positioned within the waste management network to optimise operational efficiency, minimise environmental impact, and ensure compliance with regulatory standards Transnet, 2022).

Moreover, WMI is essential for facilitating the proper segregation and management of various waste streams, including municipal solid waste, recyclables, hazardous waste, and organic waste. The design and deployment of robust WMI are crucial for effectively addressing waste management challenges, enhancing resource recovery, and mitigating environmental pollution. Furthermore, advancements in technology and innovative solutions play a key role in modernising waste management infrastructure, enabling real-time monitoring, data-driven decision-making, and the automation of key processes (Papademetriou & Hooper, 2019; University of Pretoria, 2024; Ohene-Afoakwa & Nyanhongo, 2017; Sultan, 2022).

As waste generation continues to rise globally, developing and maintaining resilient and sustainable WMI is imperative for promoting environmental sustainability, public health, and socioeconomic well-being.

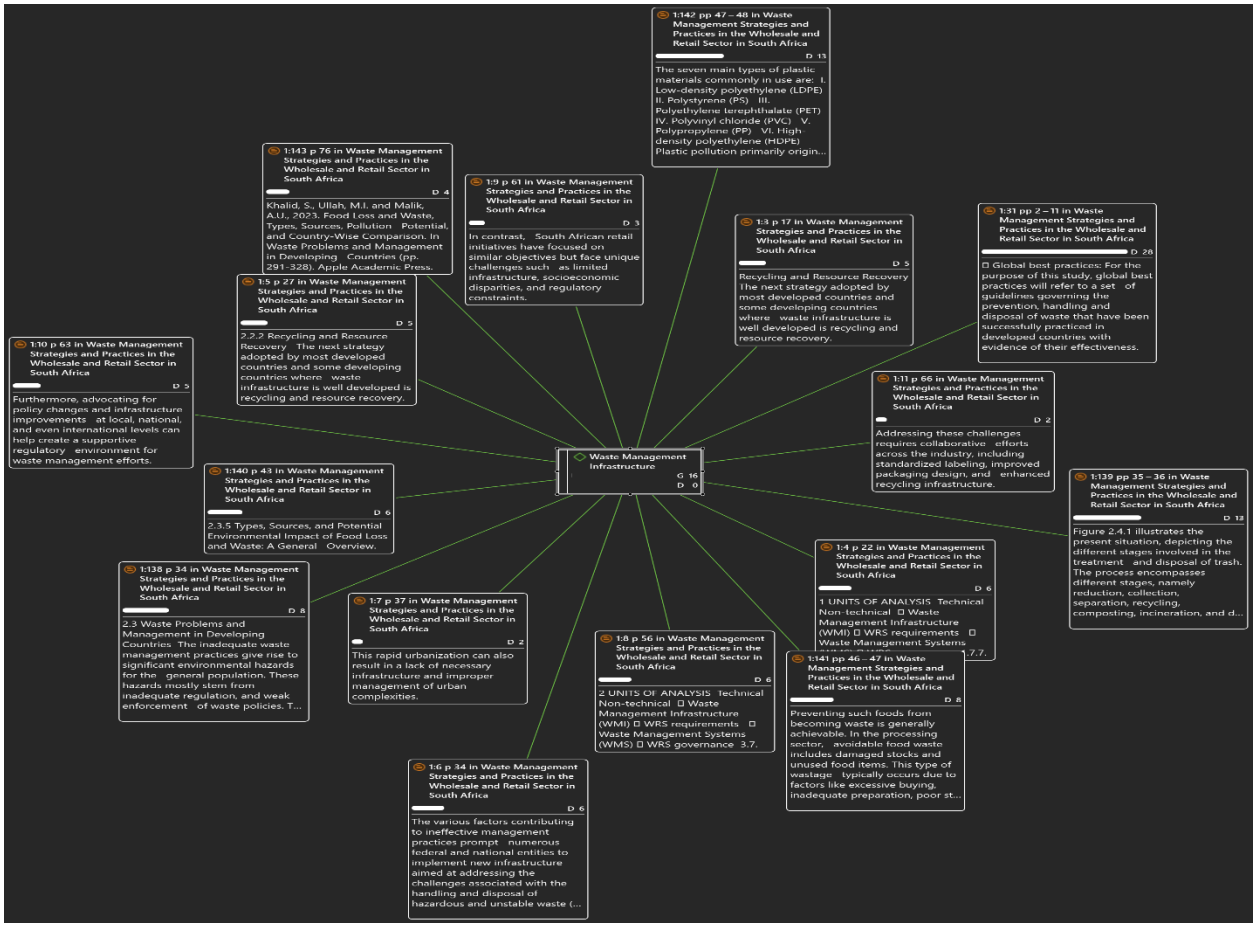

Figure 3. 1: Waste Management Infrastructure (WMI)

Source: Researcher's Design

3.9.2. WRS policy requirements

The WRS requirements, also known as Waste Management Reduction strategies requirements, delineate the necessary specifications, standards, specify the standards, criteria, and guidelines governing the operation and functionality of WMSS (Brooks, 2012; Biswas, 2021; Transnet, 2022). These requirements cover a range of considerations, including legal and regulatory compliance, operational efficiency, environmental sustainability, and public health and safety. Key aspects of WRS policy requirements include guidelines for waste collection, transportation, storage, treatment, and disposal, as well as protocols for waste segregation, recycling, and resource recovery.

Additionally, WRS policy requirements may stipulate the need for adequate infrastructure, equipment, and personnel to support effective waste management practices (Alipour & Rahimpour, 2020; Brooks, 2012; Zhang, 2020). Provisions for monitoring, reporting, and auditing mechanisms are also integral to ensuring

transparency, accountability, and continuous improvement within WMSS. Compliance with WRS policy requirements is essential for regulatory adherence, risk mitigation, and achieving sustainability goals. By following established WRS requirements, stakeholders can promote responsible and sustainable waste management, minimise environmental impacts, and protect public health and welfare.

3.9.3. Waste Management Systems Support (WMSS)

WMSS includes the organisational structures, processes, technologies, and resources employed to manage waste effectively and sustainably (Fidelity Services Group, 2021; Alipour & Rahimpour, 2020; Tuomi, Tussyadiah & Stienmets, 2021). These systems are designed to address the entire waste lifecycle – from generation and collection to treatment, disposal, or recycling. WMSS typically consists of integrated components, such as waste collection networks, transfer stations, treatment facilities, recycling centres, and landfill sites, each serving specific functions within the waste management process (Fidelity Services Group, 2021; Alipour & Rahimpour, 2020; Tuomi et al., 2021; Note & Objective, 2022).

Key elements of WMSS include waste characterisation and classification, which involve identifying the types and quantities of waste generated, as well as assessing their properties and potential environmental impacts. Additionally, WMSS incorporates strategies for waste minimisation, source separation, and diversion to maximise resource recovery while minimising disposal to landfills or incineration (Note & Objective, 2022; UN, 2019; Heiberg, Binz & Miörner, 2022). Technologies such as sorting equipment, compaction systems, and waste-to-energy technologies may be deployed within WMSS to optimise efficiency and environmental performance. Moreover, WMSS often involve regulatory compliance measures, monitoring and reporting protocols, and public outreach and education initiatives to promote stakeholder engagement and transparency. By implementing robust and adaptive WMSS, communities and organisations can effectively manage waste streams, reduce environmental pollution, conserve natural resources, and promote a circular economy paradigm.

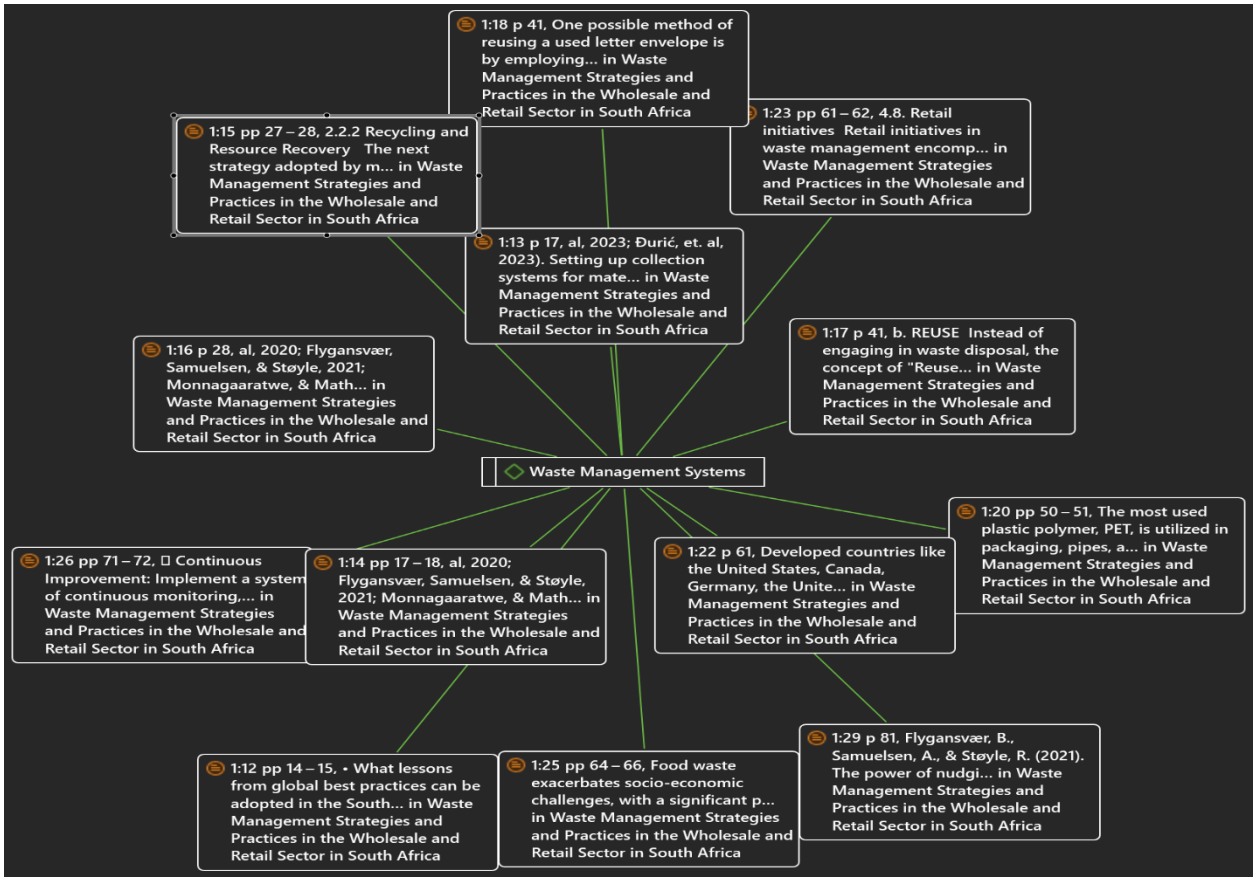

Figure 3. 2: Waste Management Systems Support (WMSS)

Source: Researcher's Design

3.9.4. W&R Sector governance framework

The W&R sector governance framework refers to the overarching framework of policies, regulations (Note & Objective, 2022; UN, 2019; Government et al., 2024; Heiberg et al., 2022), and decision-making processes that govern the planning, implementation, and oversight of waste management activities within a jurisdiction or organisation (UN, 2019; Heiberg et al., 2022). This governance structure encompasses a range of stakeholders, including government agencies, regulatory bodies, industry associations, community groups, and private sector entities, each playing distinct roles in shaping waste management policies and practices.

W&RS governance involves the formulation of laws, ordinances, and standards to regulate waste management activities, establish licensing and permitting requirements for waste facilities, and enforce compliance with environmental regulations and health and safety standards. Additionally, W&RS governance may involve the allocation of financial resources, subsidies, and incentives to support WMI

development, research and innovation, and public education campaigns. Effective W&RS governance fosters collaboration and coordination among stakeholders, promotes transparency and accountability in decision-making processes, and ensures that waste management policies align with broader environmental, social, and economic objectives (South Africa. Department of Small Business Development, 2023; Transnet, 2022; Kossewska, 2018). By establishing clear rules and responsibilities, promoting stakeholder engagement, and fostering innovation and best practices, W&R sector governance can contribute to the development of sustainable and resilient WMSS that benefit communities, economies, and the environment.

3.10. Code Design and Analysis of Stakeholders in Waste Management

Analysing best practices from the USA, Canada, Germany, the UK, and Australia offers valuable insights into effective strategies for sustainable waste management in the retail sector. These countries have implemented various initiatives and policies aimed at reducing food waste and promoting environmental sustainability. Code Design and Analysis is a qualitative research methodology used to categorise and analyse data collected from interviews, documents, and other sources.

In this methodology, codes are assigned to specific themes and concepts identified in the data, allowing researchers to systematically organise and interpret the information. Each code represents a distinct topic or idea within the dataset, and its presence or absence in the data is noted along with its frequency or density. In the provided list of codes, each code is accompanied by three pieces of information: the code itself, the groundedness, and the density.

The code is a brief descriptor of the theme or concept being identified in the data. A common example is "Collaboration and Stakeholder Engagement", which represents the theme of collaboration among various stakeholders in waste management.

Groundedness indicates the extent to which the code is grounded or supported by the data. A grounded code emerges directly from the data, reflecting the experiences, perspectives, or insights shared by participants. A code with a high groundedness value (e.g., 1) suggests that it is strongly supported by the data.

Density refers to the frequency or prevalence of the code within the dataset, reflecting how often the theme or concept represented by the code appears in the data. A code with a high-density value (e.g., 7) indicates that it is frequently mentioned or prominent in the dataset. Using Atlas.ti software and similar tools,

researchers can input the coded data and employ various features to analyse and interpret the findings. This may involve exploring relationships between different codes, identifying patterns or trends within the data, and generating insights or conclusions based on the analysis.

In the context of waste management in the W&R sector, Atlas.it Code Design and Analysis could be applied to identify key themes or strategies related to food waste management, financial resources, environmental challenges, policy frameworks, and other relevant factors. Researchers can use this methodology to gain a deeper understanding of the complexities and nuances surrounding waste management practices and develop evidence-based recommendations for improvement.

3.11. Conclusion

Chapter 3 outlined the multifaceted methodology employed to gain a comprehensive understanding of sustainable waste management strategies and practices in the W&R sector. The research began with an extensive exploratory project and literature review to investigate existing sustainable waste management initiatives in developed countries, analysing academic literature, reports, case studies, and industry publications to identify best practices and successful approaches.

Interviews with professionals actively engaged in implementing technology-driven sustainable waste management solutions in SA and internationally provided valuable firsthand insights into the challenges, successes, and opportunities of these practices in real-world contexts. Additionally, a workshop with focus groups of retailers and waste management experts was organised to review and critique a draft policy report based on the exploratory project and interviews. This collaborative session facilitated in-depth discussions, feedback, and suggestions for refining the research findings and recommendations.

Following the workshop, an amended draft report was circulated to focus group members for their review and agreement on revisions, ensuring alignment and consensus on the final report. Collectively, these methodological approaches enabled the project to capture a diversity of perspectives and expertise, forming the basis for comprehensive recommendations for sustainable waste management in the W&R sector.

CHAPTER 4: PROJECT CASE ANALYSIS

4.1. Design of Waste Management Strategy and Best Practices

The design thinking in waste management practices involves a structured examination of specific initiatives within the W&R sector to understand their complexities, challenges, and outcomes in real-world settings. The process begins with the careful selection of a relevant case that aligns with the research objectives, ranging from local community programmes to industrial projects. Clear research questions are established to guide the investigation, focusing on factors like effectiveness, sustainability, and stakeholder involvement.

Multiple data collection methods are used, including interviews, observations, and document analysis, to gather comprehensive information. Qualitative data is then systematically analysed using techniques such as thematic analysis to identify patterns and insights. In some instances, cross-case analysis is conducted to compare multiple studies and identify overarching trends. Findings from the analysis are then synthesised to address research questions, highlight successful strategies, and propose recommendations for improvement. These results are presented through reports or presentations to disseminate insights to stakeholders and influence decision-making. Through this systematic approach, researchers gain profound insights into waste management practices, contributing to the development of sustainable solutions and facilitating knowledge sharing within the field.

4.2. Scope and Objective of SA's W&R Sector

The scope and objectives of this research encompass three main goals. First, it aims to assess the current state of FLW within SA's W&R sector by examining available data, reports, and literature to understand the extent and causes of FLW in the country's W&R sector. Second, the research seeks to conduct an exploratory project on sustainable waste management strategies and practices implemented in advanced countries such as the USA, Canada, Germany, the UK, and Australia. This involves analysing case studies, policies, and initiatives aimed at mitigating food wastage and encouraging sustainable waste management in the retail sector of these countries (Alipour & Rahimpour, 2020; Dangelico & Nonino, 2019). Lastly, the research endeavours to identify and recommend sustainable waste management strategies and practices that could be adopted by SA's W&R sector in a post-COVID-19 context. This process involves synthesising findings from the assessment of SA's current situation and the exploration of international best practices, tailoring recommendations to address the specific context and challenges faced by the SA W&R sector while considering the impacts and lessons learned from the COVID-19 pandemic.

4.2.1. The structure of waste management strategies and practices in the W&RS

The structure of waste management strategies and practices in the W&R sector case involves several key components aimed at effectively addressing waste generation, collection, treatment, and disposal. This structured approach aims to develop comprehensive and sustainable waste management strategies and practices tailored to the specific needs and context of the W&R sector. Through careful planning, implementation, and evaluation, the case seeks to optimise waste management processes, minimise environmental impact, and promote a culture of sustainability within the industry.

- **Assessment of current waste management practices**: The case begins with an assessment of the existing waste management practices within the W&R sector. This involves evaluating the types and quantities of waste generated, current disposal methods, and compliance with regulatory requirements.
- **Identification of waste management challenges**: Next, the case identifies the challenges and shortcomings in the current waste management practices. This may include issues such as inadequate infrastructure, lack of employee training, or limited awareness of sustainable waste management practices.
- **Setting waste management objectives**: Clear objectives are established to guide the development of waste management strategies and practices. These objectives may focus on reducing waste generation, increasing recycling rates, minimising environmental impact, and improving overall efficiency.
- **Exploration of waste management best practices**: The case explores best practices in waste management from both domestic and international contexts. This involves researching innovative technologies, successful initiatives, and proven strategies that have been implemented in similar industries and regions.
- **Development of waste management strategies**: Based on the assessment of current practices and exploration of best practices, the case develops tailored waste management strategies and practices for the W&R sector. These strategies may include implementing recycling programmes, optimising inventory management to reduce waste, training employees on proper waste handling procedures, and partnering with external stakeholders such as waste management companies or non-profit organisations.
- **Implementation of a waste management plan**: A detailed implementation plan is devised to outline the steps, responsibilities, and timelines for executing the waste management strategies.

This plan may include resource allocation, training programmes, communication strategies, and monitoring mechanisms to track progress and performance.

- **Evaluation and continuous improvement of the waste management policy**: Finally, the case emphasises the importance of continuous evaluation and improvement of waste management strategies and practices. Regular assessments are conducted to measure the effectiveness of implemented initiatives, identify areas for improvement, and adapt strategies to changing circumstances and emerging challenges.

4.3. International Cases Studies and Examples

Global waste management practices encompass a diverse array of strategies aimed at reducing waste generation, promoting recycling, and ensuring environmentally responsible waste disposal. These practices are influenced by factors such as geography, economic status, cultural norms, and regulatory frameworks. Key practices include waste reduction initiatives like source reduction and product redesign, alongside widespread recycling programmes targeting materials such as paper, plastics, glass, and metals (Rouhani & Mehri, 2018; Köhle et al., 2021).

Composting organic waste is increasingly recognised as a valuable strategy for waste management, contributing to both waste reduction and improvements in soil health. Waste-to-energy technologies, which are controversial yet significant, convert waste into energy sources like electricity or biogas, mitigating landfill volumes and supporting renewable energy production. EPR programmes hold manufacturers accountable for product end-of-life management, encouraging eco-friendly design and reducing the burden on local waste systems (Rouhani & Mehri, 2018; Köhler et al., 2021). Effective landfill management and remediation are crucial for minimising environmental contamination and public health risks. Public awareness campaigns and educational programmes play a vital role in promoting responsible waste management behaviours and fostering a culture of environmental stewardship. As global waste management practices evolve in response to environmental concerns and technological advancements, collaboration among stakeholders remains pivotal for addressing complex waste management challenges and advancing towards a more sustainable and circular economy.

4.3.1. United States

The USA has experienced success with initiatives such as the ‘Food Waste Reduction Alliance’ (WFRA), a collaboration between the Grocery Manufacturers Association (GMA), the Food Marketing Institute (FMI), and the National Restaurant Association (NRA). This alliance aims to reduce food waste through education, research, and industry collaboration. Notable successes include the implementation of food

donation programmes by major retailers and restaurants, such as Walmart and Starbucks, which donate surplus food to food banks and charities rather than disposing of it.

4.3.2. Canada

Canada's National Zero Waste Council has developed the "Love Food Hate Waste" policy campaign, which educates consumers on how to reduce food waste at home. This initiative includes tips for meal planning, proper storage, and creative ways to use leftovers. Supermarkets in Canada have also implemented innovative solutions such as selling "ugly" produce at discounted prices to prevent it from being wasted due to cosmetic imperfections.

4.3.3. Germany

Germany has adopted a comprehensive approach to food waste reduction, which includes legislative measures such as the ‘German Resource Efficiency Programme’ and the ‘Circular Economy Act’. These initiatives aim to minimise waste and promote recycling. Retailers in Germany frequently collaborate with food banks and charities to redistribute surplus food to those in need, thereby reducing waste while addressing food insecurity.

4.3.4. United Kingdom

The UK's ‘Courtauld Commitment’ brings together retailers, manufacturers, and food service companies to collectively reduce food waste across the supply chain. This initiative sets targets for waste reduction and encourages businesses to adopt more sustainable practices.

Retailers in the UK have also introduced initiatives such as "wonky veg" boxes, which offer discounted prices on imperfect produce to encourage consumers to embrace fruits and vegetables that are less visually appealing but perfectly edible.

4.3.5. Australia

Australia's Fight Food Waste Cooperative Research Centre focuses on research and innovation to tackle food waste throughout the supply chain. This collaborative effort brings together industry partners, researchers, and government agencies to develop practical solutions. Supermarkets in Australia have implemented programmes like ‘Food Rescue’ and ‘Second Bite’, which involve donating surplus food to charities and community organisations to feed vulnerable populations rather than sending it to landfill. Analysing these case studies and success stories can provide valuable insights into effective waste

management strategies that can be adapted and implemented in SA's W&R sector to reduce food waste and promote sustainability.

4.4. African Case Studies and Examples

These examples illustrate the diverse array of waste management initiatives across Africa (Transnet, 2022;), highlighting innovative solutions to environmental challenges and simultaneously addressing social and economic needs within local communities (Fidelity Services Group, 2021; Oumran, Atan, Nor, Binti, Abdullah & Mukred, 2021). There are several case studies and examples of waste management initiatives from different African countries:

4.4.1. Ethiopia – Koshe Waste-to-Energy Plant

In Addis Ababa, the Koshe landfill has transformed into a waste-to-energy facility. By converting waste into electricity, the plant provides power to thousands of households in the city. This initiative not only addresses waste management challenges but also contributes to renewable energy generation and environmental sustainability efforts (Kalonda, Pupkewitz & Govender, 2021).

4.4.2. Kenya – TakaTaka Solutions

TakaTaka Solutions, located in Nairobi, Kenya, is a waste management company offering recycling and waste collection services to households, businesses, and industries (Idp et al., 2024; Mnembe, 2022; Stellenbosch Municipality, 2020). They employ innovative approaches to waste segregation, recycling, and composting, diverting significant waste from landfills and promoting a circular economy model.

4.4.3. Rwanda – Gashora Landfill Gas Project

The Gashora Landfill Gas Project in Rwanda captures methane emissions from landfills and converts them into electricity. This renewable energy source is used to power nearby communities, contributing to reduced GHG emissions and showcasing an innovative approach to waste management and energy generation (Idp et al., 2024; Mnembe, 2022; Stellenbosch Municipality, 2020).

4.4.4. Nigeria – Wecyclers

Wecyclers, a social enterprise based in Lagos, Nigeria, incentivises waste recycling by offering rewards to households for their recyclable materials. Using a mobile-based platform, households can schedule waste pickups, which not only promotes recycling but also addresses urban unemployment and poverty.

4.5. SA – Waste Management Best Practices

In SA, waste management best practices focuses on waste collection, recycling, and resource recovery. They provide customised waste management solutions for businesses and municipalities, emphasising waste diversion and sustainable practices to minimise environmental impact.

4.5.1. Three Rs to reduce waste generation

The findings on WRS, particularly the "Reduce, Reuse, Recycle" (3Rs) framework, underscore the importance of prioritising waste prevention and reduction. The "Reduce" component is recognised as the most desirable approach, focusing on minimising waste generation at the source. Strategies such as source reduction in manufacturing processes and local sourcing in the wholesale and retail sectors are highlighted as effective ways to prevent waste. Additionally, designing products that are easy to compost, repair, and reuse is recommended. Implementing fees for solid waste disposal and establishing cradle-to-grave accountability laws are also suggested to promote responsible waste management practices.

The "Reuse" component emphasises extending the lifespan of materials through practices such as cleaning and reusing, which reduce pollution and resource consumption. Examples include repurposing materials, such as using beer bottles in construction projects, showcasing the effectiveness of reuse in various contexts.

The "Recycle" component involves the systematic sorting and processing of discarded materials into raw inputs for new products. While recycling is often undertaken informally in impoverished nations, there is a critical need for improved WMI and governance to enhance recycling rates and reduce overall waste generation. Addressing these gaps can support more sustainable waste management practices worldwide, emphasising the essential roles of reduction, reuse, and recycling in mitigating environmental impacts and conserving resources.

4.5.2. Design of waste management strategy and best practices

A waste management strategies and practices design thinking programme is an experimental initiative created to test and evaluate approaches aimed at enhancing waste management within specific contexts, such as the W&R sector (Western Cape Economic Development Partnership, 2019; Chlebna & Mattes, 2022; Fidelity Services Group, 2021). This programme typically involves implementing and assessing various waste management strategies, techniques, or technologies on a smaller scale, with the goal of

refining these approaches before considering broader implementation (Chlebna & Mattes, 2022; Ghani, Nayan, Ghazali & Shafie, 2019).

The objectives of such a design thinking programme may include identifying the most effective waste reduction methods, evaluating the feasibility and cost-effectiveness of different approaches, and assessing the impact on environmental sustainability and operational efficiency. Key components of a waste management design thinking programme may include conducting waste audits to understand current waste streams, implementing targeted interventions such as recycling programmes or food waste reduction initiatives, and collecting data to measure outcomes and inform decision-making (Chlebna & Mattes, 2022; Ghani et al., 2019; Fidelity Services Group, 2021; Wang & Yang, 2021).

Stakeholder engagement and collaboration are also essential aspects of a design thinking programme, involving participation from retailers, suppliers, waste management companies, and other relevant parties to ensure buy-in and support for the initiatives being tested. Ultimately, the insights and lessons learned from the design thinking programme can guide the development of comprehensive waste management strategies and inform future efforts to promote sustainability and reduce waste within the W&R sector and beyond.

4.6. The Role of Citizens on Waste Management Best Practice

Citizens play a pivotal role in implementing effective food waste management practices through various actions and behaviours. Firstly, they can minimise food waste by adopting strategies such as meal planning, portion control, and the creative use of leftovers, thereby significantly reducing the amount of food that goes to waste. Additionally, citizens can donate surplus food to food banks, shelters, or community organisations, addressing food insecurity while diverting edible items from landfills. Composting food scraps is another impactful approach that citizens can take, contributing to the reduction of methane emissions and enriching soil health. Supporting local food recovery initiatives by volunteering or donating helps rescue surplus food and redistribute it to those in need or for animal feed, thereby reducing waste at the community level. Advocating for policy change is crucial, with citizens supporting measures such as food waste reduction targets and standardised date labelling to create a conducive environment for waste reduction across the supply chain. Lastly, raising awareness about the environmental, social, and economic impacts of food waste through educational campaigns and community events fosters a culture of waste reduction and promotes sustainable food practices. By actively participating in these actions, citizens can play a significant role in mitigating food waste, conserving resources, reducing GHG emissions, and building more resilient and sustainable food systems.

CHAPTER 5: OVERVIEW OF CASE ANALYSIS, FINDINGS AND DISCUSSIONS

5.1. Introduction of Findings Concepts and Case Analysis

The efficiency of waste management in the W&R sectors is crucial for both environmental sustainability and financial viability (Suping, 2022; van Rensburg, 2012). SA can refine its waste management strategies by drawing insights from global best practices. Currently, the country generates approximately 10 million metric tons of food waste annually from the W&R sector alone based on a world wide fund for nature estimate, with a significant portion ending up in landfills. Key strategies include waste reduction through improved inventory management and packaging optimisation, which studies have shown can lead to a reduction of up to 30% in waste generation.

Implementation of recycling programmes with separate bins for recyclable materials has been proven to increase recycling rates by as much as 50% in similar contexts. Composting organic waste from perishable goods presents a substantial opportunity, with estimates suggesting that up to 40% of waste in this sector is organic (Raulinajtys-Grzybek & Karwowski, 2021; Zhang, 2020; Kossewska, 2018). Partnering with food banks for surplus food redistribution not only reduces waste but also addresses food insecurity.. Advocating for EPR programmes has been successful in other regions, resulting in a decrease of up to 25% in overall product waste. Employee training on waste management and energy-efficient practices has shown to increase employee engagement and efficiency by as much as 20%, leading to more effective waste management practices (Dania et al., 2007; Zhang, 2020; UN, 2019).

Investment in energy-efficient technologies is not only environmentally beneficial but also financially prudent, with significant potential savings on annual energy costs. Monitoring waste metrics allows businesses to track their progress; studies indicate that companies monitoring these metrics are significantly more likely to achieve their waste reduction goals (Simmermann, 2019). Collaboration among stakeholders, government entities, and local communities is essential for SA's W&R sector to contribute effectively to a circular economy. By working together, businesses can access resources and expertise, leading to more comprehensive and sustainable waste management practices. This collaborative approach not only mitigates environmental degradation but also optimises operational costs, ensuring the long-term sustainability of businesses and the broader ecosystem.

5.1.1. Qualitative data collection

The qualitative data on the waste management strategies was collected using documentation. This technique was chosen primarily because, at the time of this project, the phenomenon was new and being designed in phases. Consequently, no empirical evidence on the full implementation could be obtained through other data collection techniques, such as interviews. The documents were collected electronically from the Department of Waste Management website. Since these documents were obtained from the public domain, the researcher did not seek permission for data collection. The documents were selected based on certain criteria, as stated in Chapter 3. The "Gr" values appear to represent a form of ranking or score associated with the importance or relevance of each aspect.

- Benefits of waste management: This aspect seems to be highly interconnected with various other aspects, with a relatively high "Gr" value indicating its importance.
- Challenges of waste management: Similarly, the challenges associated with waste management are also interconnected with other aspects.
- Collaboration and stakeholder engagement: This aspect emphasises the importance of collaboration and engaging stakeholders in effective waste management practices.
- Education and training in waste management: Highlights the role of education and training in ensuring effective waste management practices.
- Environmental impact: Indicates the interconnectedness of waste management with its environmental implications.
- Financial resources and support: Underscores the importance of financial resources and support in implementing waste management strategies.
- Health and food security: Addresses the implications for health and food security associated with waste management practices.

Table 4.1: Qualitative data from documents

Descriptive Statistics			
	Mean	**Std. Deviation**	**N**
○ **Adoption of waste management policy: Gr=18**	**2.03**	**4.305**	**72**
○ **Adoption of Reverse Logistics and Product Returns: Gr=2**	**2.07**	**5.298**	**72**
○ **Challenges of waste management: Gr=160**	**33.28**	**78.036**	**72**
○ **Benefits of waste management: Gr=3409**	**186.47**	**568.194**	**72**
○ **Collaboration and Stakeholder Engagement: Gr=139**	**29.75**	**70.344**	**72**
○ **Environmental impact: Gr=153**	**31.67**	**70.538**	**72**
○ **Financial support: Gr=652**	**30.79**	**109.249**	**72**
○ **Global challenges: Gr=40**	**12.03**	**30.578**	**72**
● **Food Waste Management Strategies: Gr=24**	**6.89**	**12.187**	**72**
○ **Financial resources: Gr=789**	**59.74**	**131.858**	**72**
○ **Financial burdens: Gr=652**	**30.79**	**109.249**	**72**

○ Health and food security: Gr=20	3.85	6.324	72
○ Human interventions: Gr=144	16.90	38.303	72
○ Implementation of technological-driven waste management: Gr=381	13.65	27.827	72
○ Local challenges: Gr=41	12.08	30.562	72
○ Model for waste reduction and prevention strategies: Gr=0	.00	.000	72
○ National waste management strategy: Gr=1	.26	1.210	72
○ Pollution impact and side effects: Gr=373	30.43	79.906	72
○ Pollution levels: Gr=299	23.14	56.456	72
○ Support benefits: Gr=355	37.82	91.221	72
○ Support markets: Gr=355	37.82	91.221	72
○ Support ERP: Gr=355	37.82	91.221	72
○ Support expenses: Gr=355	37.82	91.221	72
○ Support programmes: Gr=355	37.82	91.221	72
○ Waste disposal systems: Gr=477	22.33	56.875	72
○ Sustainable supply chain: Gr=72	10.03	16.936	72
○ Waste Management Act 2008: Gr=1	.06	.231	72
○ Waste management hierarchies: Gr=3421	188.86	573.605	72
○ Wholesale & Retail: Gr=120	19.26	35.836	72
○ Waste reduction and prevention strategies: Gr=74	12.22	23.958	72
○ Zero Food Waste Act: Gr=84	8.94	23.354	72
○ Zero Waste tolerance: Gr=84	8.94	23.354	72
○ WRS requirements: Gr=2	.22	.562	72
○ Waste management systems: Gr=19	4.69	12.894	72
○ Waste management programmes: Gr=98	6.58	15.166	72
○ Waste management concepts: Gr=182	3.71	6.929	72
○ Strategies: Gr=64	8.61	15.176	72
○ Recycling and resource recovery: Gr=373	30.50	79.984	72

These descriptive statistics provide insights into various variables related to waste management policies, challenges, strategies, and impacts. They offer a quantitative overview of the key aspects concerning waste management in the W&R sector, highlighting perceived challenges, benefits, and levels of adoption and support. Further analysis and interpretation of these variables can inform strategic decision-making and policy development in waste management.

Adoption of Waste Management Policy (Mean = 2.03, Std. Deviation = 4.305): This variable measures the extent to which waste management policies are adopted within the context of the study. The mean value indicates a relatively low level of adoption, while a considerable standard deviation suggests significant variability in responses among participants.

Adoption of Reverse Logistics and Product Returns (Mean = 2.07, Std. Deviation = 5.298): This variable assesses the adoption of reverse logistics practices and product return policies within the W&R sector. The mean value suggests a moderate level of adoption, with a relatively high standard deviation indicating variability in participants' responses.

Challenges of Waste Management (Mean = 33.28, Std. Deviation = 78.036): This variable quantifies the perceived challenges associated with waste management in the sector. The high mean value and standard deviation indicate that participants view waste management as a significant challenge, with considerable variability in the perceived severity of challenges.

Benefits of Waste Management (Mean = 186.47, Std. Deviation = 568.194): This variable evaluates the perceived benefits of waste management practices. The high mean value and standard deviation suggest that participants perceive a wide range of benefits associated with effective waste management, although there is considerable variability in the magnitude of these perceived benefits.

Collaboration and Stakeholder Engagement (Mean = 29.75, Std. Deviation = 70.344): This variable assesses the level of collaboration and stakeholder engagement in waste management efforts. The moderate mean value suggests a moderate degree of collaboration, while the high standard deviation indicates considerable variability in the extent of stakeholder engagement among participants.

Environmental Impact (Mean = 31.67, Std. Deviation = 70.538): This variable quantifies participants' perceptions of the environmental impact of waste management practices. The moderate mean value suggests a perceived moderate environmental impact, while the high standard deviation indicates significant variability in perceptions among participants.

Financial Support (Mean = 30.79, Std. Deviation = 109.249): This variable evaluates the level of financial support available for waste management initiatives. The mean value suggests a moderate level of financial support, although the high standard deviation indicates variability in the availability of financial resources among participants.

Table 5. 1: Statistics grp themes

		○ Adoption of reverse logistics and product returns: Gr=2	○ Adoption of waste management policy: Gr=18	○ Behavioural theory: Gr=504	○ Benefits of waste management: Gr=3409	○ Challenges of waste management: Gr=160
N	Valid	72	72	72	72	72
	Missing	4	4	4	4	4
Mean		1.29	1.13	1.49	2.42	1.51

Std. Deviation	.777	.529	1.245	1.422	1.163
Variance	.604	.280	1.549	2.021	1.352
Sum	93	81	107	174	109

These statistics provide insights into several variables related to waste management policies, behavioural theories, and challenges and benefits in the context of reverse logistics and product returns:

Adoption of Reverse Logistics and Product Returns (Mean = 1.29, Std. Deviation = 0.777): This variable indicates the level of adoption of reverse logistics and product return practices within the studied context. The mean value of 1.29 suggests a relatively low level of adoption, with a standard deviation of 0.777 indicating some variability in responses among participants.

Adoption of Waste Management Policy (Mean = 1.13, Std. Deviation = 0.529): This variable measures the extent to which waste management policies have been adopted. The mean value of 1.13 indicates a low level of adoption, with a relatively small standard deviation of 0.529 suggesting less variability in responses compared to reverse logistics and product returns.

Behavioural Theory (Mean = 1.49, Std. Deviation = 1.245): This variable relates to the application of behavioural theories in waste management practices. The mean value of 1.49 suggests a moderate level of application, with a standard deviation of 1.245 indicating some variability in the application of behavioural theories among participants.

Benefits of Waste Management (Mean = 2.42, Std. Deviation = 1.422): This variable quantifies the perceived benefits of waste management practices. The mean value of 2.42 suggests a relatively high perception of benefits, with a standard deviation of 1.422 indicating variability in the perceived magnitude of benefits among participants.

Challenges of Waste Management (Mean = 1.51, Std. Deviation = 1.163): This variable assesses the perceived challenges associated with waste management. The mean value of 1.51 suggests a moderate level of perceived challenges, with a standard deviation of 1.163 indicating variability in the severity of perceived challenges among participants.

These statistics provide a quantitative overview of key variables related to waste management policies, behavioural theories, and challenges and benefits, offering insights into the adoption and perception of various aspects of waste management practices within the studied context.

Table 5. 2: Statistics grp themes

		○ Collaboration and stakeholder engagement: Gr=139	○ Education and training in waste management: Gr=138	○ Effects of COVID-19: Gr=1	○ Environmental impact: Gr=153	○ Financial burdens: Gr=652
N	Valid	72	72	72	72	72
	Missing	4	4	4	4	4
Mean		1.35	1.54	1.00	1.44	1.50
Std. Deviation		.981	1.198	.000	1.099	1.332
Variance		.962	1.435	.000	1.208	1.775
Sum		97	111	72	104	108

These statistics offer quantitative insights into the perceived levels of collaboration, stakeholder engagement, education and training provision, the impact of COVID-19, environmental impact, and financial burdens within the context of waste management practices, highlighting areas of concern and potential focus for improvement.

Collaboration and Stakeholder Engagement (Mean = 1.35, Std. Deviation = 0.981): This variable measures the extent of collaboration and stakeholder engagement in waste management efforts. The mean value of 1.35 suggests a moderate level of collaboration, while a standard deviation of 0.981 indicates some variability in collaboration levels among participants.

Education and Training in Waste Management (Mean = 1.54, Std. Deviation = 1.198): This variable assesses the provision of education and training programmes in waste management. The mean value of 1.54 indicates a moderate level of education and training provision, with a standard deviation of 1.198 suggesting variability in the extent of educational initiatives among participants.

Effects of COVID-19 (Mean = 1.00, Std. Deviation = 0.000): This variable quantifies the perceived effects of the COVID-19 pandemic on waste management practices. The mean value of 1.00 suggests that all respondents perceive some impact from COVID-19, as indicated by a standard deviation of zero, which means there is no variability in responses for this variable.

Environmental Impact (Mean = 1.44, Std. Deviation = 1.099): This variable evaluates the perceived environmental impact of waste management practices. The mean value of 1.44 indicates a moderate perception of environmental impact, while the standard deviation of 1.099 reflects variability in perceptions among participants.

Financial Burdens (Mean = 1.50, Std. Deviation = 1.332): This variable measures the perceived financial burdens associated with waste management. The mean value of 1.50 suggests a moderate level of perceived financial burdens, with a standard deviation of 1.332 indicating variability in the severity of these perceived financial challenges among participants.

Table 5. 3: Statistics grp themes

		○ Financial resources: Gr=789	○ Financial support: Gr=652	○ Food waste: Gr=1	● Food waste management strategies: Gr=24	○ General waste: Gr=1
N	Valid	72	72	72	72	72
	Missing	4	4	4	4	4
Mean		1.64	1.36	1.00	1.63	1.06
Std. Deviation		1.202	.954	.000	1.215	.331
Variance		1.445	.910	.000	1.477	.110
Sum		118	98	72	117	76

These statistics provide insights into several variables related to financial resources, financial support, food waste, food waste management strategies, and general waste. They offer quantitative insights into the perceived availability of financial resources and support, the presence of food waste and general waste, and the effectiveness of food waste management strategies within the context of waste management practices. This information is valuable for decision-making and strategy development in waste management initiatives.

This variable measures the perceived availability of financial resources for waste management initiatives. The mean value of 1.64 indicates a moderate perception of financial resources, while a standard deviation of 1.202 suggests variability in perceptions among participants.

Financial Support (Mean = 1.36, Std. Deviation = 0.954): This variable assesses the perceived level of financial support for waste management activities. The mean value of 1.36 indicates a moderate perception of financial support, with a standard deviation of 0.954 reflecting variability in perceived levels of support among participants.

Food Waste (Mean = 1.00, Std. Deviation = 0.000): This variable likely indicates the presence or absence of food waste in the context being studied. The mean value of 1.00 signifies that all respondents reported the presence of food waste, as the standard deviation is zero, indicating no variability in responses for this variable.

Food Waste Management Strategies (Mean = 1.63, Std. Deviation = 1.215): This variable measures the perceived effectiveness or implementation of food waste management strategies. The mean value of 1.63 suggests a moderate perception of the effectiveness of these strategies, while a standard deviation of 1.215 indicates variability in perceptions among participants.

General Waste (Mean = 1.06, Std. Deviation = 0.331): This variable likely indicates the presence or absence of general waste in the context being studied. The mean value of 1.06 suggests that all respondents reported the presence of general waste, as the standard deviation is zero, indicating no variability in responses for this variable.

Table 5. 4: Statistics grp themes

		○ Global challenges: Gr=40	○ Global intervention practices level (GIPL): Gr=1	○ Health and food security: Gr=20	○ Human health: Gr=143	○ Human health risk: Gr=143
N	Valid	72	72	72	72	72
	Missing	4	4	4	4	4
Mean		1.42	1.00	1.38	1.74	1.42
Std. Deviation		.931	.000	1.013	1.061	.852

Variance	.866	.000	1.026	1.127	.725
Sum	102	72	99	125	102

These statistics provide insights into several variables related to global challenges, global intervention practices level (GIPL), health and food security, human health, and human health risk. They offer quantitative insights into the perceived global challenges, intervention practices, impacts on health and food security, and risks to human health associated with waste management practices, providing valuable information for policymakers and stakeholders involved in waste management initiatives.

Global Challenges (Mean = 1.42, Std. Deviation = 0.931): This variable measures the perceived level of global challenges in waste management. The mean value of 1.42 indicates a moderate perception of global challenges, with a standard deviation of 0.931 suggesting variability in perceptions among participants.

Global Intervention Practices Level (GIPL) (Mean = 1.00, Std. Deviation = 0.000): This variable likely indicates the presence or absence of global intervention practices in waste management. The mean value of 1.00 indicates that all respondents reported the presence of global intervention practices, as the standard deviation is zero, meaning there is no variability in responses for this variable.

Health and Food Security (Mean = 1.38, Std. Deviation = 1.013): This variable measures the perceived impact of waste management on health and food security. The mean value of 1.38 suggests a moderate perception of the impact on health and food security, with a standard deviation of 1.013 indicating variability in perceptions among participants.

Human Health (Mean = 1.74, Std. Deviation = 1.061): This variable assesses the perceived impact of waste management on human health. The mean value of 1.74 suggests a relatively high perception of the impact on human health, with a standard deviation of 1.061 indicating variability in perceptions among participants.

Human Health Risk (Mean = 1.42, Std. Deviation = 0.852): This variable measures the perceived level of risk to human health related to waste management practices. The mean value of 1.42 indicates a moderate perception of human health risk, with a standard deviation of 0.852 suggesting variability in perceptions among participants.

Table 5. 5: Statistics grp themes

		○ Human interventions: Gr=144	○ Impact: Gr=17	○ Implementation of technological driven waste management: Gr=381	○ Imported annotation: Gr=7	○ Initiative types: Gr=1
N	Valid	72	72	72	72	72
	Missing	4	4	4	4	4
Mean		1.57	1.40	1.38	1.00	1.00
Std. Deviation		1.019	1.206	1.106	.000	.000
Variance		1.037	1.455	1.224	.000	.000
Sum		113	101	99	72	72

These statistics pertain to several variables related to waste management initiatives, providing insights into the extent of human interventions, perceived impact, adoption of technological solutions, presence of imported annotations, and categorisation of initiative types. This information is valuable for assessing the effectiveness and scope of such initiatives.

Human Interventions (Mean = 1.57, Std. Deviation = 1.019): This variable measures the extent of human interventions in waste management initiatives. The mean value of 1.57 suggests a moderate level of human intervention, while the standard deviation of 1.019 indicates variability in the degree of human involvement among participants.

Impact (Mean = 1.40, Std. Deviation = 1.206): This variable assesses the perceived impact of waste management initiatives. The mean value of 1.40 suggests a moderate perception of impact, with a standard deviation of 1.206 indicating variability in participants' perceptions regarding the effectiveness of these initiatives.

Implementation of Technologically Driven Waste Management (Mean = 1.38, Std. Deviation = 1.106): This variable measures the adoption and implementation of technological solutions in waste management. The mean value of 1.38 suggests a moderate level of adoption, while a standard deviation of 1.106 indicates variability in the degree of technological integration among participants.

Imported Annotation (Mean = 1.00, Std. Deviation = 0.000): This variable likely denotes the presence or absence of imported annotations in waste management initiatives. The mean value of 1.00 indicates that all respondents reported the presence of imported annotations, as the standard deviation is zero, meaning there is no variability in responses for this variable.

Initiative Types (Mean = 1.00, Std. Deviation = 0.000): This variable likely categorises waste management initiatives into different types. The mean value of 1.00 indicates that all respondents reported the presence of initiative types, with no variability in responses, as indicated by a standard deviation of zero.

Table 5. 6: Statistics grp themes

		○ Local challenges: Gr=41	○ Model for waste reduction and prevention strategies: Gr=0	○ National waste management strategy: Gr=1	○ Plastic waste pollution: Gr=12	○ Pollution impact and side effects: Gr=373
N	Valid	72	72	72	72	72
	Missing	4	4	4	4	4
Mean		1.56	1.04	1.11	1.35	1.50
Std. Deviation		1.185	.201	.358	.922	1.101
Variance		1.405	.040	.128	.850	1.211
Sum		112	75	80	97	108

These statistics pertain to several variables related to waste management and pollution. They provide insights into various aspects of waste management and pollution, including local challenges, the presence of waste reduction models and national strategies, plastic waste pollution levels, and respondents' perceptions of pollution's impact and side effects

Local Challenges (Mean = 1.56, Std. Deviation = 1.185): This variable assesses the local challenges faced in waste management. The mean value of 1.56 suggests a moderate level of local challenges, while the standard deviation of 1.185 indicates variability in the perceived difficulties encountered at the local level.

Model for Waste Reduction and Prevention Strategies (Mean = 1.04, Std. Deviation = 0.201): This variable likely represents the presence or absence of a model for waste reduction and prevention strategies. The

mean value of 1.04 indicates that most respondents reported the presence of such a model, while the low standard deviation of 0.201 suggests little variability in their responses.

National Waste Management Strategy (Mean = 1.11, Std. Deviation = 0.358): This variable measures the presence or absence of a national waste management strategy. The mean value of 1.11 suggests that most respondents reported the existence of such a strategy, with a low standard deviation of 0.358 indicating minimal variability in responses.

Plastic Waste Pollution (Mean = 1.35, Std. Deviation = 0.922): This variable assesses the extent of plastic waste pollution. The mean value of 1.35 indicates a moderate level of plastic waste pollution, while the standard deviation of 0.922 suggests variability in the reported levels of pollution among respondents.

Pollution Impact and Side Effects (Mean = 1.50, Std. Deviation = 1.101): This variable evaluates the perceived impact and side effects of pollution. The mean value of 1.50 suggests a moderate perception of pollution's impact, with a standard deviation of 1.101 indicating variability in respondents' perceptions regarding the severity of pollution effects.

Table 5. 7: Statistics grp themes

		○ Pollution levels Gr=299	○ Post-COVID-19 Gr=1	○ Potential solution to waste management Gr=1	○ Potential threat Gr=2	○ Prevent food waste Gr=3
N	Valid	72	72	72	72	72
	Missing	4	4	4	4	4
Mean		1.50	1.01	1.19	1.00	1.29
Std. Deviation		1.151	.118	.664	.000	.795
Variance		1.324	.014	.441	.000	.632
Sum		108	73	86	72	93

These statistics describe several variables related to pollution, waste management, and post-pandemic considerations. They provide insights into perceptions and considerations regarding pollution levels, post-pandemic waste management practices, potential solutions and threats, and efforts to prevent food waste among respondents.

Pollution Levels (Mean = 1.50, Std. Deviation = 1.151): This variable assesses the perceived levels of pollution. The mean value of 1.50 suggests a moderate perception of pollution levels among respondents, with a standard deviation of 1.151 indicating variability in these perceptions.

Post-COVID-19 (Mean = 1.01, Std. Deviation = 0.118): This variable likely pertains to considerations or changes related to waste management practices post-pandemic. The mean value of 1.01 indicates that respondents generally agree with the necessity of such changes, with a low standard deviation of 0.118 suggesting minimal variability in responses.

Potential Solution to Waste Management (Mean = 1.19, Std. Deviation = 0.664): This variable examines the perceived potential solutions to waste management challenges. The mean value of 1.19 suggests that respondents perceive the presence of potential solutions, with a moderate standard deviation of 0.664 indicating variability in the reported solutions.

Potential Threat (Mean = 1.00, Std. Deviation = 0.000): This variable likely addresses potential threats associated with waste management or environmental issues. The mean value of 1.00 suggests that respondents perceive the presence of potential threats, with a standard deviation of 0.000 indicating no variability in responses.

Prevent Food Waste (Mean = 1.29, Std. Deviation = 0.795): This variable evaluates efforts to prevent food waste. The mean value of 1.29 suggests that respondents generally agree with the importance of preventing food waste, with a moderate standard deviation of 0.795 indicating variability in responses regarding the effectiveness of such efforts.

Table 5. 8: Statistics grp themes

		○ Problems of waste management Gr=11	○ Recycling and resource recovery Gr=373	○ Reduce waste management generation Gr=17	○ Strategies Gr=64	○ Support benefits Gr=355
N	Valid	72	72	72	72	72
	Missing	4	4	4	4	4
Mean		1.28	1.42	1.18	1.33	1.74
Std. Deviation		.791	1.123	.678	.979	1.332

Variance	.626	1.261	.460	.958	1.774
Sum	92	102	85	96	125

These statistics pertain to various aspects of waste management and support measures. They offer insights into respondents' perceptions of waste management problems, attitudes toward recycling and waste reduction, the perceived effectiveness of strategies, and the benefits of support measures in waste management.

Problems of Waste Management (Mean = 1.28, Std. Deviation = 0.791): This variable addresses the perceived problems or challenges associated with waste management. The mean value of 1.28 suggests that respondents recognise the existence of problems in waste management, with a moderate standard deviation of 0.791 indicating variability in the reported challenges.

Recycling and Resource Recovery (Mean = 1.42, Std. Deviation = 1.123): This variable likely evaluates attitudes or efforts related to recycling and resource recovery. The mean value of 1.42 suggests that respondents generally agree on the importance of recycling and resource recovery initiatives, with a moderate standard deviation of 1.123 indicating variability in responses.

Reduce Waste Management Generation (Mean = 1.18, Std. Deviation = 0.678): This variable assesses efforts or attitudes toward reducing waste generation. The mean value of 1.18 suggests that respondents acknowledge the importance of reducing waste generation, with a relatively low standard deviation of 0.678 indicating less variability in responses regarding this aspect.

Strategies (Mean = 1.33, Std. Deviation = 0.979): This variable likely refers to the perceived effectiveness or importance of waste management strategies. The mean value of 1.33 suggests that respondents recognise the significance of employing strategies in waste management practices, with a moderate standard deviation of 0.979 indicating variability in reported strategies.

Support Benefits (Mean = 1.74, Std. Deviation = 1.332): This variable evaluates the perceived benefits of support measures in waste management. The mean value of 1.74 suggests that respondents generally agree on the benefits provided by support measures, with a relatively high standard deviation of 1.332 indicating variability in reported benefits.

Table 5. 9: Statistics grp themes

		○ Support markets Gr=355	○ Support ERP Gr=355	○ Support expenses Gr=355	○ Support programmes Gr=355	○ Sustainability of waste management Gr=605
N	Valid	72	72	72	72	72
	Missing	4	4	4	4	4
Mean		1.51	1.49	1.65	1.61	1.18
Std. Deviation		1.245	1.473	1.365	1.327	.757
Variance		1.549	2.169	1.864	1.762	.573
Sum		109	107	119	116	85

These statistics provide insights into various aspects related to support measures and the sustainability of waste management.

Support Markets (Mean = 1.51, Std. Deviation = 1.245): This variable likely assesses the perceived effectiveness or importance of support measures in waste management markets. The mean value of 1.51 suggests that respondents generally acknowledge the significance of these measures, with a moderate standard deviation of 1.245 indicating variability in their responses.

Support Enterprise Resource Planning (ERP) (Mean = 1.49, Std. Deviation = 1.473): This variable evaluates the perceived effectiveness or importance of support measures in ERP systems for waste management. The mean value of 1.49 indicates that respondents generally recognise the significance of these measures, with a moderate standard deviation of 1.473 reflecting variability in their responses.

Support Expenses (Mean = 1.65, Std. Deviation = 1.365): This variable likely refers to the perceived effectiveness or importance of support measures in managing expenses related to waste management. The mean value of 1.65 suggests that respondents generally agree on the benefits provided by these measures, with a moderate standard deviation of 1.365 indicating variability in reported perceptions.

Support Programmes (Mean = 1.61, Std. Deviation = 1.327): This variable evaluates the perceived effectiveness or importance of support programmes in waste management. The mean value of 1.61 suggests that respondents generally recognise the significance of these programmes, while the moderate standard deviation of 1.327 indicates variability in their responses.

Sustainability of Waste Management (Mean = 1.18, Std. Deviation = 0.757): This variable likely assesses perceptions of the sustainability of waste management practices. The mean value of 1.18 suggests that respondents generally view waste management practices as sustainable, while the relatively low standard deviation of 0.757 indicates less variability in the reported perceptions of sustainability.

Table 5. 10: Statistics grp themes

		○ SDG 17 Gr=1	○ Sustainable environment Gr=18	○ Sustainable supply chain Gr=72	○ Sustainable waste management practice Gr=5856	○ Type of waste Gr=1
N	Valid	72	72	72	72	72
	Missing	4	4	4	4	4
Mean		1.01	1.21	1.24	2.82	1.06
Std. Deviation		.205	.711	.896	1.656	.471
Variance		.042	.505	.803	2.742	.222
Sum		73	87	89	203	76

These statistics provide insights into various aspects related to sustainable waste management practices.

SDG 17 (Mean = 1.01, Std. Deviation = 0.205): This variable likely assesses the extent to which respondents perceive SDG 17, which focuses on partnerships for the goals, as relevant or achievable in the context of waste management. The mean value of 1.01 suggests that respondents generally perceive SDG 17 as being somewhat relevant or achievable, with a low standard deviation of 0.205 indicating relatively consistent perceptions among respondents.

Sustainable Environment (Mean = 1.21, Std. Deviation = 0.711): This variable likely evaluates perceptions of the sustainability of the environment concerning waste management practices. The mean value of 1.21 suggests that respondents generally perceive the environment as somewhat sustainable in the context of waste management, with a moderate standard deviation of 0.711 indicating some variability in reported perceptions.

Sustainable Supply Chain (Mean = 1.24, Std. Deviation = 0.896): This variable likely assesses perceptions of the sustainability of supply chains involved in waste management processes. The mean value of 1.24 suggests that respondents generally perceive supply chains in waste management as somewhat sustainable, with a moderate standard deviation of 0.896 indicating some variability in reported perceptions.

Sustainable Waste Management Practice (Mean = 2.82, Std. Deviation = 1.656): This variable likely evaluates perceptions of the extent to which waste management practices are sustainable. The mean value of 2.82 suggests that respondents generally perceive waste management practices as moderately sustainable. The relatively high standard deviation of 1.656 indicates variability in reported perceptions.

Type of Waste (Mean = 1.06, Std. Deviation = 0.471): This variable likely categorises different types of waste relevant to the study. The mean value of 1.06 suggests that respondents generally perceive the types of waste included in the study as somewhat similar in terms of their relevance to sustainable waste management practices. The relatively low standard deviation of 0.471 indicates consistency in reported perceptions of waste types.

Table 5. 11: Statistics grp themes

		○ Waste disposal systems Gr=477	○ Waste Management Gr=98	○ Waste Management Act 2008 Gr=1	○ Waste management concepts Gr=182	○ Waste management hierarchies Gr=3421
N	Valid	72	72	72	72	72
	Missing	4	4	4	4	4
Mean		1.61	1.22	1.14	1.32	2.72
Std. Deviation		1.273	.736	.421	1.005	1.629
Variance		1.621	.541	.178	1.009	2.654
Sum		116	88	82	95	196

These statistics provide insights into various aspects of waste management.

Waste Disposal Systems (Mean = 1.61, Std. Deviation = 1.273): This variable likely assesses perceptions of waste disposal systems, including methods and infrastructure for waste disposal. The mean value of 1.61 suggests that respondents generally perceive waste disposal systems as somewhat effective or adequate, while the moderate standard deviation of 1.273 indicates some variability in reported perceptions.

Waste Management (Mean = 1.22, Std. Deviation = 0.736): This variable likely assesses perceptions of the effectiveness or impact of the Waste Management Act of 2008, which serves as a regulatory framework

governing waste management practices. The mean value of 1.14 suggests that respondents generally view the act as somewhat effective or influential, with a relatively low standard deviation of 0.421 indicating consistency in reported perceptions.

Waste Management Act 2008 (Mean = 1.14, Std. Deviation = 0.421): This variable likely assesses perceptions of the effectiveness or impact of the Waste Management Act of 2008, which could be a regulatory framework governing waste management practice. The mean value of 1.14 suggests that respondents generally perceive the act as somewhat effective or influential, with a relatively low standard deviation of 0.421 indicating consistency in reported perceptions.

Waste Management Concepts (Mean = 1.32, Std. Deviation = 1.005): This variable likely evaluates perceptions of various concepts or principles related to waste management, such as sustainability, recycling, or circular economy principles. The mean value of 1.32 suggests that respondents generally perceive waste management concepts as somewhat important or relevant, with a moderate standard deviation of 1.005 indicating some variability in reported perceptions.

Waste Management Hierarchies (Mean = 2.72, Std. Deviation = 1.629): This variable likely assesses perceptions of waste management hierarchies or prioritisation schemes, such as the waste management hierarchy, which prioritises waste prevention, reuse, recycling, recovery, and disposal in that order. The mean value of 2.72 suggests that respondents generally perceive waste management hierarchies as relatively important or effective, while the relatively high standard deviation of 1.629 indicates variability in reported perceptions.

Table 5. 12: Statistics grp themes

		○ Waste management infrastructure Gr=16	○ Waste management intervention Gr=63	○ Waste management initiatives Gr=13	○ Waste management model (WMM) Gr=7	○ Waste management practice Gr=64
N	Valid	72	72	72	72	72
	Missing	4	4	4	4	4
Mean		1.38	1.03	1.17	1.42	1.40
Std. Deviation		.941	.165	.628	.975	.944
Variance		.886	.027	.394	.951	.892
Sum		99	74	84	102	101

These statistics provide insights into perceptions related to various aspects of waste management best practice.

WMI (Mean = 1.38, Std. Deviation = 0.941): This variable likely assesses perceptions of the infrastructure in place for waste management, including facilities, equipment, and systems. The mean value of 1.38 suggests that respondents generally perceive the WMI as somewhat adequate or effective, with a moderate standard deviation of 0.941 indicating some variability in reported perceptions.

Waste Management Intervention (Mean = 1.03, Std. Deviation = 0.165): This variable likely evaluates perceptions of interventions or measures taken to address waste management issues. The mean value of 1.03 suggests that respondents generally perceive waste management interventions as somewhat effective or impactful, with a relatively low standard deviation of 0.165 indicating consistency in reported perceptions.

Waste Management Initiatives (Mean = 1.17, Std. Deviation = 0.628): This variable likely assesses perceptions of specific initiatives or programmes aimed at improving waste management practices. The mean value of 1.17 suggests that respondents generally perceive waste management initiatives as somewhat positive or beneficial, with a moderate standard deviation of 0.628 indicating some variability in reported perceptions.

Waste Management Model (WMM) (Mean = 1.42, Std. Deviation = 0.975): This variable likely evaluates perceptions of models or frameworks used for waste management planning or decision-making. The mean value of 1.42 suggests that respondents generally perceive the waste management model as somewhat effective or useful, with a moderate standard deviation of 0.975 indicating some variability in reported perceptions.

Waste Management Practice (Mean = 1.40, Std. Deviation = 0.944): This variable likely assesses perceptions of actual waste management practices implemented or observed. The mean value of 1.40 suggests that respondents generally perceive waste management practices as somewhat satisfactory or adequate, with a moderate standard deviation of 0.944 indicating some variability in reported perceptions.

Table 5. 13: Statistics grp themes

		○ Waste management programmes Gr=98	○ Waste management strategies Gr=1	○ Waste management systems Gr=19	○ Waste prevention measures Gr=1	○ Waste reduction and prevention strategies Gr=74
N	Valid	72	72	72	72	72
	Missing	4	4	4	4	4
Mean		1.08	1.00	1.25	.97	1.57
Std. Deviation		.278	.000	.707	.289	1.254
Variance		.077	.000	.500	.084	1.573
Sum		78	72	90	70	113

These statistics provide insights into perceptions regarding different aspects of waste management.

Waste Management Programmes (Mean = 1.08, Std. Deviation = 0.278): This variable likely assesses perceptions of organised programmes or initiatives aimed at managing waste. The mean value of 1.08 suggests that respondents generally perceive waste management programmes positively, with a low standard deviation of 0.278 indicating relatively consistent perceptions among respondents.

Waste Management Strategies (Mean = 1.00, Std. Deviation = 0.000): This variable likely evaluates perceptions of overarching strategies or approaches adopted for waste management. The mean value of 1.00 suggests that respondents perceive waste management strategies as universally important or effective, with a standard deviation of 0.000 indicating no variability in reported perceptions.

Waste Management Systems (Mean = 1.25, Std. Deviation = 0.707): This variable likely assesses perceptions of the systems or frameworks in place for managing waste. The mean value of 1.25 suggests that respondents generally perceive waste management systems positively, with a moderate standard deviation of 0.707 indicating some variability in reported perceptions.

Waste Prevention Measures (Mean = 0.97, Std. Deviation = 0.289): This variable likely evaluates perceptions of measures taken to prevent or reduce waste generation. The mean value of 0.97 suggests that respondents generally perceive waste prevention measures positively, with a low standard deviation of 0.289 indicating relatively consistent perceptions among respondents.

Waste Reduction and Prevention Strategies (Mean = 1.57, Std. Deviation = 1.254): This variable likely assesses perceptions of specific strategies or actions aimed at reducing or preventing waste. The mean value of 1.57 suggests that respondents generally perceive waste reduction and prevention strategies positively, with a relatively high standard deviation of 1.254 indicating some variability in reported perceptions.

Table 5. 14: Statistics grp themes

		○ Waste service Gr=1	○ Wholesale & Retail Gr=120	○ Wholesale & Retail food market Gr=1	○ Wholesale & Retail sector Gr=6	○ WRS governance Gr=2
N	Valid	72	72	72	72	72
	Missing	4	4	4	4	4
Mean		1.03	1.42	1.00	1.13	1.11
Std. Deviation		.165	.550	.000	.670	.461
Variance		.027	.303	.000	.449	.213
Sum		74	102	72	81	80

These statistics provide insights into perceptions regarding various aspects of waste management and the W&R sector.

Waste Service (Mean = 1.03, Std. Deviation = 0.165): This variable likely assesses perceptions of waste management services provided to the Wholesale & Retail sector. The mean value of 1.03 suggests that respondents generally view waste services positively, with a low standard deviation of 0.165 indicating relatively consistent perceptions among respondents.

Wholesale & Retail (Mean = 1.42, Std. Deviation = 0.550): This variable likely evaluates perceptions related to the W&R sector in general. The mean value of 1.42 indicates that respondents generally hold positive views of the Wholesale & Retail sector, with a moderate standard deviation of 0.550 reflecting some variability in reported perceptions.

Wholesale & Retail Food Market (Mean = 1.00, Std. Deviation = 0.000): This variable likely assesses perceptions specifically related to the food market within the W&R sector. The mean value of 1.00 suggests that respondents perceive the W&R food market positively, with no variability in reported perceptions, as indicated by a standard deviation of 0.000.

W&R Sector (Mean = 1.13, Std. Deviation = 0.670): This variable likely evaluates perceptions of the W&R sector, encompassing various aspects beyond just waste management. The mean value of 1.13 indicates that respondents generally hold positive views of the W&R sector, with a moderate standard deviation of 0.670 reflecting some variability in reported perceptions.

WRS Governance (Mean = 1.11, Std. Deviation = 0.461): This variable likely assesses perceptions of the governance or regulatory framework related to WRS within the W&R sector. The mean value of 1.11 suggests that respondents generally perceive WRS governance positively, with a moderate standard deviation of 0.461 indicating some variability in reported perceptions.

Table 5. 15: Statistics grp themes

		○ WRS requirements Gr=2	○ Zero Energy Cold Chamber (ZECC) Gr=84	○ Zero Food Waste Act Gr=84	○ Zero waste tolerance Gr=84
N	Valid	72	72	72	72
	Missing	4	4	4	4
Mean		1.03	1.24	1.33	1.15
Std. Deviation		.165	.569	.692	.573
Variance		.027	.324	.479	.328
Sum		74	89	96	83

These statistics provide insights into perceptions regarding specific initiatives and requirements related to waste management.

WRS Requirements (Mean = 1.03, Std. Deviation = 0.165): This variable likely assesses perceptions of the requirements or regulations associated with WRS. The mean value of 1.03 suggests that respondents view WRS requirements positively, while a low standard deviation of 0.165 indicates relatively consistent perceptions among respondents.

Zero Energy Cold Chamber (ZECC) (Mean = 1.24, Std. Deviation = 0.569): This variable likely evaluates perceptions of the ZECC initiative, which may aim to reduce energy consumption in cold storage facilities. The mean value of 1.24 indicates that respondents generally perceive ZECC positively, while a moderate standard deviation of 0.569 suggests some variability in the reported perceptions.

Zero Food Waste Act (Mean = 1.33, Std. Deviation = 0.692): This variable likely assesses perceptions of the Zero Food Waste Act, which may encompass legislation or policies aimed at reducing food waste. The mean value of 1.33 suggests that respondents generally perceive the Zero Food Waste Act positively, while the standard deviation of 0.692 indicates some variability in reported perceptions.

Zero Waste Tolerance (Mean = 1.15, Std. Deviation = 0.573): This variable likely evaluates perceptions of initiatives or attitudes promoting zero tolerance for waste within a specific context, such as production or consumption. The mean value of 1.15 suggests that respondents generally perceive zero waste tolerance positively, with a standard deviation of 0.573 indicating some variability in reported perceptions.

5.2. Overview of Frequency Structural Code Analysis

The problem analysis process follows a systematic and structured approach to derive meaningful insights and conclusions from the collected data (Hozayen et al., 2018). It begins with data preparation, which involves the organisation, cleaning, and formatting of raw data to ensure accuracy and usability. Descriptive analysis then summarises key features of the dataset using measures such as means and frequencies. Exploratory data analysis examines patterns and trends through visualisation tools like charts and graphs. Inferential analysis draws conclusions about populations based on sample data using statistical methods, such as dataset testing (Wiid & Cant, 2021; Chakola, 2022; Konlan, Aarah-Bapuah, Kombat & Wuffele, 2017). Qualitative analysis interprets qualitative data thematically through content analysis to identify recurring themes. The integration of quantitative and qualitative findings provides a comprehensive understanding of research questions. Validation and interpretation assess the validity and reliability of findings within the research context (Msiza, Obokoh, Olumide & Benedict, 2022; Hermanda, Sumarwan & Tinaprillia., 2019; Gragnano, Simbula & Miglioretti, 2020). The iterative nature of the process ensures rigour and validity, with multiple rounds of review and refinement. Ultimately, systematic analysis contributes valuable insights, advancing knowledge and informing evidence-based decision-making in the field. Through this approach, researchers can generate meaningful implications and recommendations to effectively address research objectives.

The provided codes offer insights into various aspects of waste management, particularly focusing on collaboration, education, financial resources, waste management strategies, pollution, and the impacts of global challenges. Notably, codes like ‘Collaboration and Stakeholder Engagement’ (CSE) and ‘Education and Training in Waste Management’ (ETWM) emphasise the importance of collaborative efforts and education in addressing waste management issues (Oumran et al., 2021; WHO, 2019). Additionally, codes such as ‘Food Waste Management Strategies’ and ‘Recycling and Resource Recovery’ highlight specific

strategies for managing food waste and promoting recycling (Zhang, 2020; Kossewska, 2018; Balchandani, Beltrami, Berg, Hedrich, Rölkens & Amed, 2021). Moreover, codes related to pollution levels and impacts underscore the environmental consequences of inadequate waste management practices. The density of codes within different groups reflects the focus areas, with some codes being more prevalent, such as those related to challenges, education, and strategies. Overall, these codes provide a comprehensive framework for understanding and addressing waste management challenges, emphasising the importance of collaboration, education, and strategic approaches in achieving sustainable waste management practices.

5.2.1. Adoption of reverse logistics and product returns Gr=2

Table 5. 16: Adoption of reverse logistics and product returns Gr=2

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Agree	60	78.9	83.3	83.3
	Agree	7	9.2	9.7	93.1
	Neutral	2	2.6	2.8	95.8
	Disagree	2	2.6	2.8	98.6
	Strongly Disagree	1	1.3	1.4	100.0
	Total	72	94.7	100.0	
Missing	System	4	5.3		
Total		76	100.0		

Adoption

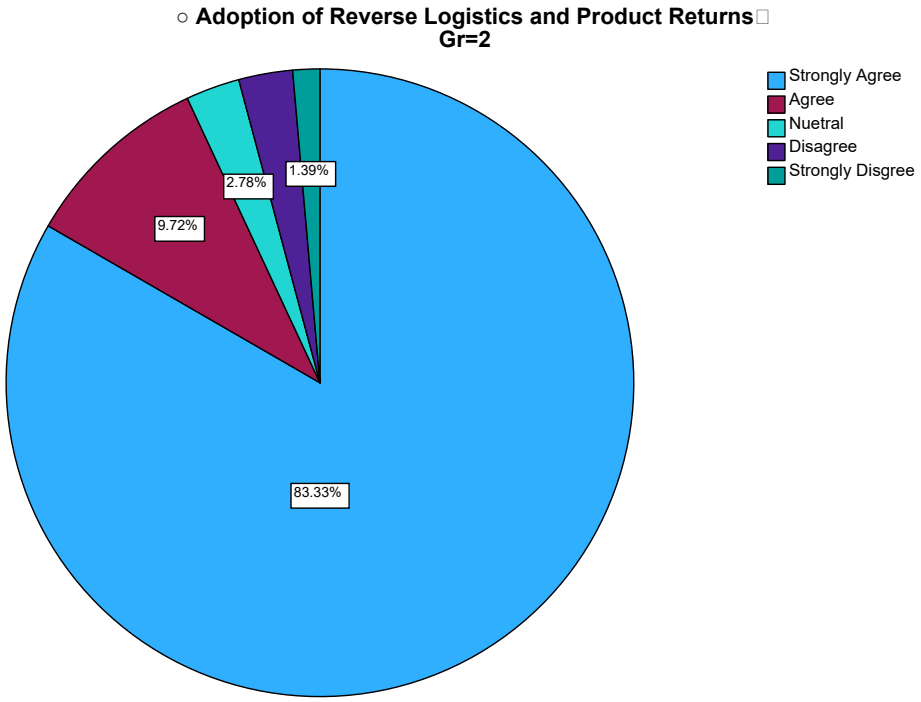

Figure 5. 1: Adoption of reverse logistics and product returns Gr=2

The statistics reflect perceptions regarding the adoption of reverse logistics and product returns, with a total of 72 valid responses. The majority, 78.9%, strongly agree with the adoption of reverse logistics and product returns, indicating a high level of support for these practices. Additionally, 9.2% agree, further emphasising positive sentiments toward this adoption. However, there are some mixed views, as 2.6% are neutral, 2.6% disagree, and 1.3% strongly disagree. Despite these differing opinions, the cumulative percentage shows that a vast majority (83.3%) either strongly agree or agree with the adoption of reverse logistics and product returns. This suggests a prevailing positive attitude toward these practices among respondents. The presence of neutral, disagreeing, and strongly disagreeing responses highlights the diversity of perspectives within the sample. Overall, the data indicate a general inclination toward embracing reverse logistics and product returns, albeit with some variation in levels of enthusiasm among respondents.

5.2.2. Adoption of waste management policy Gr=18

Table 5. 17: Adoption of waste management policy Gr=18

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Agree	66	86.8	91.7	91.7
	Agree	5	6.6	6.9	98.6
	Strongly Disagree	1	1.3	1.4	100.0
	Total	72	94.7	100.0	
Missing	System	4	5.3		
Total		76	100.0		

Adoption waste

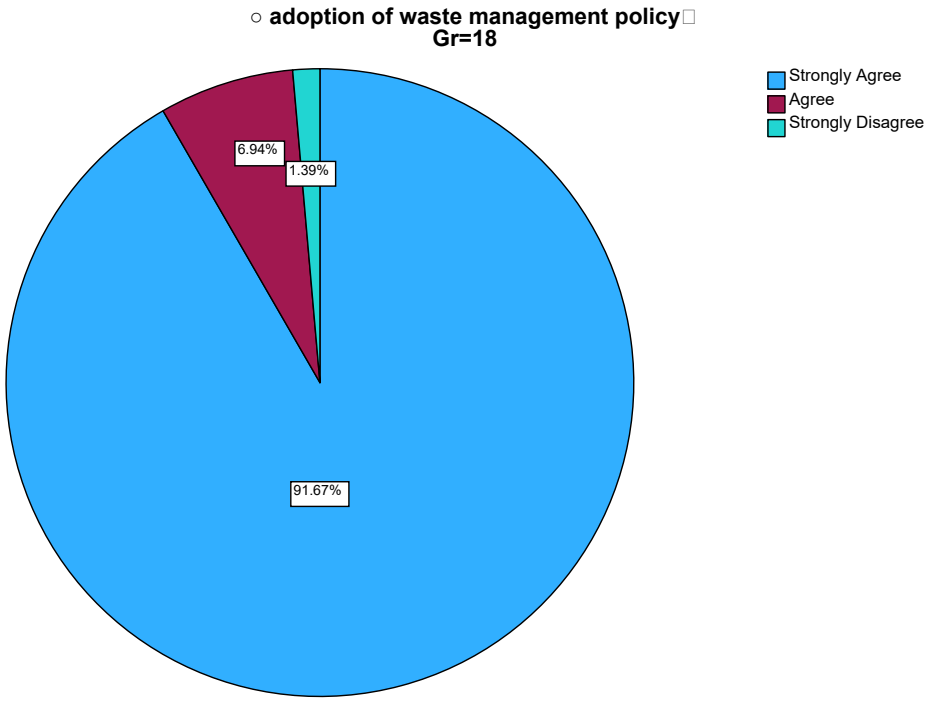

Figure 5. 2: Adoption of waste management policy Gr=18

The data reveal insights into the adoption of waste management policy based on 72 valid responses. A significant majority, comprising 86.8%, expressed strong agreement with the adoption of the waste management policy, indicating robust support for such initiatives. Additionally, 6.6% of respondents agree with the policy adoption, further reinforcing a positive stance toward waste management policies. Conversely, a small fraction, accounting for 1.3%, strongly disagrees with the adoption of these policies.

However, this dissenting perspective represents a minority within the sample. The cumulative percentage indicates that 91.7% either strongly agree or agree with the adoption of the waste management policy, signifying a prevailing endorsement of these policies among respondents.

5.2.3. Behavioural theory Gr=504

Table 5. 18: Behavioural theory Gr=504

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Agree	61	80.3	84.7	84.7
	Agree	2	2.6	2.8	87.5
	Neutral	1	1.3	1.4	88.9
	Disagree	1	1.3	1.4	90.3
	Strongly Disagree	7	9.2	9.7	100.0
	Total	72	94.7	100.0	
Missing	System	4	5.3		
Total		76	100.0		

Behavioural theory

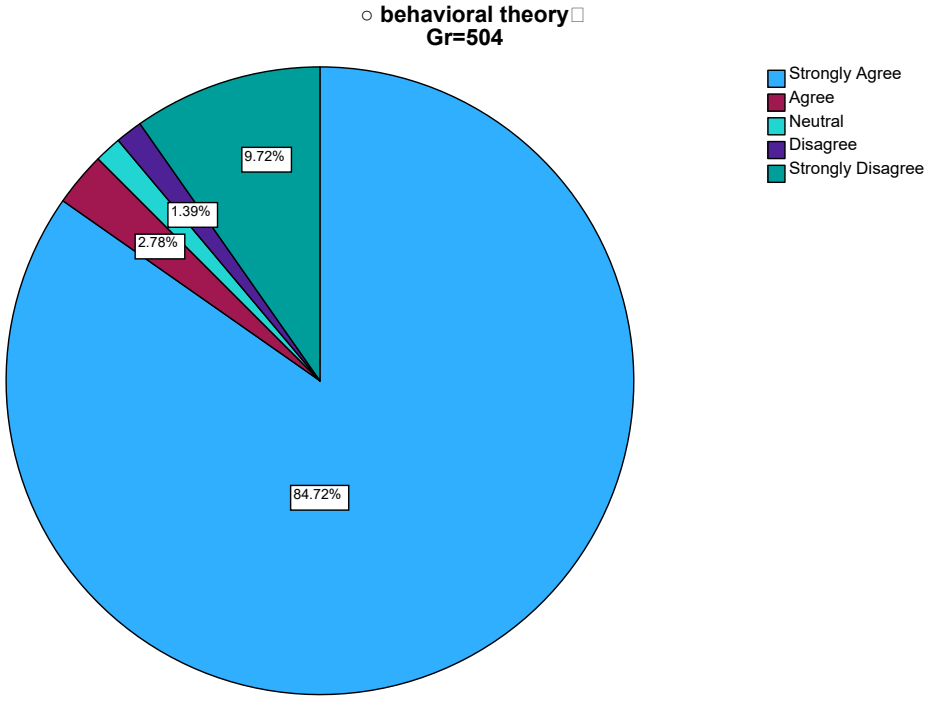

Figure 5. 3: Behavioural theory Gr=504

The data concerning the behavioural theory, derived from 72 valid responses, illustrate varying perspectives within the sample. The majority, comprising 80.3%, strongly agree with the behavioural theory, indicating a prevalent acceptance of this theoretical framework. Additionally, a small percentage, constituting 2.6%, agree with the behavioural theory, further contributing to the overall endorsement of this concept. Meanwhile, 1.3% of respondents express a neutral stance, and an equal proportion disagree with the behavioural theory. However, the most notable observation is the presence of 9.2% who strongly disagree with this theory, representing a dissenting perspective within the sample. Despite this dissent, the cumulative percentage demonstrates that the majority of respondents, accounting for 84.7%, either strongly agree or agree with the behavioural theory, emphasising its significant influence or acceptance within the surveyed population.

5.2.4 Benefits of waste management Gr=3409

Table 5. 19: Benefits of waste management Gr=3409

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Agree	29	38.2	40.3	40.3
	Agree	13	17.1	18.1	58.3
	Neutral	6	7.9	8.3	66.7
	Disagree	19	25.0	26.4	93.1
	Strongly Disagree	5	6.6	6.9	100.0
	Total	72	94.7	100.0	
Missing	System	4	5.3		
Total		76	100.0		

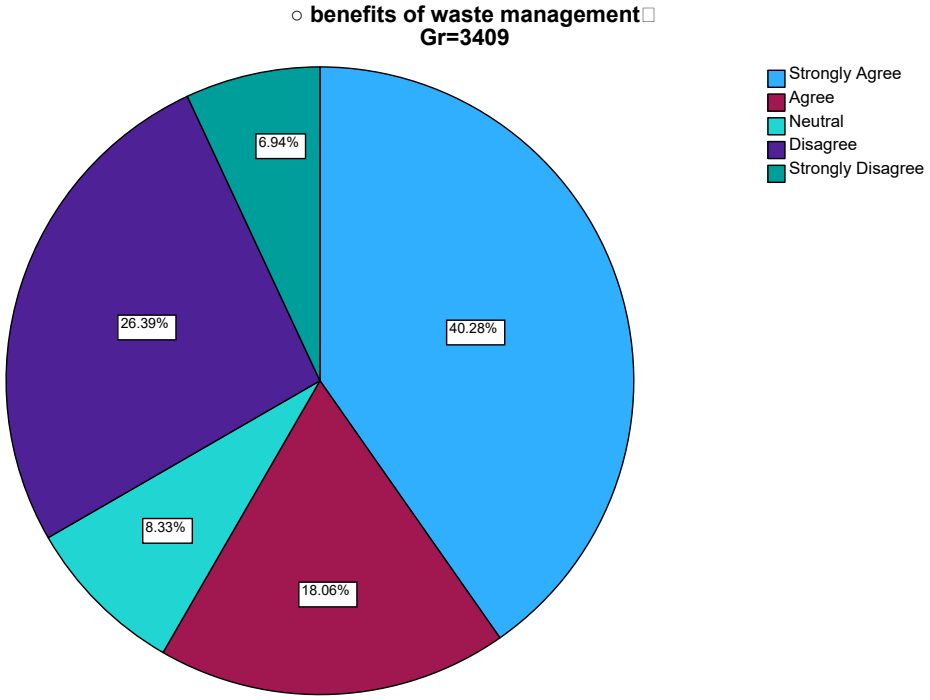

Figure 5. 4: Benefits of waste management Gr=3409

The data regarding the perceived benefits of waste management, based on 72 valid responses, present a diverse range of opinions within the sample. A significant portion, comprising 38.2%, strongly agrees that waste management offers substantial benefits. Additionally, 17.1% of respondents agree with this perspective, further acknowledging the positive impacts of waste management. Conversely, 25.0% disagree with the notion of benefits associated with waste management, while 6.6% strongly disagree. This dissenting viewpoint suggests a level of scepticism or disagreement regarding the perceived advantages of waste management. Moreover, 7.9% of respondents express a neutral stance on this matter. Notably, despite the varying perspectives, the cumulative percentage indicates that a substantial portion, accounting for 58.3%, either strongly agree or agree that waste management offers benefits, highlighting a prevailing recognition of its potential positive impacts within the surveyed population.

5.2.5. Challenges of waste management Gr=160

Table 5. 20: Challenges of waste management Gr=160

		Frequency	Per cent	Valid Percent	Cumulative Percent
Valid	Strongly Agree	58	76.3	80.6	80.6
	Agree	2	2.6	2.8	83.3
	Neutral	6	7.9	8.3	91.7
	Disagree	1	1.3	1.4	93.1
	Strongly Disagree	5	6.6	6.9	100.0
	Total	72	94.7	100.0	
Missing	System	4	5.3		
Total		76	100.0		

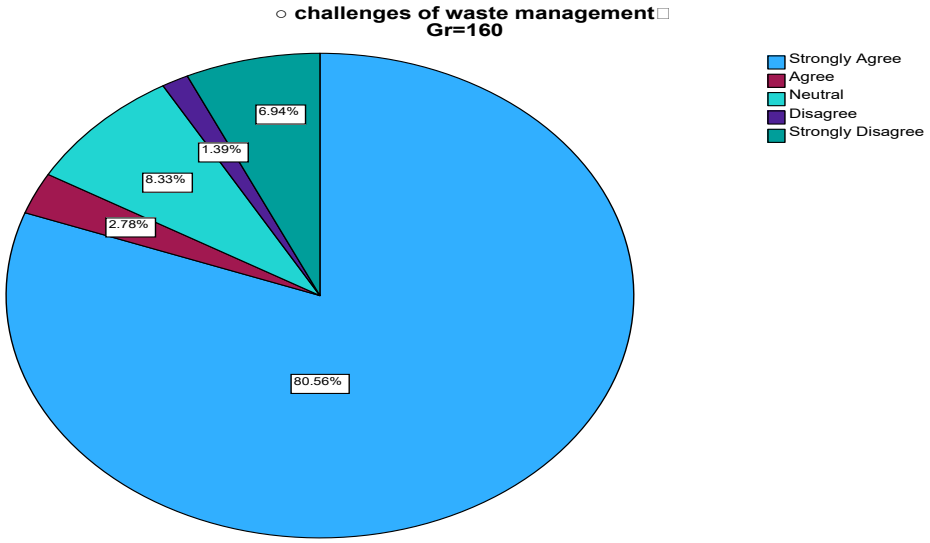

Figure 5. 5: Challenges of waste management Gr=160

In the assessment of challenges related to waste management, data from 72 valid responses reveals a predominant acknowledgement of these difficulties within the surveyed population. A significant majority, constituting 76.3%, strongly agree that waste management poses substantial challenges. Additionally, a smaller portion, representing 2.6%, agrees with this perspective, which further emphasises the recognition of the complexities associated with waste management. Conversely, only 1.3% of respondents disagree with the notion that waste management presents challenges, while 6.6% strongly disagree. This indicates a minority viewpoint suggesting a lack of acknowledgment or awareness regarding the challenges in waste

management. Furthermore, 7.9% of respondents express a neutral stance on this matter. Despite some variations in opinion, the cumulative percentage highlights a prevalent recognition among 80.6% of respondents regarding the significant challenges inherent in waste management practices, underscoring the importance of effectively addressing these issues.

5.2.6. Collaboration and stakeholder engagement Gr=139

Table 5. 21: Collaboration and stakeholder engagement Gr=139

		Frequency	Per cent	Valid Percent	Cumulative Percent
Valid	Repurpose	63	82.9	87.5	87.5
	Change/Adjust strategy	5	6.6	6.9	94.4
	Support the strategy	1	1.3	1.4	95.8
	Adoption/Implementation	3	3.9	4.2	100.0
	Total	72	94.7	100.0	
Missing	System	4	5.3		
Total		76	100.0		

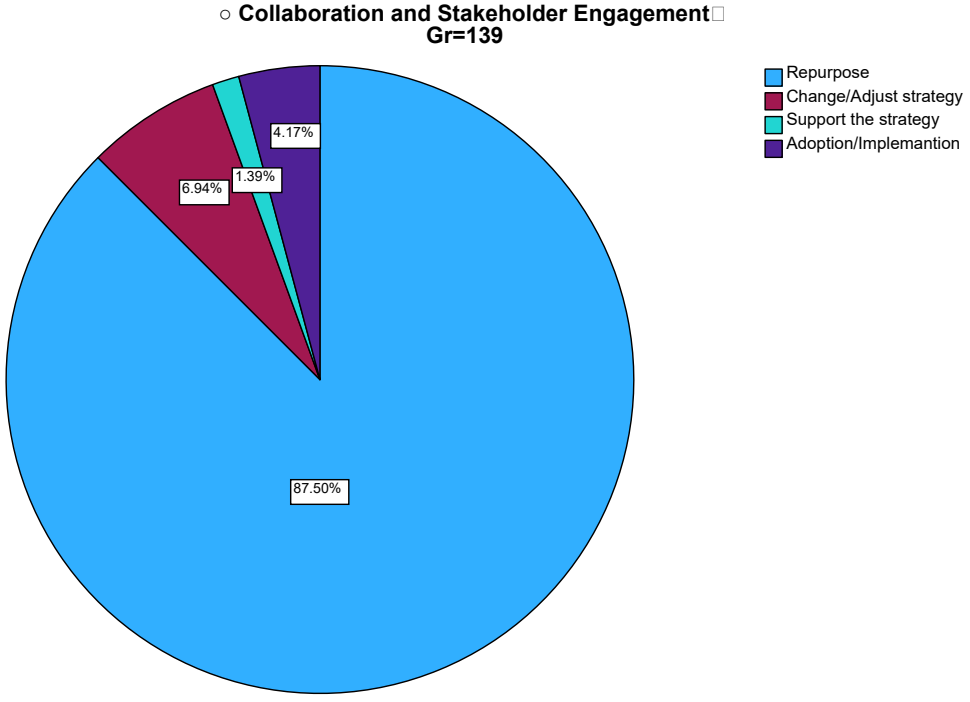

Figure 5. 6: Collaboration and Stakeholder Engagement Gr=139

The data regarding collaboration and stakeholder engagement in waste management initiatives reflect a high level of involvement and varied approaches among respondents. The majority, comprising 82.9%, indicated a preference for repurposing existing strategies, demonstrating a proactive stance towards leveraging past efforts for future improvement. Additionally, 6.6% of respondents expressed a willingness to change or adjust current strategies, reflecting an openness to adaptability and innovation in addressing waste management challenges. A smaller percentage, 1.3%, advocated for supporting the existing strategy, suggesting confidence in the efficacy of the current approach. Furthermore, 3.9% of respondents emphasised the importance of adopting and implementing new strategies, indicating a readiness to embrace novel solutions. Overall, these findings underscore the multifaceted nature of collaboration and stakeholder engagement, with respondents exhibiting a range of perspectives and actions aimed at enhancing waste management practices.

5.2.7. Education and training in waste management Gr=138

Table 5. 22: Education and training in waste management Gr=138

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Repurpose	58	76.3	80.6	80.6
	Refocus	1	1.3	1.4	81.9
	Change/Adjust strategy	6	7.9	8.3	90.3
	Support the strategy	2	2.6	2.8	93.1
	Adoption/Implementation	5	6.6	6.9	100.0
	Total	72	94.7	100.0	
Missing	System	4	5.3		
Total		76	100.0		

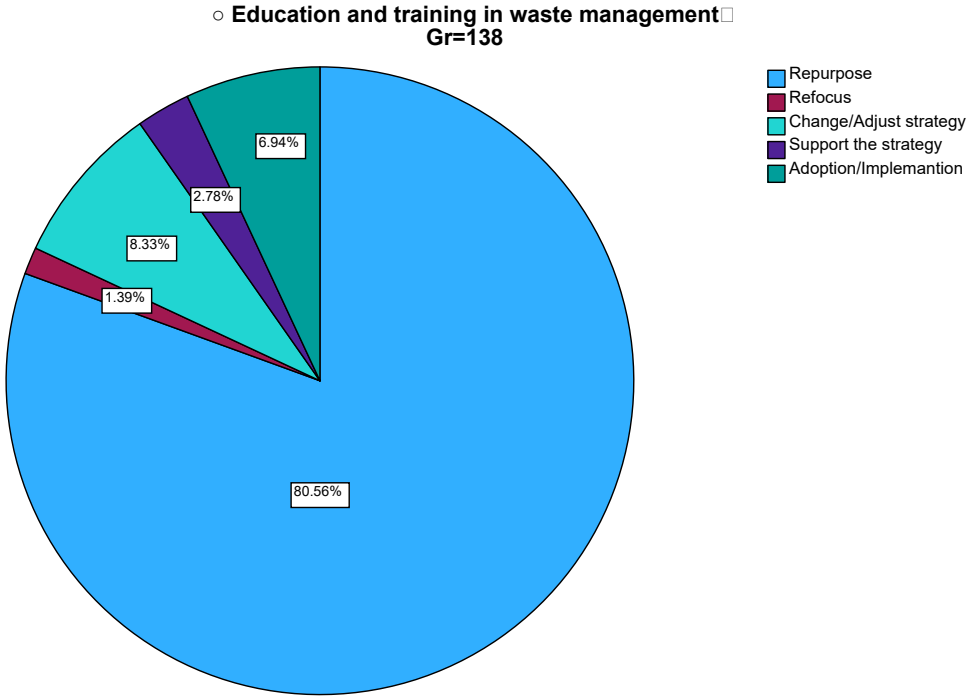

Figure 5. 7: Education and training in waste management Gr=138

The data on education and training in waste management reveal a diverse range of perspectives and actions among respondents. The majority, accounting for 76.3%, advocated for repurposing existing educational initiatives, indicating a preference for leveraging current resources and programmes to address waste management challenges. Additionally, 1.3% of respondents suggested refocusing educational efforts, signalling a need to realign priorities or areas of emphasis within educational programmes. Furthermore, 7.9% of respondents expressed a desire to change or adjust current educational strategies, highlighting a recognition of the need for flexibility and adaptation in response to evolving waste management needs. A smaller percentage, 2.6%, emphasised the importance of supporting the existing educational strategy, underscoring confidence in its effectiveness. Lastly, 6.6% of respondents highlighted the significance of adopting and implementing new educational initiatives, indicating a readiness to embrace innovative approaches to waste management education and training. These findings underscore the necessity of a multifaceted approach to education and training in effectively addressing waste management challenges.

5.2.8. Effects of COVID-19 Gr=1

Table 5. 23: Effects of COVID-19 Gr=1

		Frequency	Per cent	Valid Percent	Cumulative Percent
Valid	Repurpose	72	94.7	100.0	100.0
Missing	System	4	5.3		
Total		76	100.0		

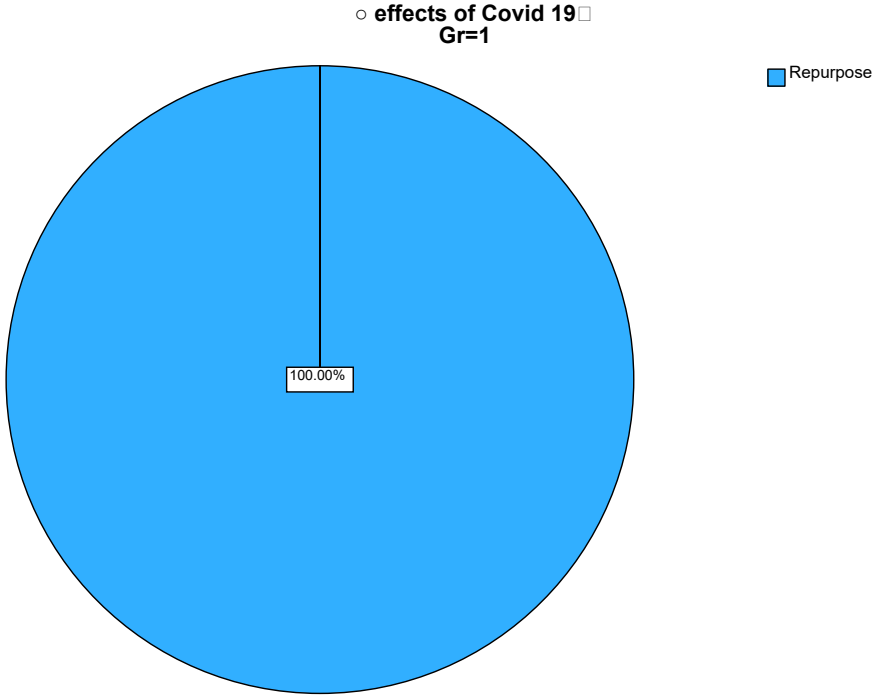

Figure 5. 8: Effects of COVID-19 Gr=1

The data regarding the effects of COVID-19 on waste management strategies indicate a unanimous response among respondents, with 94.7% agreeing on the need to repurpose existing strategies in light of the pandemic. This overwhelming consensus suggests a recognition of the unique challenges posed by COVID-19 to waste management practices and the necessity to adapt strategies accordingly. The absence of dissenting opinions or alternative suggestions underscores the widespread acknowledgement of the pandemic's impact on waste management efforts. The unanimous agreement on the need for repurposing reflects a collective understanding among respondents of the importance of agility and resilience in the face of unexpected disruptions such as the COVID-19 pandemic. This data highlight the importance of proactive measures and flexibility in addressing emergent challenges to waste management systems, ensuring continued effectiveness and sustainability amid unprecedented circumstances.

5.2.9. Environmental impact Gr=153

Table 5. 24: Environmental impact Gr=153

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Repurpose	61	80.3	84.7	84.7
	Refocus	1	1.3	1.4	86.1
	Change/Adjust strategy	1	1.3	1.4	87.5
	Support the strategy	7	9.2	9.7	97.2
	Adoption/Implementation	2	2.6	2.8	100.0
	Total	72	94.7	100.0	
Missing	System	4	5.3		
Total		76	100.0		

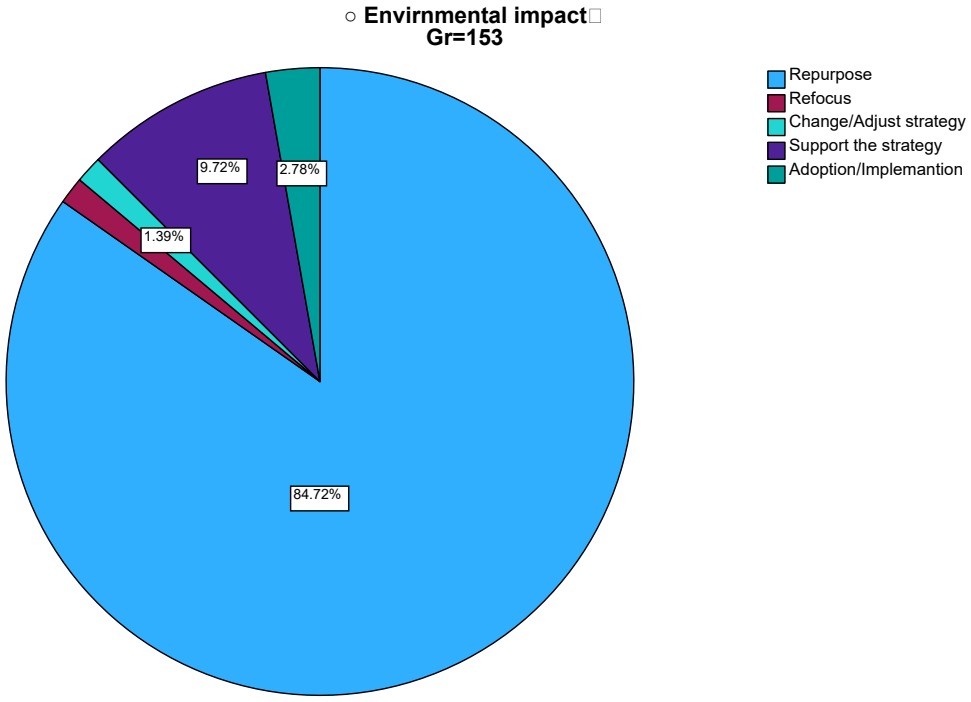

Figure 5. 9: Environmental impact Gr=153

The data concerning the environmental impact of waste management strategies reveal a variety of responses among respondents. The majority, constituting 80.3%, advocate for repurposing existing strategies to address environmental concerns, reflecting a recognition of the need for proactive measures to mitigate environmental degradation. Additionally, 9.2% of respondents express support for existing

strategies, indicating a level of confidence in their effectiveness in addressing environmental challenges. However, a smaller percentage of respondents, 1.3% each, suggest refocusing or changing/adjusting strategies, indicating a nuanced perspective on the adequacy of current approaches. Furthermore, a single respondent, comprising 1.3%, proposes the adoption or implementation of new strategies, underscoring a desire for innovation and evolution in waste management practices. Overall, the data reflect a diverse range of opinions on how best to address the environmental impact of waste management, emphasising the importance of considering various perspectives in developing comprehensive and effective strategies.

5.2.10. Financial burdens Gr=652

Table 5. 25: Financial burdens Gr=652

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Repurpose	63	82.9	87.5	87.5
	Adoption/Implementation	9	11.8	12.5	100.0
	Total	72	94.7	100.0	
Missing	System	4	5.3		
Total		76	100.0		

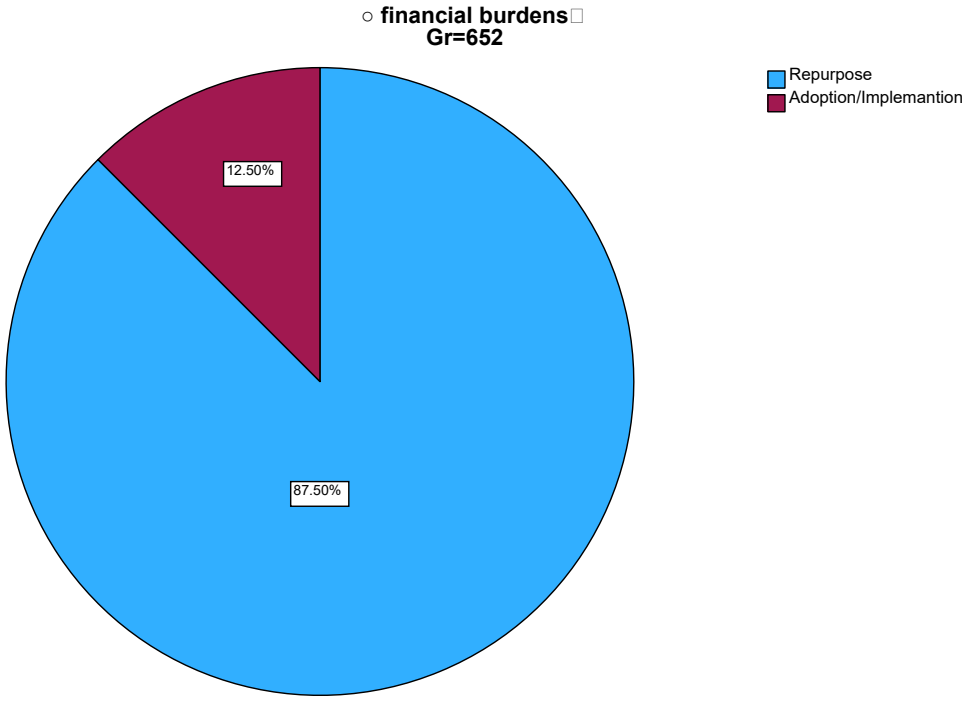

Figure 5. 10: Financial burdens Gr=652

The data regarding financial burdens associated with waste management illustrates predominant sentiments among respondents. A significant majority, comprising 82.9%, advocate for repurposing existing resources to alleviate financial strains, suggesting a preference for optimising current financial allocations rather than seeking additional funding. Additionally, 11.8% of respondents support adopting or implementing new financial strategies, indicating a recognition of the need for innovative approaches to effectively address financial challenges. However, it is notable that a smaller percentage of respondents opted for this approach compared to repurposing existing resources, highlighting a preference for leveraging existing assets rather than seeking new solutions. Overall, the data suggests a consensus among respondents on the importance of managing financial burdens related to waste management by optimising resources and, where necessary, introducing new financial strategies.

5.2.11. Financial resources Gr=789

Table 5. 26: Financial resources Gr=789

		Frequency	Per cent	Valid Percent	Cumulative Percent
Valid	Repurpose	51	67.1	70.8	70.8
	Refocus	9	11.8	12.5	83.3
	Change/Adjust strategy	4	5.3	5.6	88.9
	Support the strategy	3	3.9	4.2	93.1
	Adoption/Implementation	5	6.6	6.9	100.0
	Total	72	94.7	100.0	
Missing	System	4	5.3		
Total		76	100.0		

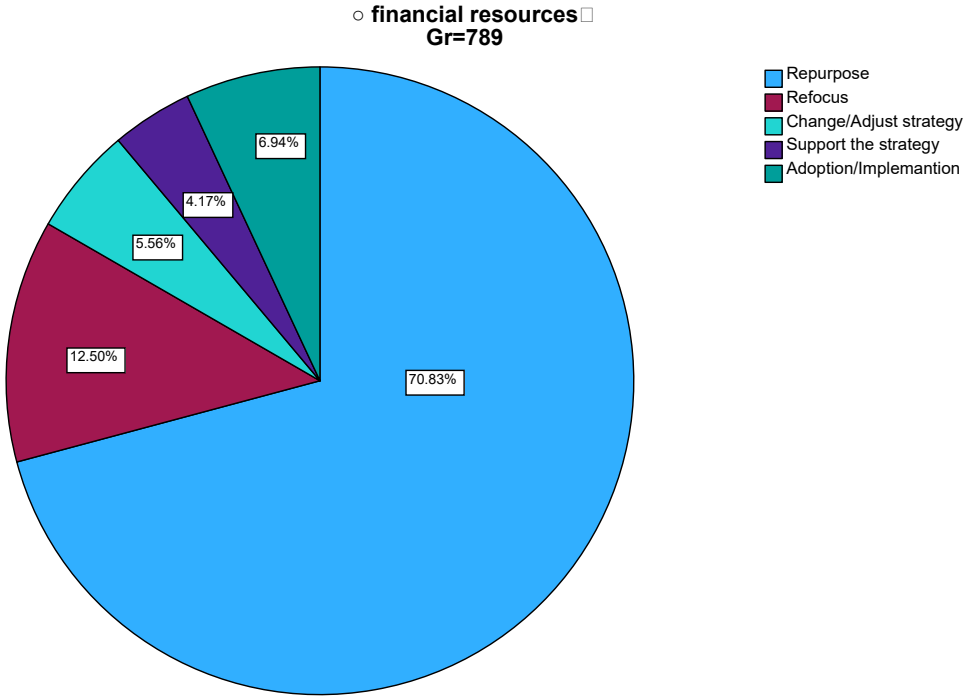

Figure 5. 11: Financial resources Gr=789

The data on financial resources in waste management highlight various perspectives among respondents. A majority, constituting 67.1%, advocate for repurposing existing financial resources, indicating a preference for reallocating funds to address waste management challenges effectively. Furthermore, 11.8% suggest refocusing financial allocations, implying a need to redirect resources towards specific waste management initiatives or areas of concern. Additionally, 5.3% propose changing or adjusting financial strategies, reflecting a willingness to adapt financial approaches to better suit evolving waste management needs. A smaller percentage, 3.9%, emphasise supporting existing financial strategies, indicating a preference for maintaining current approaches with additional backing or resources. Finally, 6.6% recommend adopting or implementing new financial strategies, suggesting a recognition of the need for innovative financial solutions to comprehensively address waste management challenges. Overall, the data underscore the importance of strategic financial management in effectively tackling waste management issues.

5.2.12. Financial support Gr=652

Table 5. 27: Financial support Gr=652

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Repurpose	58	76.3	80.6	80.6
	Refocus	10	13.2	13.9	94.4
	Adoption/Implementation	4	5.3	5.6	100.0
	Total	72	94.7	100.0	
Missing	System	4	5.3		
Total		76	100.0		

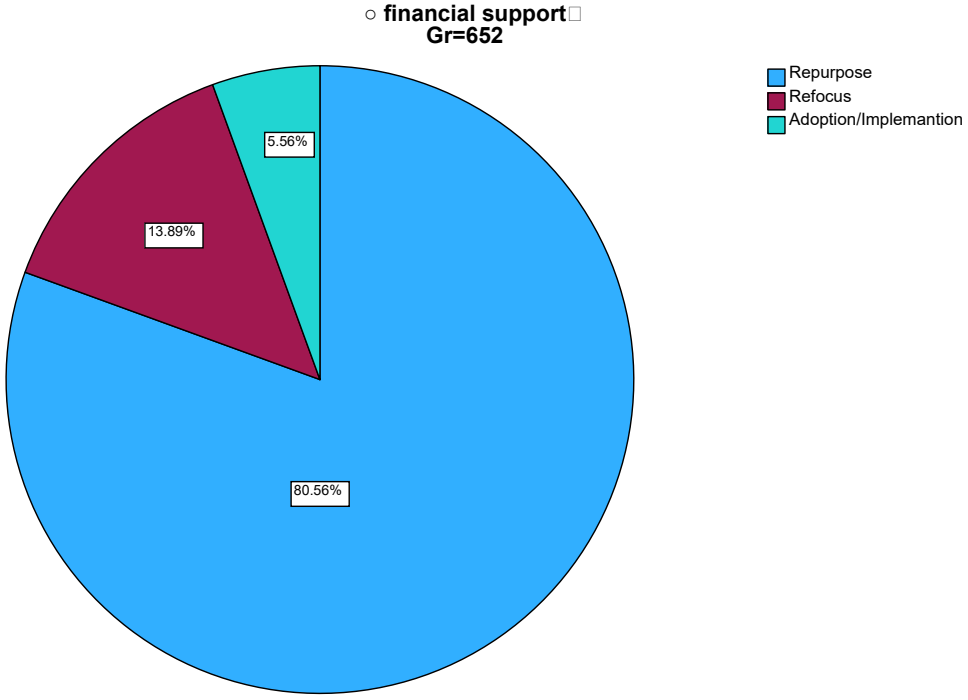

Figure 5. 12: Financial support Gr=652

The data concerning financial support in waste management demonstrate diverse viewpoints among respondents. A majority, comprising 76.3%, advocate for repurposing existing financial support, suggesting a need to reallocate funding towards more effective waste management strategies. Additionally, 13.2% propose refocusing financial support, indicating a desire to redirect resources towards specific waste management initiatives or areas of concern to enhance their effectiveness. A smaller percentage, 5.3%, suggests adopting or implementing new financial support mechanisms, reflecting a recognition of the need

for innovative approaches to address evolving waste management challenges comprehensively. Overall, the data underscore the importance of strategic financial support in effectively tackling waste management issues and the need for flexibility in financial approaches to adapt to changing circumstances and priorities.

5.2.13. Food waste Gr=1

Table 5. 28: Food waste Gr=1

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Agree	72	94.7	100.0	100.0
Missing	System	4	5.3		
Total		76	100.0		

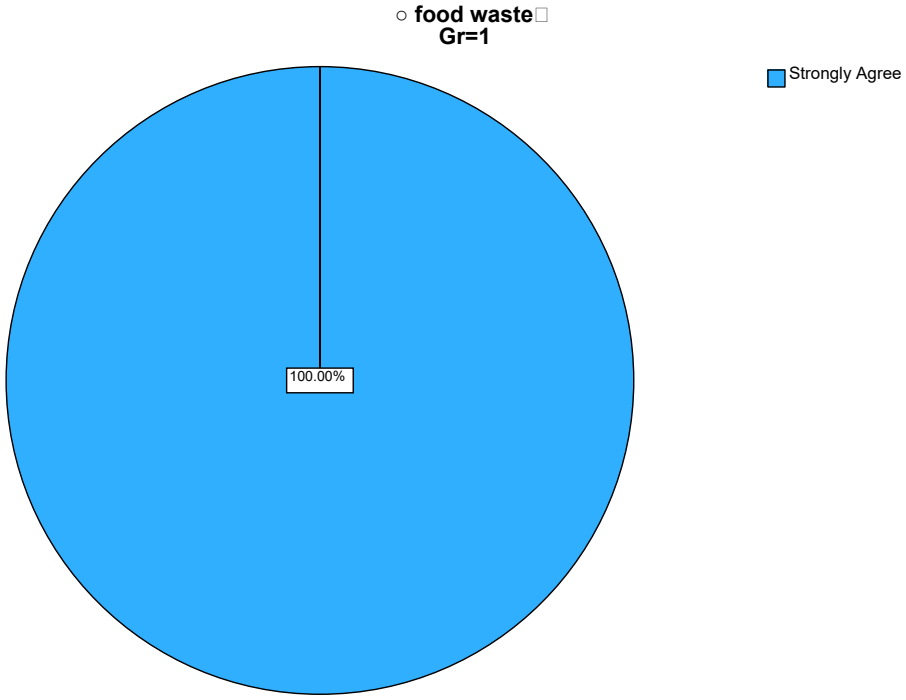

Figure 5. 13: Food waste Gr=1

The data on attitudes toward food waste reveal unanimous agreement among respondents, with 100% strongly agreeing on the significance of addressing food waste. This unanimous consensus underscores the universal recognition of the critical need to tackle food waste issues comprehensively. The overwhelming agreement suggests a shared understanding of the severity of food waste's impact on various aspects, including environmental, economic, and social dimensions. The data highlight a collective commitment to

addressing food waste challenges, indicating a potential for unified efforts in implementing strategies to minimise food waste generation, enhance food distribution efficiency, and promote sustainable consumption practices. They also highlight the importance of raising awareness and fostering behavioural changes to reduce food waste at individual, community, and organisational levels.

5.2.14. Food waste management strategies Gr=24

Table 5. 29: Food waste management strategies Gr=24

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Repurpose	55	72.4	76.4	76.4
	Refocus	3	3.9	4.2	80.6
	Change/Adjust strategy	2	2.6	2.8	83.3
	Support the strategy	10	13.2	13.9	97.2
	Adoption/Implementation	2	2.6	2.8	100.0
	Total	72	94.7	100.0	
Missing	System	4	5.3		
Total		76	100.0		

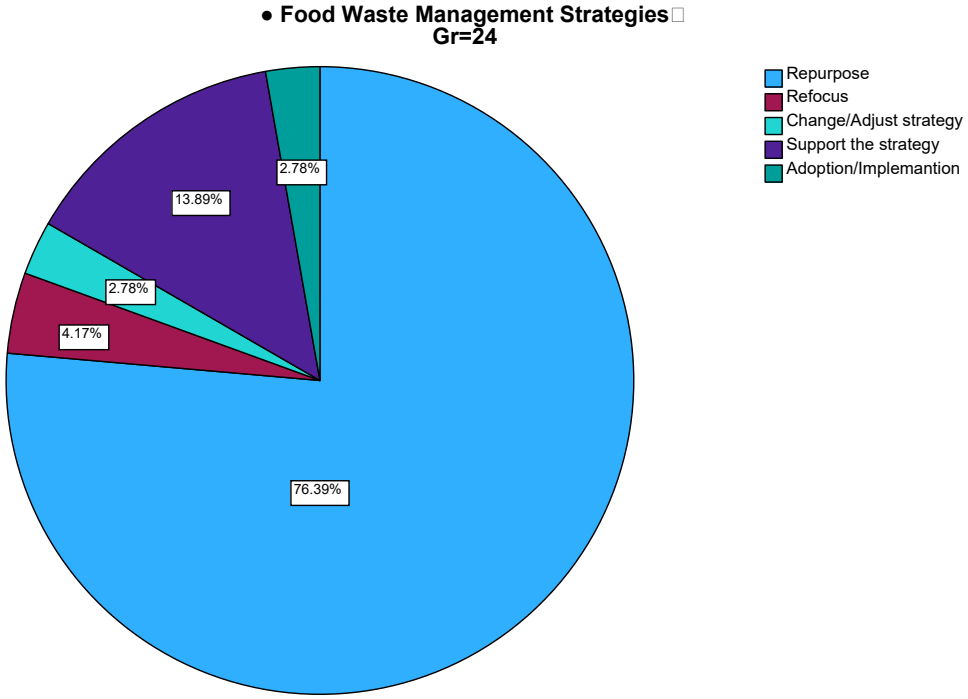

Figure 5. 14: Food Waste Management Strategies Gr=24

The data on food waste management strategies reveal a predominant inclination towards repurposing strategies, with 76.4% of respondents expressing agreement or strong agreement with this approach. This suggests a widespread recognition of the importance of repurposing food waste to minimise its environmental impact and optimise resource utilisation. Additionally, 13.9% of respondents indicated support for the strategy, demonstrating a willingness to back initiatives aimed at effectively managing food waste. However, there were also indications of a need for adjustments or refinements in current strategies, with 4.2% of respondents suggesting a need to refocus and 2.8% proposing changes to the existing strategies. The data underscore the importance of implementing comprehensive food waste management strategies that incorporate a variety of approaches to address this pressing issue effectively.

5.2.15. General waste Gr=1

Table 5. 30: General waste Gr=1

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Repurpose	70	92.1	97.2	97.2
	Change/Adjust strategy	2	2.6	2.8	100.0
	Total	72	94.7	100.0	
Missing	System	4	5.3		
Total		76	100.0		

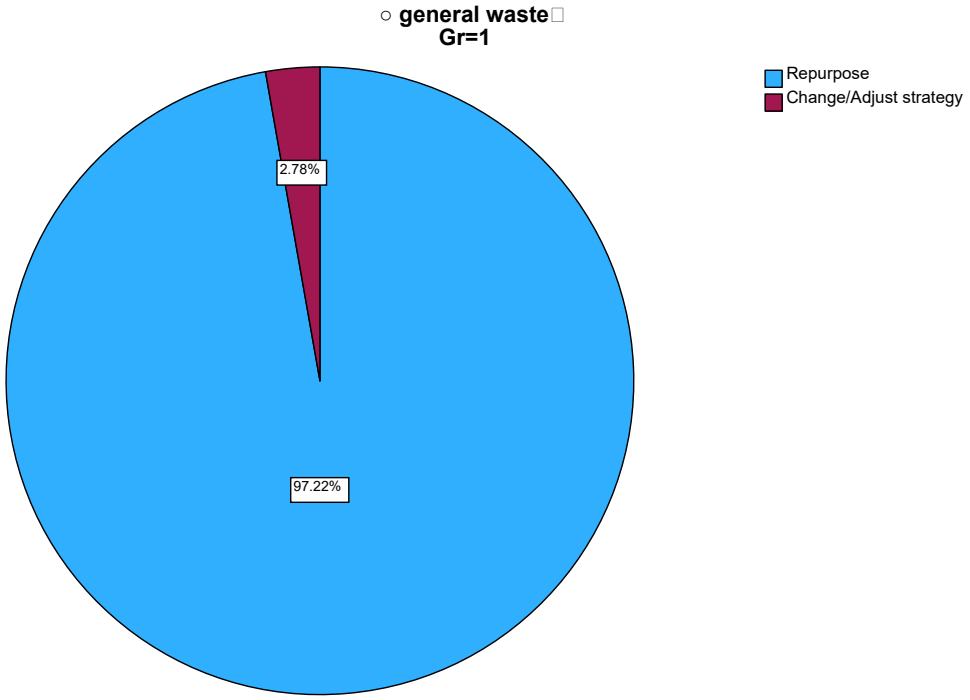

Figure 5. 15: General waste Gr=1

The statistics concerning general waste management indicate a strong consensus among respondents regarding the importance of repurposing strategies, with 97.2% expressing agreement or strong agreement with this approach. This overwhelming endorsement highlights the recognition of repurposing as a key strategy for mitigating the environmental impact of general waste and optimising resource utilisation. Additionally, a small proportion of respondents (2.8%) indicated a need for changes or adjustments to existing strategies, suggesting an awareness of areas where improvements or modifications may be necessary to enhance the effectiveness of waste management practices. Overall, these findings emphasise the significance of prioritising repurposing initiatives and continually refining waste management strategies to effectively address emerging challenges and opportunities.

5.2.16. Global challenges Gr=40

Table 5. 31: Global challenges Gr=40

		Frequency	Per cent	Valid Percent	Cumulative Percent
Valid	Strongly Agree	57	75.0	79.2	79.2
	Agree	6	7.9	8.3	87.5
	Neutral	4	5.3	5.6	93.1

	Disagree	4	5.3	5.6	98.6
	Strongly Disagree	1	1.3	1.4	100.0
	Total	72	94.7	100.0	
Missing	System	4	5.3		
Total		76	100.0		

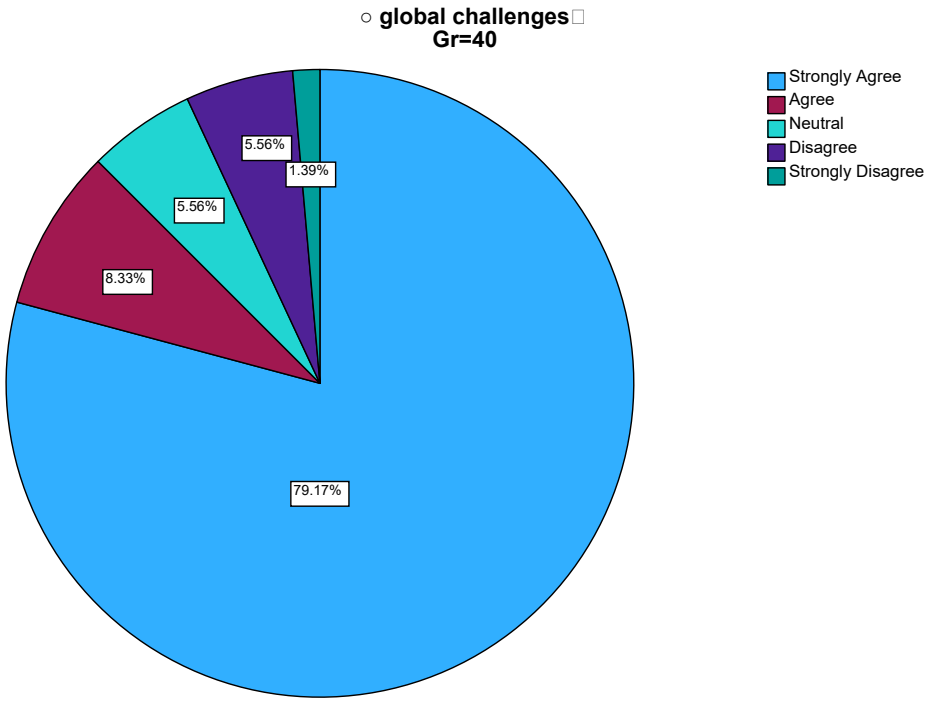

Figure 5. 16: Global challenges Gr=40

The statistics on global challenges in waste management reveal a prevailing acknowledgement of the significant hurdles faced, with 79.2% strongly agreeing on the existence of these challenges. This indicates a widespread recognition among respondents of the complexities and difficulties associated with managing waste on a global scale. Additionally, a smaller but notable portion of respondents (8.3%) agreed with this sentiment, further emphasising the consensus on the presence of global challenges in waste management. A minority expressed neutrality or disagreement, suggesting differing perspectives within the respondent pool. Overall, these findings underscore the widespread acknowledgement of the formidable global challenges in waste management, highlighting the importance of concerted efforts and innovative solutions to address these issues effectively on an international scale.

5.2.17. Global intervention practices level (GIPL) Gr=1

Table 5. 32: Global intervention practices level (GIPL) Gr=1

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Repurpose	72	94.7	100.0	100.0
Missing	System	4	5.3		
Total		76	100.0		

Global intervention practices level

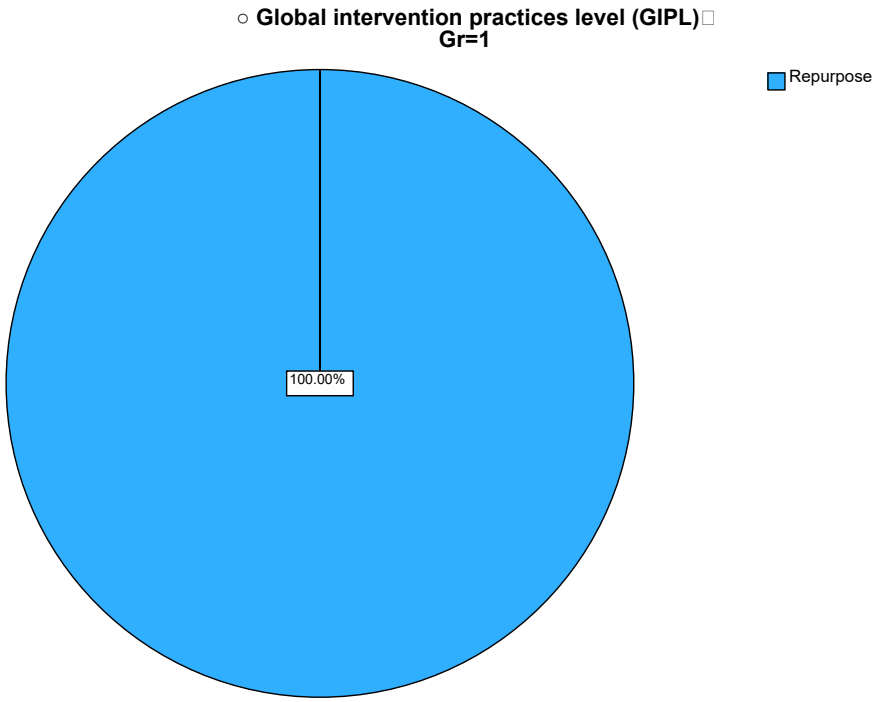

Figure 5. 17: Global intervention practices level (GIPL) Gr=1

The statistics on the GIPL indicate unanimous consensus among respondents, with 100% reporting the need to repurpose intervention practices at a global level. This suggests a universal recognition of the necessity for reevaluating and adapting intervention strategies to address pressing issues in waste management globally. The absence of any disagreement or variation in responses underscores the agreement among participants regarding the imperative to reorient intervention practices to better tackle the challenges in waste management. This unified perspective emphasises the urgency and importance of adopting innovative and adaptable approaches to address the complex and evolving landscape of waste management worldwide.

5.2.18. Health and food security Gr=20

Table 5. 33: Health and food security Gr=20

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Agree	62	81.6	86.1	86.1
	Agree	2	2.6	2.8	88.9
	Neutral	1	1.3	1.4	90.3
	Disagree	5	6.6	6.9	97.2
	Strongly Disagree	2	2.6	2.8	100.0
	Total	72	94.7	100.0	
Missing	System	4	5.3		
Total		76	100.0		

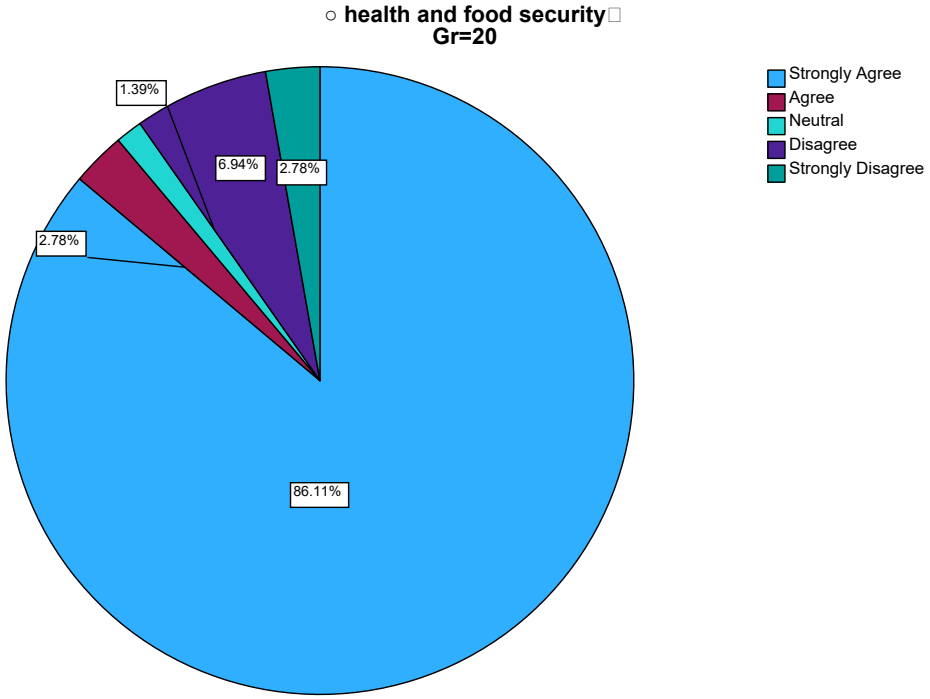

Figure 5. 18: Health and food security Gr=20

The data regarding health and food security reveals a predominant concern among respondents, with 86.1% strongly agreeing on the significance of this issue. Additionally, 2.8% agreed, while 1.4% remained neutral. However, 6.9% disagreed, and 2.8% strongly disagreed, indicating some divergence in opinions regarding the extent of the relationship between health, food security, and waste management. The majority

consensus on the importance of addressing health and food security concerns underscores the interconnectedness of waste management practices with broader societal well-being. Despite some dissenting voices, the overwhelming agreement suggests a shared recognition of the critical role that waste management plays in ensuring public health and food security. The data highlight the need for comprehensive waste management strategies that prioritise health and food security considerations to effectively address the challenges in these domains.

5.2.19. Waste on human health Gr=143

Table 5. 34: Waste on human health Gr=143

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Agree	45	59.2	62.5	62.5
	Agree	6	7.9	8.3	70.8
	Neutral	18	23.7	25.0	95.8
	Disagree	1	1.3	1.4	97.2
	Strongly Disagree	2	2.6	2.8	100.0
	Total	72	94.7	100.0	
Missing	System	4	5.3		
Total		76	100.0		

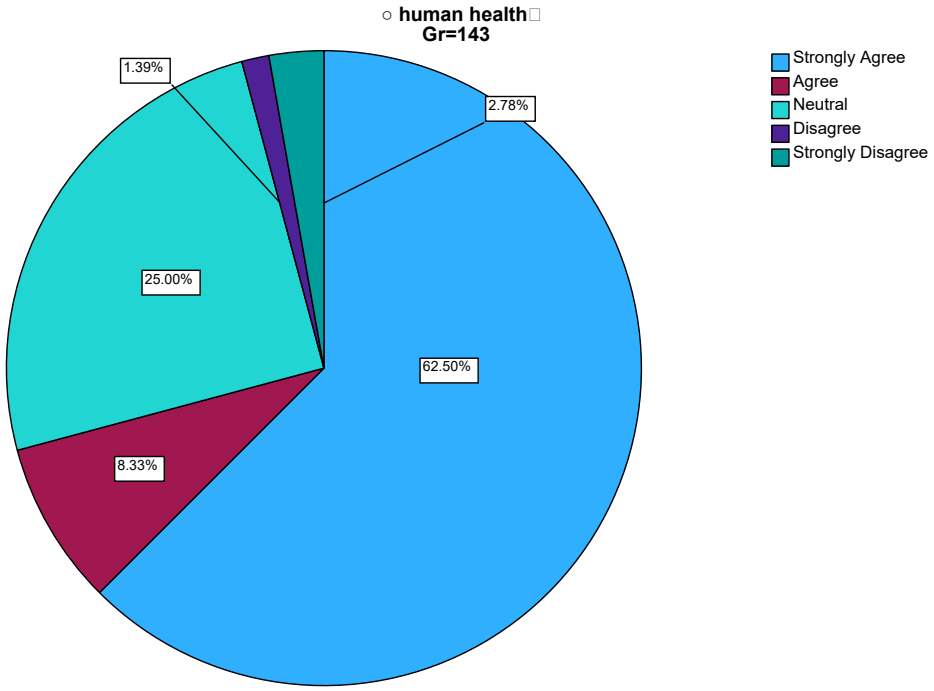

Figure 5. 19: Waste on human health

The data concerning human health reveal a mixed perspective among respondents. While 62.5% strongly agree on the importance of human health in waste management, a significant proportion, 25.0%, remain neutral. Additionally, 8.3% agree, indicating some acknowledgement but not complete consensus, while 1.4% disagree and 2.8% strongly disagree. This distribution suggests varying levels of awareness or concern regarding the direct impact of waste management practices on human health. The significant portion of respondents remaining neutral might indicate a need for more information or further education on the subject. Overall, the data underscore the importance of integrating human health considerations into waste management policies and practices. They also suggest a potential opportunity for awareness campaigns or educational initiatives to enhance understanding and engagement with this critical aspect of waste management.

5.2.20. Human health risk Gr=143

Table 5. 35: Human health risk Gr=143

		Frequency	Per cent	Valid Percent	Cumulative Percent
Valid	Strongly Agree	55	72.4	76.4	76.4
	Agree	7	9.2	9.7	86.1

	Neutral	8	10.5	11.1	97.2
	Disagree	1	1.3	1.4	98.6
	Strongly Disagree	1	1.3	1.4	100.0
	Total	72	94.7	100.0	
Missing	System	4	5.3		
Total		76	100.0		

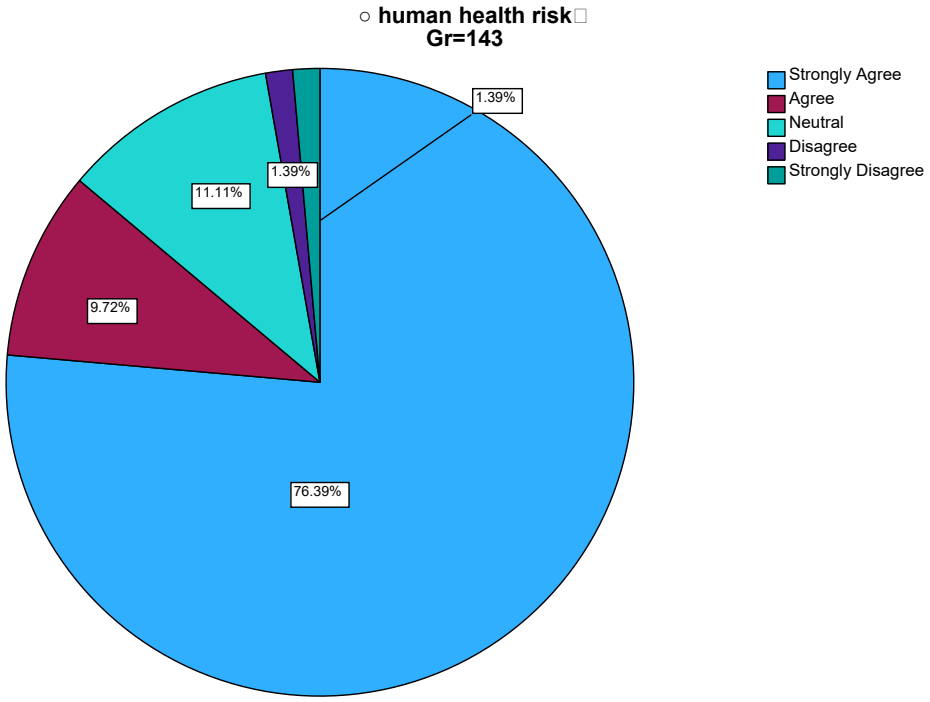

Figure 5. 20: Human health risk Gr=143

The data on human health risks associated with waste management indicate a higher level of agreement and concern among respondents compared to general human health considerations. Specifically, 76.4% strongly agree that human health risks are a significant concern in waste management practices. Additionally, 9.7% agree, while 11.1% remain neutral. Only a small percentage, 1.4%, disagree or strongly disagree with this notion. The data suggest a more unanimous recognition of the potential health risks posed by improper waste management practices. The relatively low percentage of neutral responses indicates a generally shared understanding among respondents regarding this issue. Overall, the findings highlight the importance of addressing and mitigating health risks in waste management strategies and underscore the need for proactive measures to protect public health in waste management initiatives.

5.2.21. Human interventions Gr=144

Table 5. 36: Human interventions Gr=144

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Repurpose	52	68.4	72.2	72.2
	Refocus	4	5.3	5.6	77.8
	Change/Adjust strategy	13	17.1	18.1	95.8
	Support the strategy	1	1.3	1.4	97.2
	Adoption/Implementation	2	2.6	2.8	100.0
	Total	72	94.7	100.0	
Missing	System	4	5.3		
Total		76	100.0		

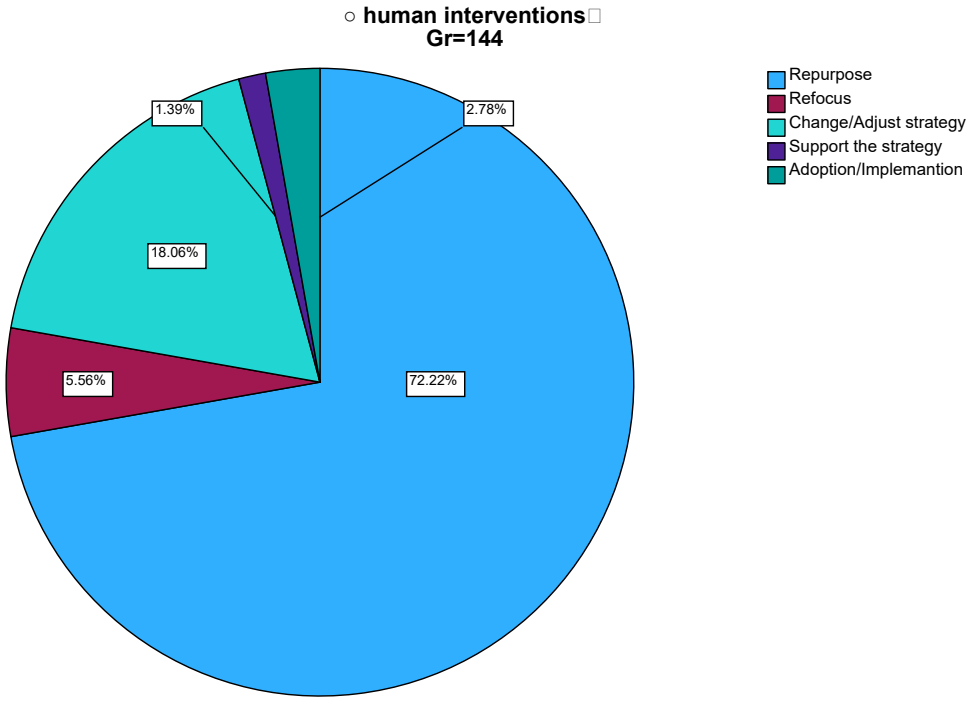

Figure 5. 21: Human interventions Gr=144

The data concerning human interventions in waste management demonstrates various levels of engagement and action. Most notably, 72.2% of respondents express a desire to repurpose these interventions, indicating a willingness to utilise existing resources in new ways. Additionally, 18.1% advocate for changing or adjusting current strategies, suggesting a recognition of the need for adaptation

and improvement. A smaller percentage, 5.6%, propose refocusing efforts, possibly indicating a redirection of attention or resources. Only 1.4% explicitly support the current strategy, which may imply that there is room for enhancement or modification. Finally, 2.8% emphasise the importance of adopting or implementing new approaches, underscoring a desire for innovation and progression in waste management practices. Overall, the data reflect a diverse range of perspectives on addressing human interventions in waste management, underscoring the complexity of the issue and the need for multifaceted solutions.

5.2.22. Waste management impact Gr=17

Table 5. 37: Waste management impact Gr=17

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Agree	61	80.3	84.7	84.7
	Agree	5	6.6	6.9	91.7
	Neutral	1	1.3	1.4	93.1
	Disagree	1	1.3	1.4	94.4
	Strongly Disagree	3	3.9	4.2	98.6
	8	1	1.3	1.4	100.0
	Total	72	94.7	100.0	
Missing	System	4	5.3		
Total		76	100.0		

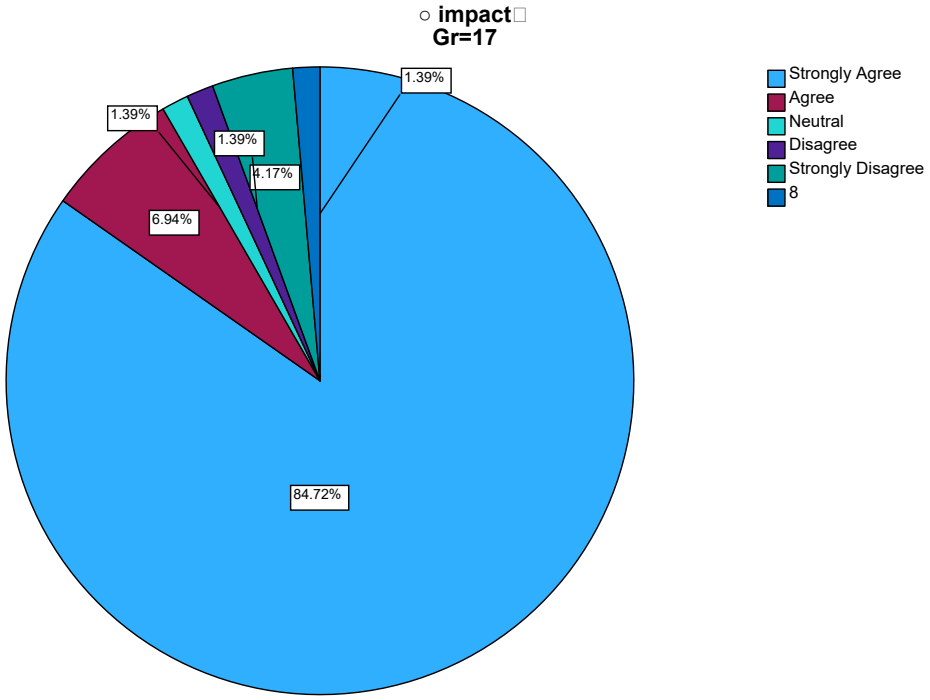

Figure 5. 22: Waste management impact Gr=17

The data on the impact of waste management initiatives indicate a generally positive perception among respondents. A significant majority, comprising 84.7%, strongly agree that waste management has a substantial impact. Additionally, 6.9% agree with this sentiment, contributing to a cumulative agreement of 91.7%. Only a small percentage express neutrality or disagreement, with 1.4% each, while 4.2% strongly disagree with the notion that waste management has a significant impact. Interestingly, there is an anomaly in the data with an entry labelled "8", representing 1.4% of responses. This discrepancy may require further investigation to understand its origin and significance. Overall, the overwhelming consensus among respondents regarding the positive impact of waste management suggests a recognition of its importance in addressing environmental concerns and promoting sustainability.

5.2.23. Implementation of technologically driven waste management Gr=381

Table 5. 38: Implementation of technologically driven waste management Gr=381

		Frequency	Per cent	Valid Percent	Cumulative Percent
Valid	Repurpose	64	84.2	88.9	88.9
	Change/Adjust strategy	2	2.6	2.8	91.7
	Support the strategy	1	1.3	1.4	93.1
	Adoption/Implementation	5	6.6	6.9	100.0
	Total	72	94.7	100.0	
Missing	System	4	5.3		
Total		76	100.0		

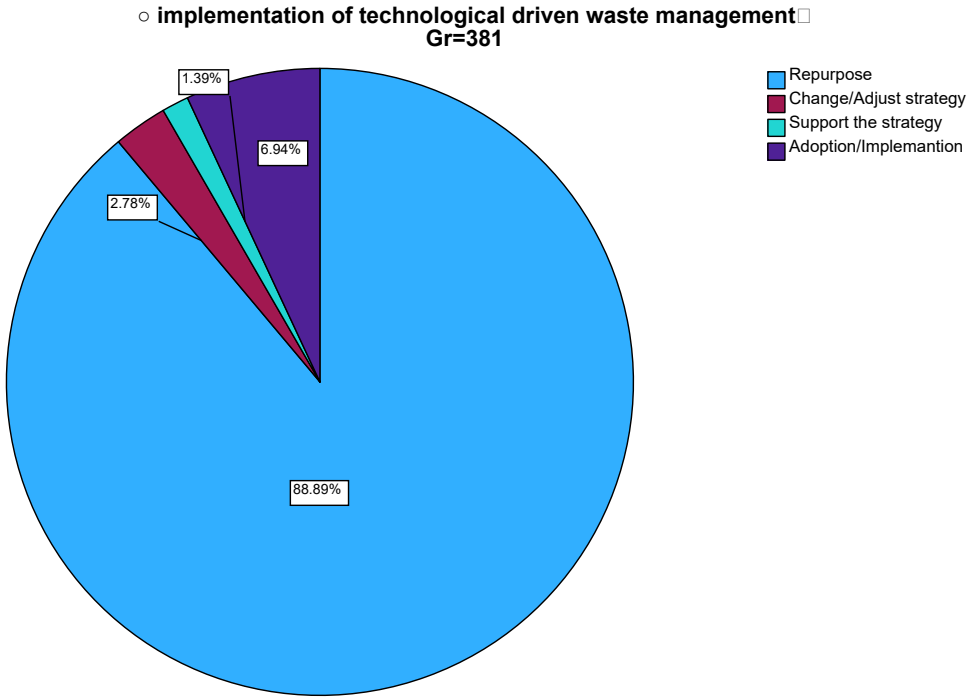

Figure 5. 23: Implementation of technologically driven waste management Gr=381

The statistics on the implementation of technology-driven waste management reveal a generally positive attitude towards this approach. A significant proportion, 88.9%, agree or strongly agree that technological interventions can be repurposed effectively for waste management. This suggests a widespread recognition of technology's potential in addressing waste-related challenges. Additionally, 2.8% express a willingness to change or adjust existing strategies to accommodate technological advancements, contributing to a cumulative agreement of 91.7%. Only a small fraction, 1.4%, indicates a need for support in implementing

technological solutions, while 6.9% specifically endorse the adoption and implementation of such strategies. The high percentage of respondents supporting the adoption of technology-driven waste management suggests a strong belief in its efficacy and potential to improve waste management practices. This positive reception underscores the importance of technological innovation in addressing contemporary environmental issues.

5.2.24. Prevent food waste Gr=3

Table 5. 39: Prevent food waste Gr=3

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Agree	62	81.6	86.1	86.1
	Agree	2	2.6	2.8	88.9
	Neutral	6	7.9	8.3	97.2
	Disagree	1	1.3	1.4	98.6
	Strongly Disagree	1	1.3	1.4	100.0
	Total	72	94.7	100.0	
Missing	System	4	5.3		
Total		76	100.0		

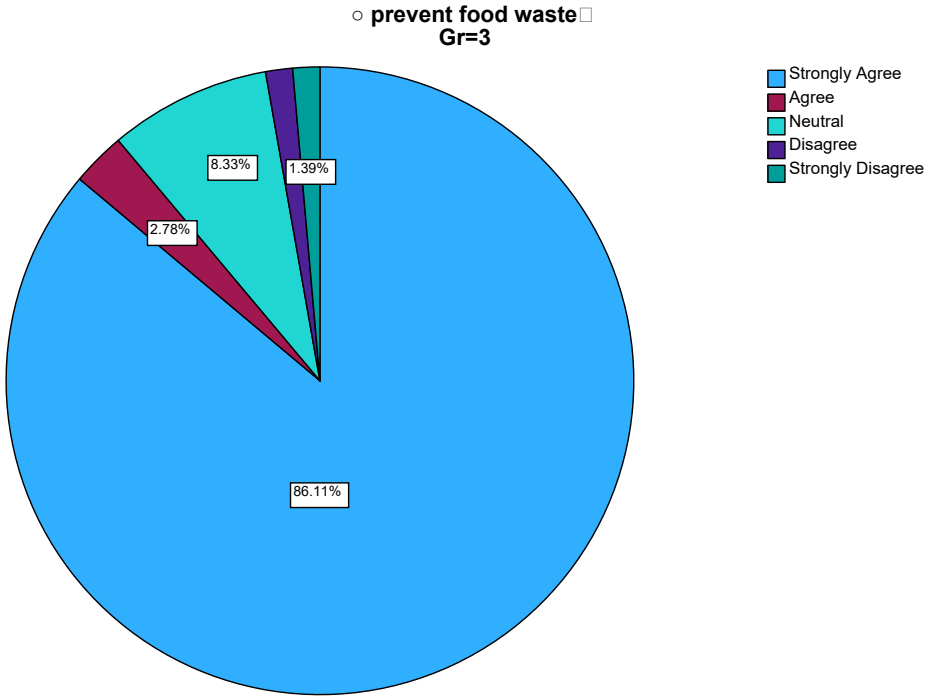

Figure 5. 24: Prevent food waste Gr=3

The data on preventing food waste reveal a significant consensus among the respondents. A majority (86.1%) strongly agree on the importance of preventing food waste, indicating a shared recognition of the need to address this issue. Additionally, a small percentage either agree or disagree, while some remain neutral. The presence of neutral responses suggests a potential for further education or discussion to clarify perspectives on food waste prevention. Overall, the high percentage of respondents who strongly agree underscores the importance placed on this aspect of waste management. It indicates a collective understanding of the environmental, economic, and social impacts of food waste and the urgency to implement measures to mitigate it. However, the presence of some dissenting opinions suggests that there may be differing viewpoints or challenges to consider when implementing food waste prevention strategies effectively. Therefore, while there is a strong consensus, it is essential to address diverse perspectives and potential barriers to maximise the effectiveness of prevention efforts.

5.2.25. Sustainable waste management practice Gr=5856

Table 5. 40: Sustainable waste management practice Gr=5856

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Repurpose	22	28.9	30.6	30.6
	Refocus	16	21.1	22.2	52.8
	Change/Adjust strategy	10	13.2	13.9	66.7
	Support the strategy	1	1.3	1.4	68.1
	Adoption/Implementation	23	30.3	31.9	100.0
	Total	72	94.7	100.0	
Missing	System	4	5.3		
Total		76	100.0		

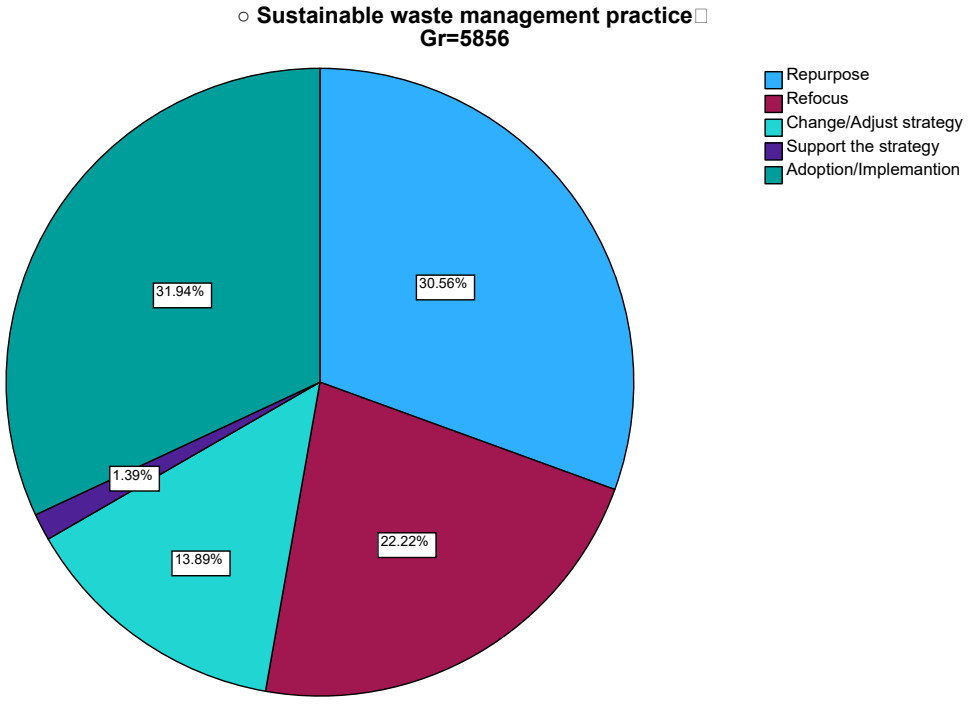

Figure 5. 25: Sustainable waste management practice Gr=5856

In the realm of sustainable waste management practices, various approaches are suggested. Of the respondents, 28.9% advocate for repurposing existing methods, indicating a desire to reuse or adapt current strategies for better sustainability outcomes. Additionally, 21.1% propose refocusing efforts, suggesting a need to shift attention or resources to different aspects of waste management for improved sustainability.

Another 13.2% recommend changing or adjusting strategies, reflecting the necessity for flexibility and adaptation in response to evolving challenges. Furthermore, 1.3% express support for existing strategies, while 30.3% advocate for their adoption or implementation, highlighting a significant emphasis on action and execution in achieving sustainable waste management goals. These findings underscore a multifaceted approach to addressing waste management challenges, combining elements of innovation, adaptation, and implementation for sustainable outcomes.

5.2.26. Local challenges Gr=41

Table 5. 41: Local challenges Gr=41

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Agree	55	72.4	76.4	76.4
	Agree	5	6.6	6.9	83.3
	Neutral	5	6.6	6.9	90.3
	Disagree	5	6.6	6.9	97.2
	Strongly Disagree	1	1.3	1.4	98.6
	7	1	1.3	1.4	100.0
	Total	72	94.7	100.0	
Missing	System	4	5.3		
Total		76	100.0		

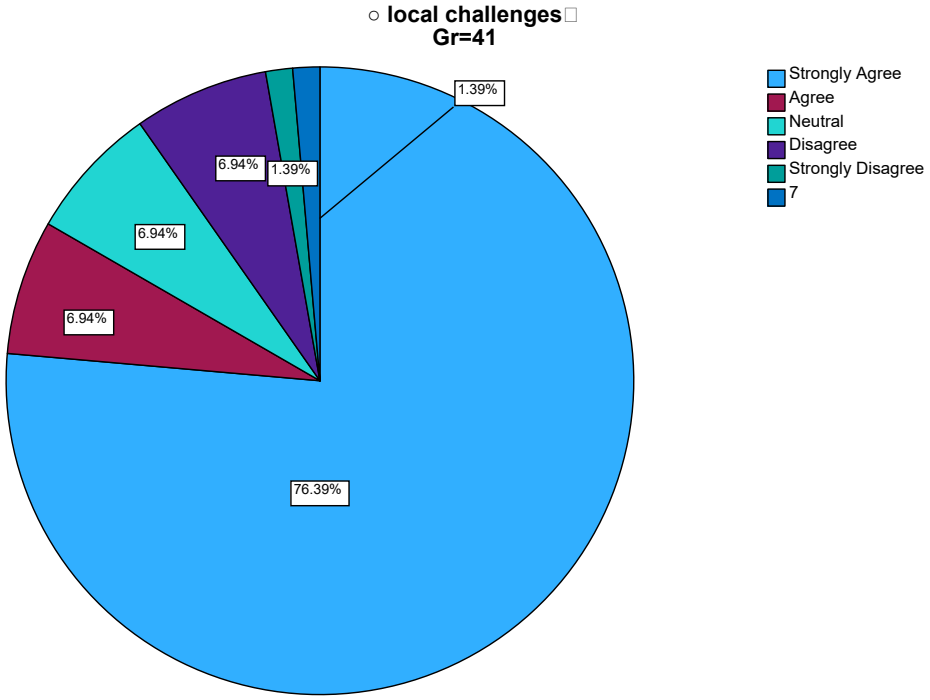

Figure 5. 26: Local challenges Gr=41

The data regarding local challenges in waste management indicate a mixed perception among respondents. A substantial portion, 76.4%, either strongly agree or agree that there are significant challenges at the local level. This suggests widespread acknowledgement of the complexities and difficulties faced in managing waste within local communities. Additionally, 6.9% express a neutral stance, indicating uncertainty or a lack of strong opinion regarding the extent of these challenges. Meanwhile, 8.3% either disagree or strongly disagree, suggesting a minority perspective that views local challenges as less significant. However, it is crucial to note that the majority of respondents recognise the presence of challenges at the local level, highlighting the importance of targeted interventions and solutions tailored to address these specific issues. This underscores the need for localised approaches and community engagement strategies in waste management initiatives to effectively tackle the challenges faced at the grassroots level.

5.2.27. Model for waste reduction and prevention strategies Gr=0

Table 5. 42: Model for waste reduction and prevention strategies Gr=0

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Repurpose	69	90.8	95.8	95.8
	Refocus	3	3.9	4.2	100.0
	Total	72	94.7	100.0	
Missing	System	4	5.3		
Total		76	100.0		

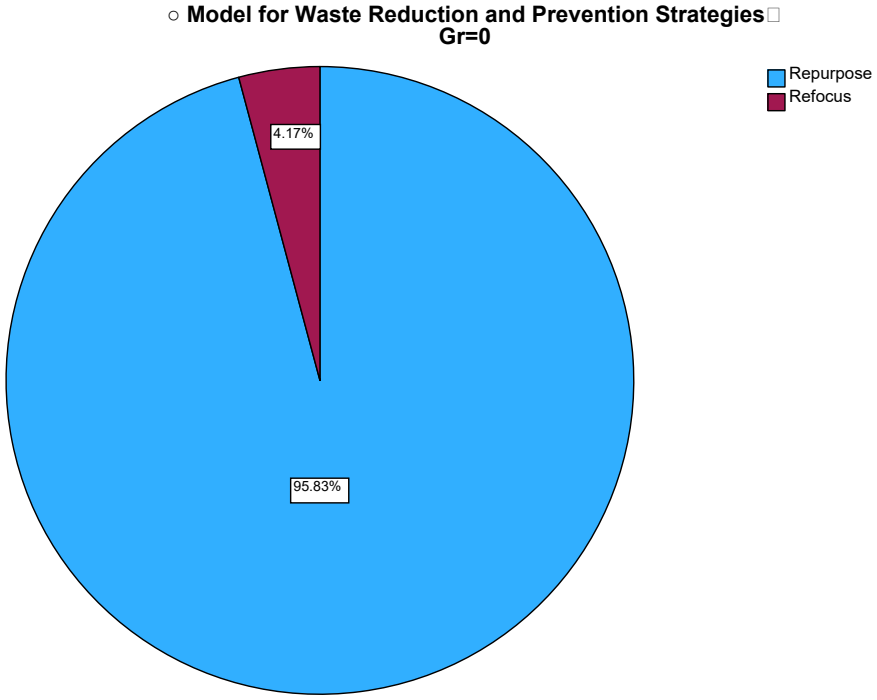

Figure 5. 27: Model for waste reduction and prevention strategies Gr=0

The statistics regarding the model for waste reduction and prevention strategies reveal a notable trend. A vast majority of respondents, accounting for 95.8%, either strongly agree or agree with repurposing or reusing existing waste reduction and prevention strategies rather than creating entirely new models. This suggests a consensus among respondents on the importance and effectiveness of building upon existing frameworks and strategies to address waste reduction and prevention. Additionally, 4.2% of respondents express a willingness to refocus or make minor adjustments to existing models, indicating a minority perspective that sees room for improvement or optimisation within current strategies. Overall, the data

underscore the significance of leveraging established approaches and best practices in waste management rather than reinventing the wheel, emphasising the value of continuity and efficiency in addressing waste reduction and prevention challenges.

5.2.28. National Waste Management Strategy Gr=1

Table 5. 43: National Waste Management Strategy Gr=1

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Repurpose	65	85.5	90.3	90.3
	Refocus	6	7.9	8.3	98.6
	Change/Adjust strategy	1	1.3	1.4	100.0
	Total	72	94.7	100.0	
Missing	System	4	5.3		
Total		76	100.0		

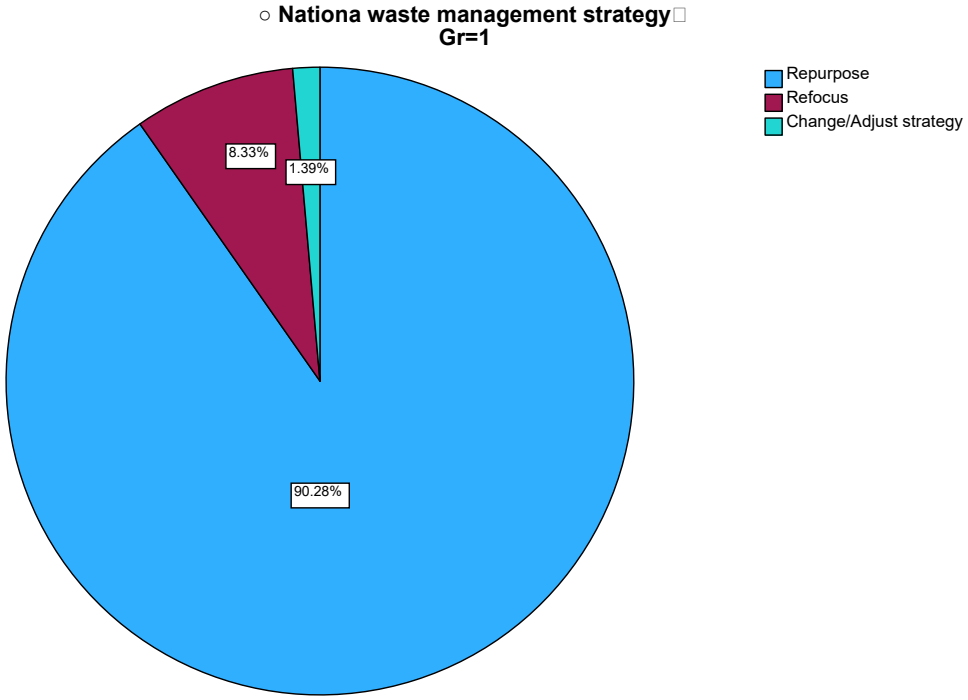

Figure 5. 28: National Waste Management Strategy Gr=1

The statistics for the National Waste Management Strategy demonstrate a clear preference for repurposing existing strategies. A significant majority of respondents, comprising 90.3%, express a preference for

repurposing the current national waste management strategy rather than completely redesigning it. This indicates a widespread recognition of the value and effectiveness of the current approach, suggesting that stakeholders are generally satisfied with its framework and objectives. Additionally, 8.3% of respondents advocate for refocusing or making minor adjustments to the existing strategy, reflecting a smaller but still notable perspective that sees room for improvement within the current framework. With only 1.4% suggesting a need for significant changes, the data indicate a high level of confidence in the current national waste management strategy among respondents, highlighting the importance of continuity and stability in waste management policies.

5.2.29. Plastic waste pollution Gr=12

Table 5. 44: Plastic waste pollution Gr=12

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Repurpose	61	80.3	84.7	84.7
	Refocus	3	3.9	4.2	88.9
	Change/Adjust strategy	4	5.3	5.6	94.4
	Support the strategy	2	2.6	2.8	97.2
	Adoption/Implementation	2	2.6	2.8	100.0
	Total	72	94.7	100.0	
Missing	System	4	5.3		
Total		76	100.0		

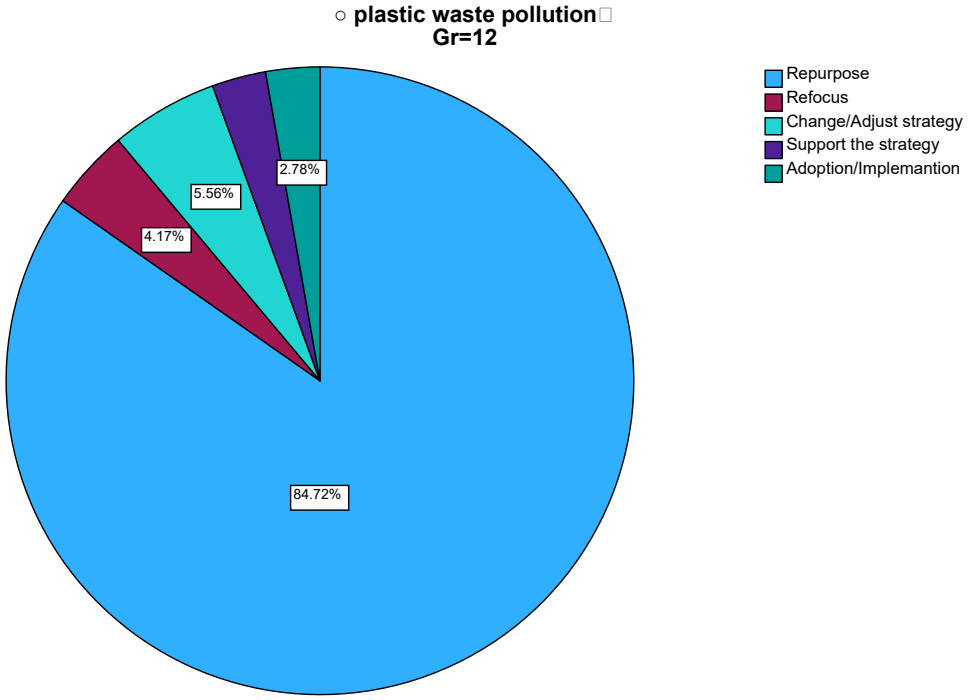

Figure 5. 29: Plastic waste pollution Gr=12

The statistics regarding "Plastic Waste Pollution" indicate a prevalent inclination towards repurposing existing strategies to address this issue. Approximately 84.7% of respondents advocate for repurposing current strategies, reflecting a widespread recognition of the value and effectiveness of existing approaches in combating plastic waste pollution. Additionally, 4.2% suggest refocusing on certain aspects of the current strategies, while 5.6% propose making changes or adjustments to the existing framework. This indicates a nuanced perspective among respondents, with some recognising the need for minor modifications to enhance effectiveness. Moreover, 2.8% express support for the current strategies, indicating satisfaction with the ongoing efforts to tackle plastic waste pollution. Another 2.8% advocate for the adoption or implementation of new strategies, highlighting a smaller but still notable group seeking innovative solutions to address this pressing environmental issue. Overall, the data underscore the importance of a multifaceted approach to combat plastic waste pollution, incorporating elements of continuity, adaptation, and innovation.

5.2.30. Food waste pollution impact and side effects Gr=373

Table 5. 45: Food waste pollution impact and side effects Gr=373

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Repurpose	55	72.4	76.4	76.4
	Refocus	9	11.8	12.5	88.9
	Change/Adjust strategy	1	1.3	1.4	90.3
	Support the strategy	3	3.9	4.2	94.4
	Adoption/Implementation	4	5.3	5.6	100.0
	Total	72	94.7	100.0	
Missing	System	4	5.3		
Total		76	100.0		

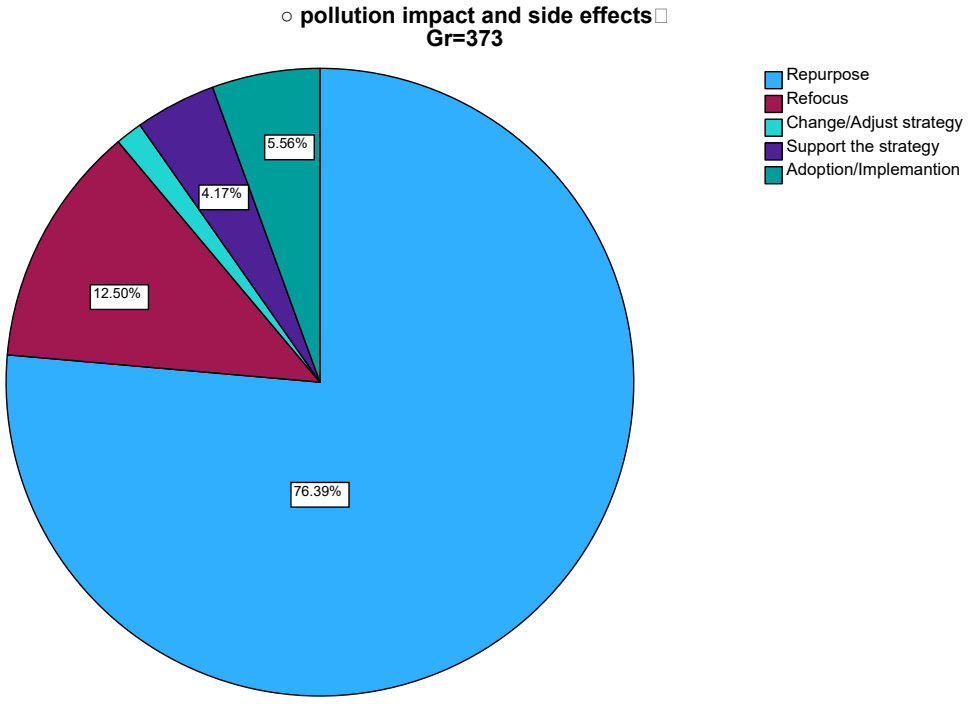

Figure 5. 30: Food waste pollution impact and side effects Gr=373

The data on food waste pollution impact and side effects reveal various perspectives on addressing this critical issue. Approximately 76.4% of respondents advocate for repurposing existing strategies, indicating a widespread belief in the value of current approaches to mitigate the impact and side effects of food waste pollution. Additionally, 12.5% suggest refocusing efforts, potentially signalling a recognition of areas

where existing strategies may need redirection or emphasis. A smaller proportion, 1.4%, recommends making changes or adjustments to current strategies, reflecting a nuanced perspective on potential improvements. Furthermore, 4.2% express support for the current strategies, indicating confidence in their effectiveness. Finally, 5.6% advocate for the adoption or implementation of new strategies, suggesting an openness to innovation and novel approaches to tackling food waste pollution. Overall, the data underscore the complexity of addressing this issue and the importance of considering a range of strategies, from maintaining existing frameworks to exploring innovative solutions.

5.2.31. Waste pollution levels Gr=299

Table 5. 46: Waste pollution levels Gr=299

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Repurpose	58	76.3	80.6	80.6
	Refocus	3	3.9	4.2	84.7
	Change/Adjust strategy	5	6.6	6.9	91.7
	Support the strategy	1	1.3	1.4	93.1
	Adoption/Implementation	5	6.6	6.9	100.0
	Total	72	94.7	100.0	
Missing	System	4	5.3		
Total		76	100.0		

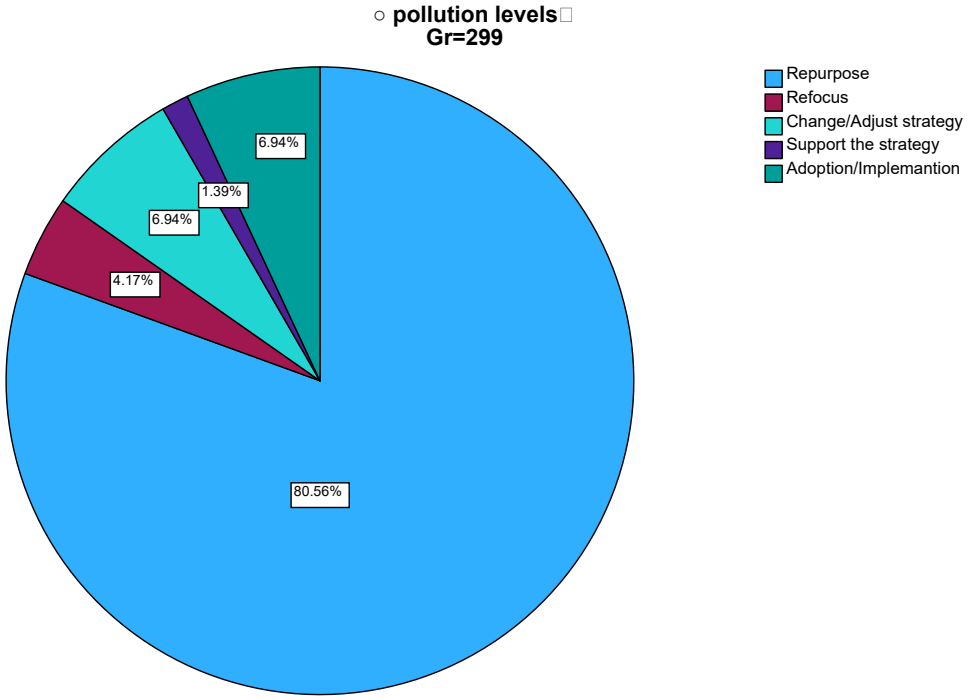

Figure 5. 31: Waste pollution levels Gr=299

The data on waste pollution levels suggest a range of perspectives on how to address this pressing issue. Approximately 80.6% of respondents advocate for repurposing existing strategies, indicating a widespread belief in the value of current approaches to mitigating waste pollution levels. Additionally, 4.2% suggest refocusing efforts, potentially signalling a recognition of areas where existing strategies may need redirection or emphasis. A further 6.9% propose making changes or adjustments to current strategies, reflecting a nuanced perspective on potential improvements. Furthermore, 1.4% express support for the current strategies, indicating confidence in their effectiveness. Finally, another 6.9% advocate for the adoption or implementation of new strategies, suggesting an openness to innovation and novel approaches to tackling waste pollution levels. Overall, the data underscore the complexity of addressing this issue and highlight the importance of considering a range of strategies, from maintaining existing frameworks to exploring innovative solutions.

5.2.32. Post-COVID-19 Gr=1

Table 5. 47: Post-COVID-19 Gr=1

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Agree	71	93.4	98.6	98.6
	Agree	1	1.3	1.4	100.0
	Total	72	94.7	100.0	
Missing	System	4	5.3		
Total		76	100.0		

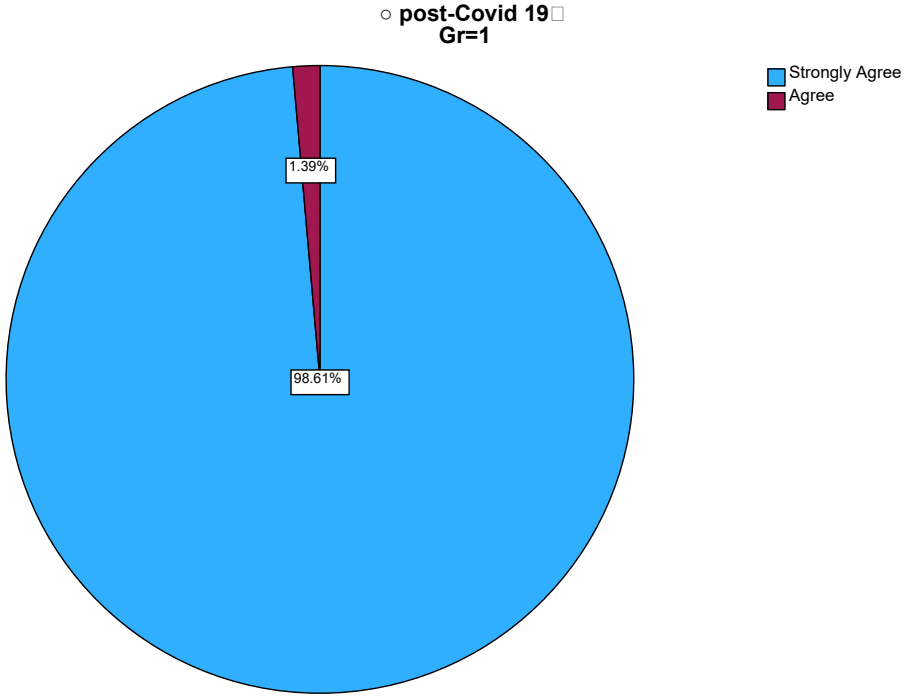

Figure 5. 32: Post-Covid 19 Gr=1

The data regarding attitudes toward post-COVID-19 scenarios indicate a high level of consensus among respondents. A significant majority, comprising 98.6%, strongly agree that there will be significant changes or impacts post-pandemic. This suggests a widespread acknowledgment of the transformative effects of the pandemic on various aspects of life, including social, economic, and environmental dimensions. Additionally, 1.4% of respondents express agreement with this perspective. The overwhelming agreement across the dataset underscores the universal recognition of the profound impact of COVID-19 and the anticipation of its lasting effects. This collective awareness may indicate a readiness

to adapt to the new normal and proactively address challenges arising from the pandemic's aftermath. Overall, the data reflect a unified understanding of the need for preparedness and adaptation in the post-COVID-19 era.

5.2.33. Potential solution to waste management Gr=1

Table 5. 48: Potential solution to waste management Gr=1

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Repurpose	65	85.5	90.3	90.3
	Refocus	2	2.6	2.8	93.1
	Change/Adjust strategy	4	5.3	5.6	98.6
	Adoption/Implementation	1	1.3	1.4	100.0
	Total	72	94.7	100.0	
Missing	System	4	5.3		
Total		76	100.0		

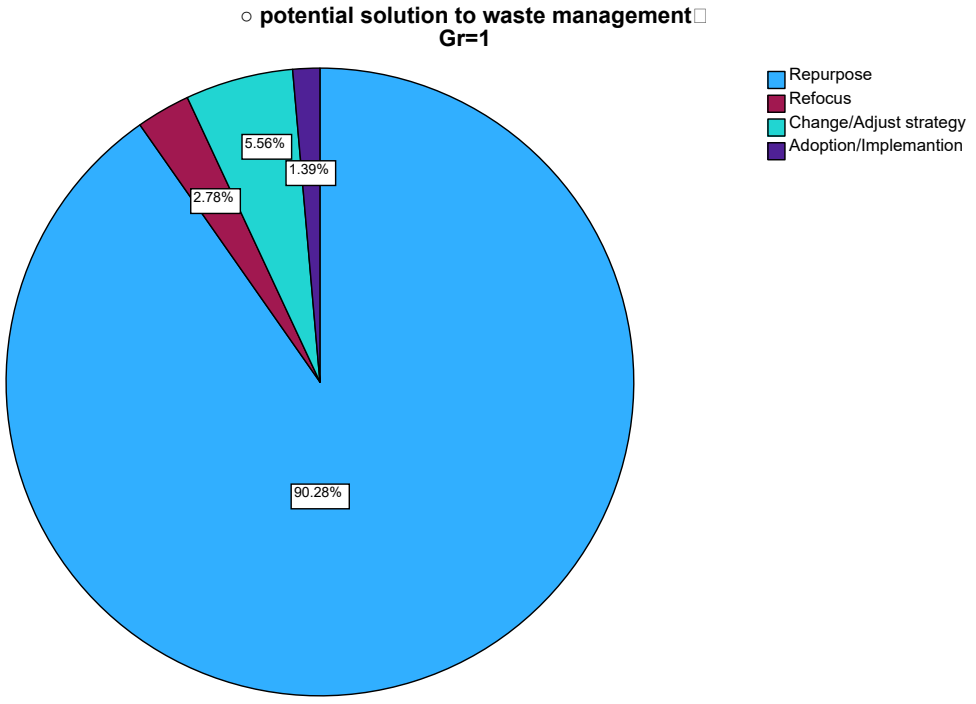

Figure 5. 33: Potential solution to waste management Gr=1

The data regarding potential solutions to waste management highlight a predominant inclination towards repurposing existing strategies. Specifically, 90.3% of the respondents strongly agree that repurposing holds promise as a solution. This indicates a widespread belief in the efficacy of adapting and reusing existing methods to address waste management challenges effectively. Additionally, a small percentage of respondents, 2.8%, advocate for refocusing efforts, while 5.6% suggest changing or adjusting current strategies. A negligible proportion, 1.4%, supports the adoption or implementation of entirely new approaches. Overall, the data suggest a preference for leveraging existing frameworks and approaches in addressing waste management issues. This inclination towards repurposing underscores a pragmatic approach, acknowledging the value of building upon established practices while also remaining open to incremental adjustments and innovations.

5.2.34. Waste potential threat Gr=2

Table 5. 49: Waste potential threat Gr=2

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Repurpose	72	94.7	100.0	100.0
Missing	System	4	5.3		
Total		76	100.0		

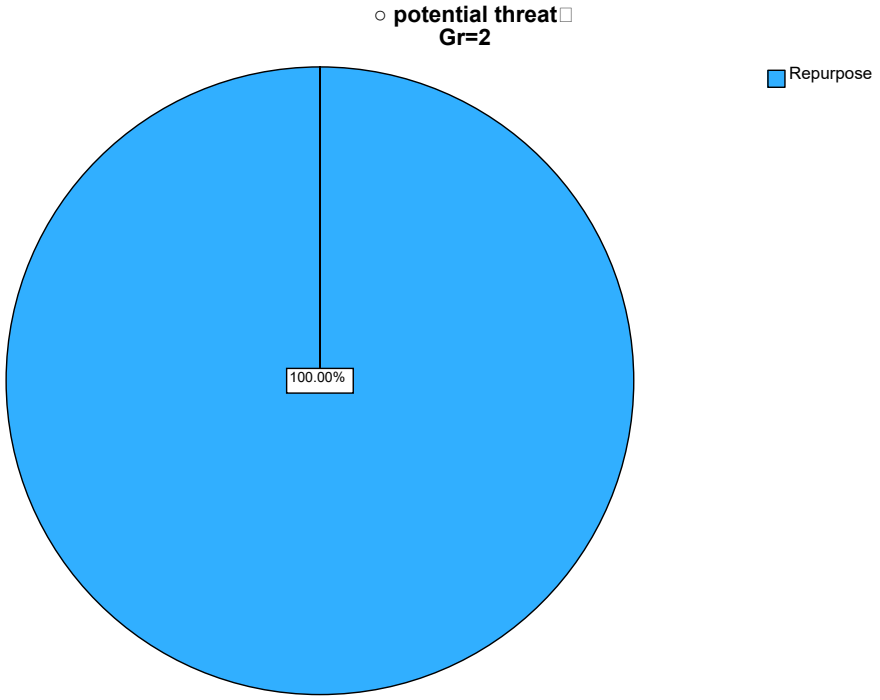

Figure 5. 34: Waste potential threat Gr=2

The data on the perceived threat posed by waste show a unanimous consensus among respondents, with 100% strongly agreeing on the need to repurpose waste. This indicates a recognition of waste not merely as a problem but as a potential resource that can be repurposed or recycled effectively. The absence of disagreement or alternative viewpoints underscores the severity of the perceived threat posed by waste and the urgency for action. This reflects a collective acknowledgment of the critical importance of finding innovative ways to manage and mitigate the negative impacts of waste on the environment, public health, and society at large. The unanimity in responses underscores the gravity of the issue and the necessity for comprehensive strategies to address waste management challenges effectively.

5.2.35. Problems of waste management Gr=11

Table 5. 50: Problems of waste management Gr=11

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Repurpose	62	81.6	86.1	86.1
	Refocus	4	5.3	5.6	91.7
	Change/Adjust strategy	3	3.9	4.2	95.8
	Support the strategy	2	2.6	2.8	98.6

	Adoption/Implementation	1	1.3	1.4	100.0
	Total	72	94.7	100.0	
Missing	System	4	5.3		
Total		76	100.0		

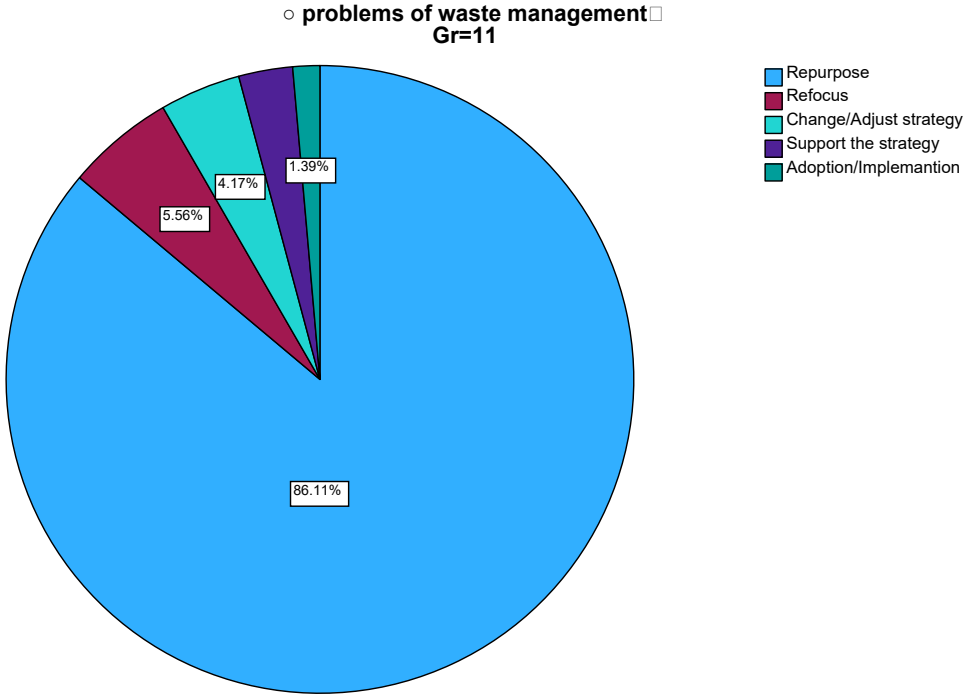

Figure 5. 35: Problems of waste management Gr=11

The data on waste management challenges reveal a diverse range of perspectives among respondents. A majority (86.1%) recognise the existence of problems in waste management and express a willingness to address them. Among these, the largest proportion strongly agree on the presence of issues, indicating a sense of urgency or concern. Additionally, smaller percentages of respondents suggest the need to refocus, adjust, or change strategies, and support or implement new approaches. These responses indicate a nuanced understanding of the complexities involved in waste management and a recognition of the need for multifaceted solutions. However, it is essential to note that a small percentage of respondents either disagree or remain neutral, suggesting potential variations in perceptions or priorities regarding waste management problems. Overall, the data highlight both the consensus on the existence of problems in waste management and the diversity of opinions on how best to address them. This diversity underscores the complexity of waste management issues and the importance of considering multiple perspectives when developing strategies for improvement.

5.2.36. Recycling and resource recovery Gr=373

Table 5. 51: Recycling and Resource Recovery Gr=373

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Repurpose	62	81.6	86.1	86.1
	Refocus	2	2.6	2.8	88.9
	Support the strategy	4	5.3	5.6	94.4
	Adoption/Implementation	4	5.3	5.6	100.0
	Total	72	94.7	100.0	
Missing	System	4	5.3		
Total		76	100.0		

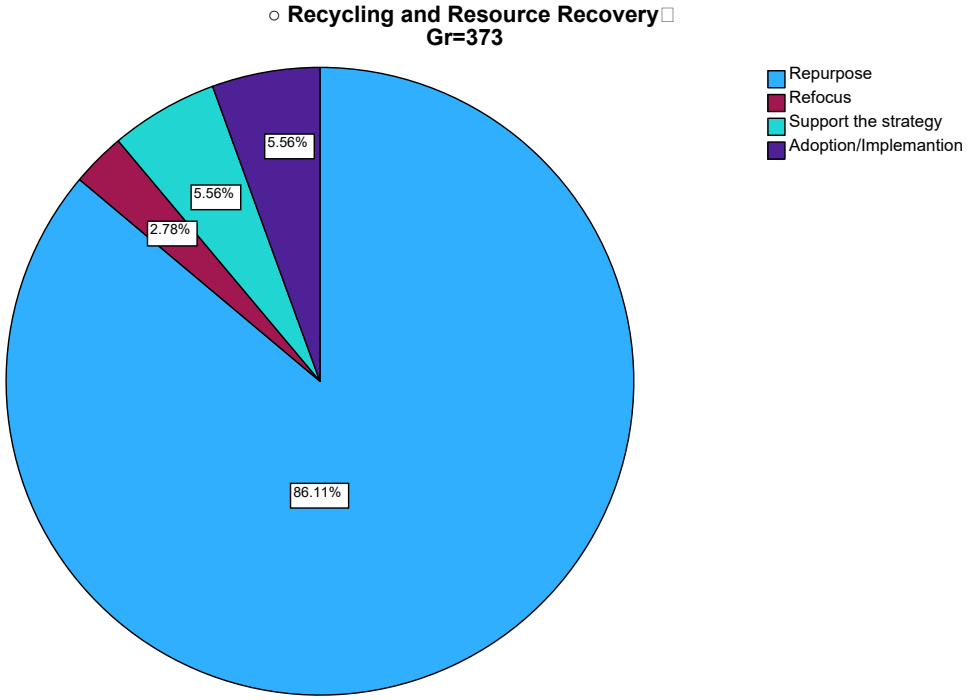

Figure 5. 36: Recycling and Resource Recovery Gr=373

The data on recycling and resource recovery reveal various perspectives on strategies related to these aspects. Many respondents (86.1%) advocate for repurposing strategies, indicating a preference for reusing materials or resources in different ways. A smaller proportion (2.8%) suggests refocusing strategies, possibly indicating a need to shift attention or priorities within recycling and resource recovery initiatives. Additionally, some respondents (5.6%) support existing strategies, while an equal percentage (5.6%)

advocate for the adoption or implementation of new approaches. Overall, these responses underscore a diverse range of opinions on how best to manage recycling and resource recovery efforts, reflecting the complexity of sustainability and waste management challenges. The presence of missing data (5.3%) emphasises the importance of considering all perspectives to develop comprehensive and effective strategies in this domain.

5.2.37. Reduce waste management generation Gr=17

Table 5. 52: Reduce waste management generation Gr=17

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Agree	66	86.8	91.7	91.7
	Agree	2	2.6	2.8	94.4
	Neutral	2	2.6	2.8	97.2
	Disagree	1	1.3	1.4	98.6
	Strongly Disagree	1	1.3	1.4	100.0
	Total	72	94.7	100.0	
Missing	System	4	5.3		
Total		76	100.0		

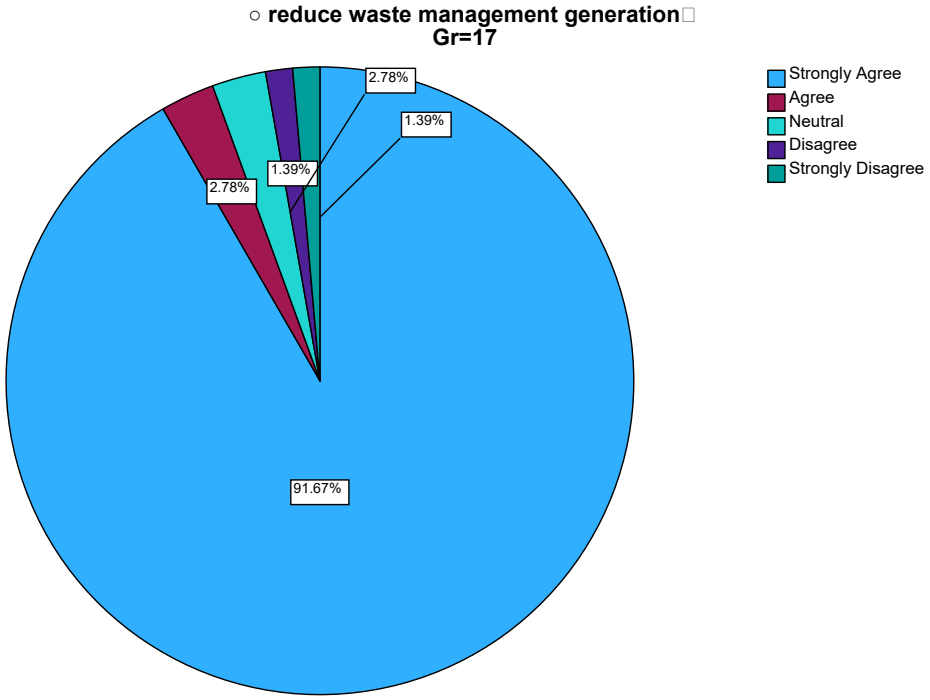

Figure 5. 37: Reduce waste management generation Gr=17

The data concerning the reduction of waste management generation indicate a high level of agreement among respondents regarding the importance of this goal. The majority (91.7%) strongly agree that efforts should be made to reduce the generation of waste requiring management. Additionally, a small percentage (2.8%) express agreement with this view, while an equal percentage (2.8%) remain neutral. Only a minimal portion of respondents (1.4%) disagree or strongly disagree with the notion of reducing waste generation for management. These responses highlight a consensus among the majority regarding the necessity of minimising the volume of waste produced, emphasising the importance of proactive measures in waste management strategies. The presence of missing data (5.3%) underscores the need for comprehensive data collection and analysis to inform effective waste reduction initiatives.

5.2.38. Waste management practice and strategies Gr=64

Table 5. 53: Waste management practice and strategies Gr=64

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Repurpose	63	82.9	87.5	87.5
	Refocus	2	2.6	2.8	90.3
	Change/Adjust strategy	2	2.6	2.8	93.1
	Support the strategy	2	2.6	2.8	95.8
	Adoption/Implementation	3	3.9	4.2	100.0
	Total	72	94.7	100.0	
Missing	System	4	5.3		
Total		76	100.0		

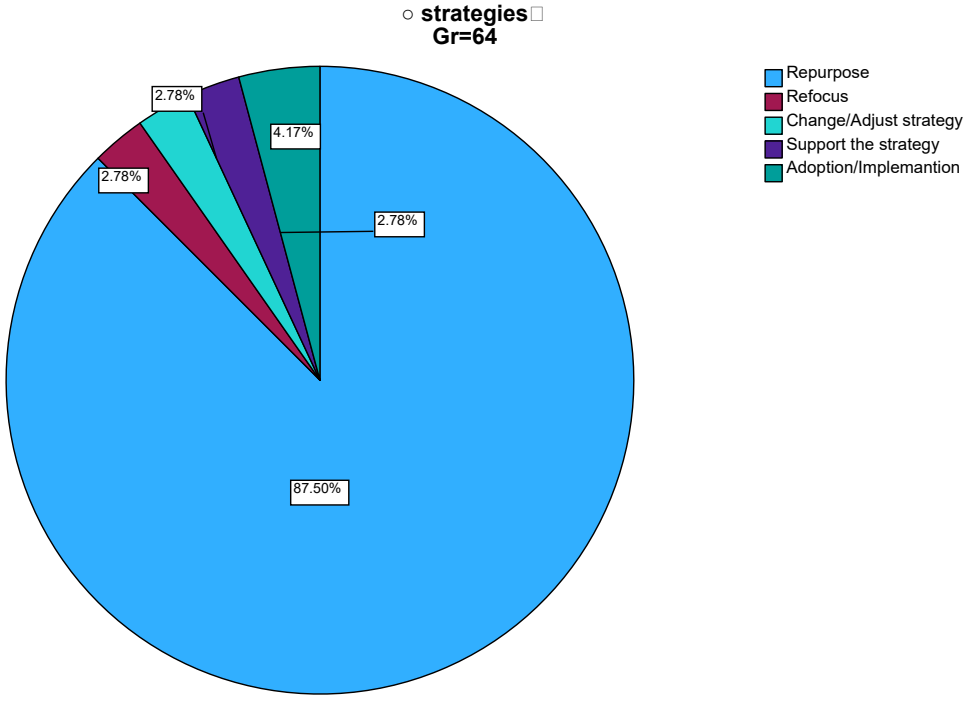

Figure 5. 38: Waste management practice and strategies Gr=64

The data on waste management practices and strategies indicate a strong inclination towards repurposing existing methods, with 87.5% of respondents opting for this approach. A minor representation of respondents (2.8%) suggests a need to refocus efforts, while an equal percentage (2.8%) advocates for changing or adjusting strategies. Additionally, a small portion (2.8%) supports the current strategies

without proposing significant alterations. Finally, 4.2% of respondents emphasise the importance of adopting or implementing new strategies. These findings highlight a predominant preference for repurposing existing waste management practices, indicating a recognition of the value in building upon established frameworks. The presence of missing data (5.3%) underscores the necessity for comprehensive data collection to inform effective waste management strategies.

5.2.39. Support benefits Gr=355

Table 5. 54: Support benefits Gr=355

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Agree	49	64.5	68.1	68.1
	Agree	11	14.5	15.3	83.3
	Neutral	2	2.6	2.8	86.1
	Disagree	2	2.6	2.8	88.9
	Strongly Disagree	8	10.5	11.1	100.0
	Total	72	94.7	100.0	
Missing	System	4	5.3		
Total		76	100.0		

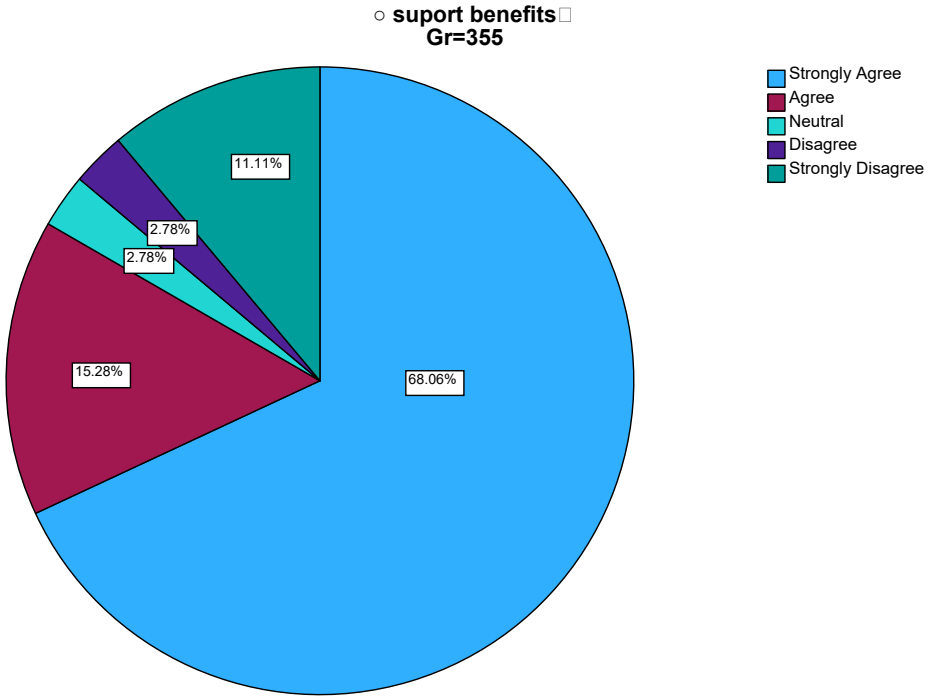

Figure 5. 39: Support benefits Gr=355

The data on support benefits in waste management reveal varied perspectives among respondents. A significant portion (64.5%) strongly agrees on the benefits of support, indicating prevalent recognition of its positive impact. Additionally, 14.5% agree with these benefits, contributing to a cumulative percentage of 83.3%. However, a notable percentage (10.5%) strongly disagrees with the notion of support benefits, contrasting with the positive sentiments expressed by others. A smaller proportion either remains neutral (2.6%) or disagrees (2.6%) with the perceived benefits. These findings reflect a range of attitudes towards the role and effectiveness of support in waste management initiatives. The presence of missing data (5.3%) underscores the importance of comprehensive responses to capture the full spectrum of perspectives in shaping effective support strategies.

5.2.40. Support ERP Gr=355

Table 5. 55: Support ERP Gr=355

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	1	1.3	1.4	1.4
	Repurpose	58	76.3	80.6	81.9
	Refocus	5	6.6	6.9	88.9

	Change/Adjust strategy	1	1.3	1.4	90.3
	Support the strategy	5	6.6	6.9	97.2
	Adoption/Implementation	1	1.3	1.4	98.6
	11	1	1.3	1.4	100.0
	Total	72	94.7	100.0	
Missing	System	4	5.3		
Total		76	100.0		

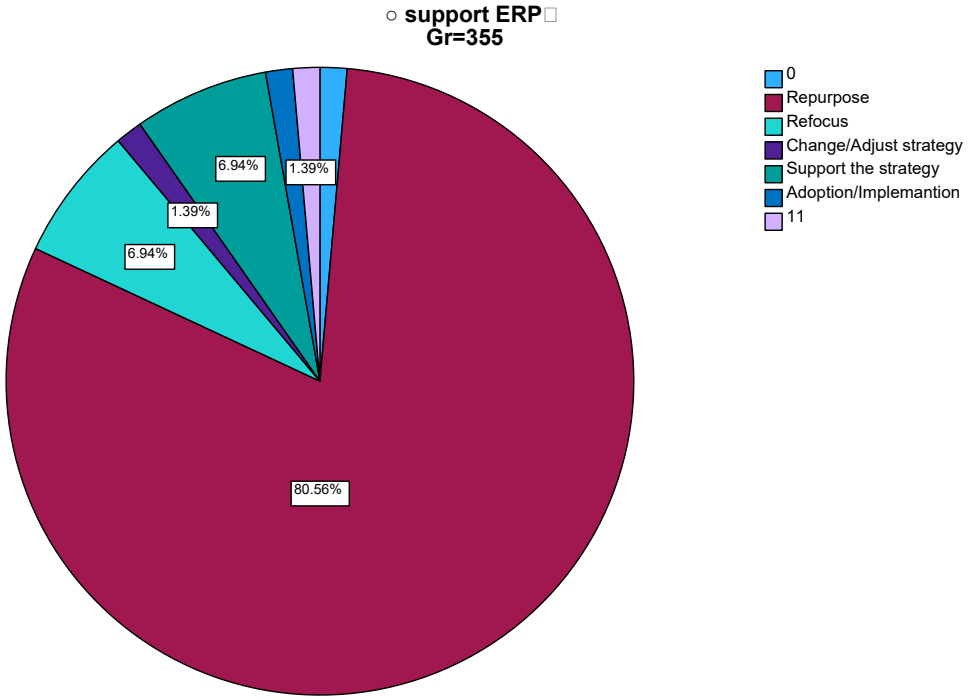

Figure 5. 40: Support ERP Gr=355

In the context of ERP support, the data suggest a range of responses. While a small percentage (1.3%) of respondents did not provide a specific answer, the majority display a favourable attitude towards integrating ERP systems into waste management practices. Specifically, 76.3% of the respondents express a willingness to repurpose existing strategies to accommodate ERP support, indicating an openness to innovation and technological integration. Additionally, 6.6% suggest refocusing or adjusting strategies to align with ERP implementation, while another 6.6% support the strategy outright. There is also a small percentage (1.3%) advocating for the adoption or implementation of ERP systems. These responses collectively highlight a positive sentiment towards leveraging ERP systems for more efficient waste management practices.

5.2.41. Support expenses Gr=355

Table 5. 56: Support expenses Gr=355

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Agree	56	73.7	77.8	77.8
	Agree	4	5.3	5.6	83.3
	Neutral	1	1.3	1.4	84.7
	Disagree	3	3.9	4.2	88.9
	Strongly Disagree	8	10.5	11.1	100.0
	Total	72	94.7	100.0	
Missing	System	4	5.3		
Total		76	100.0		

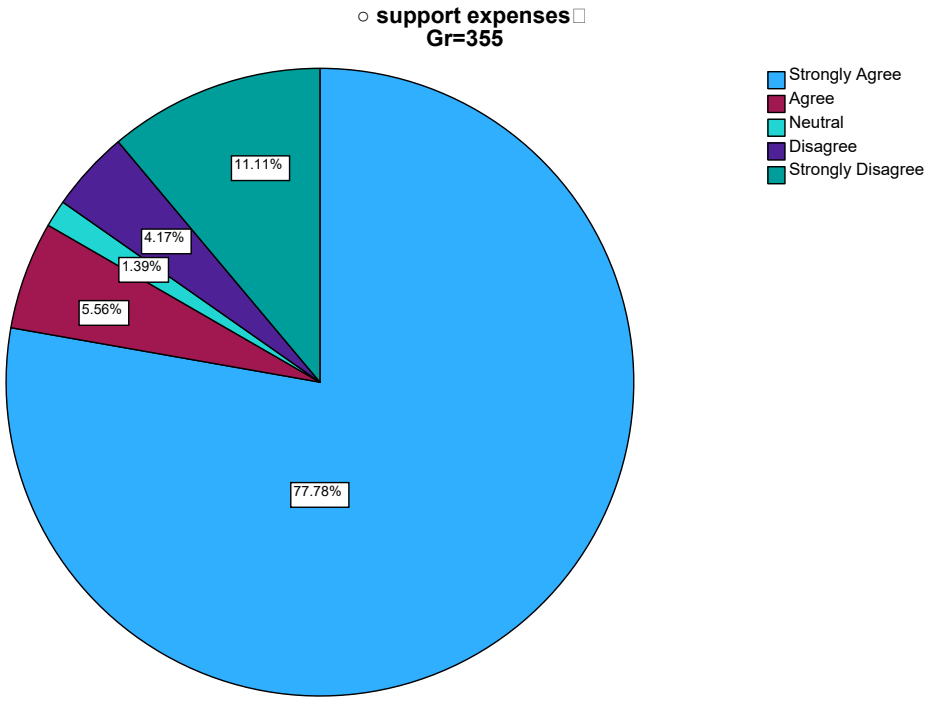

Figure 5. 41: Support expenses Gr=355

The data on support expenses reveal varied attitudes among respondents. A significant portion, 73.7%, strongly agrees that support expenses are warranted, suggesting a recognition of the importance of allocating resources to support initiatives. An additional 5.3% agree, while 1.3% remain neutral, possibly indicating a lack of strong opinion or uncertainty about resource allocation. In contrast, 3.9% disagree, and

10.5% strongly disagree, reflecting a notable minority who question the value of allocating resources to support expenses. These responses highlight the importance of cost considerations and financial planning in waste management strategies, capturing a range of perspectives on this issue.

5.2.42. Support programmes Gr=355

Table 5. 57: Support programmes Gr=355

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Repurpose	57	75.0	79.2	79.2
	Refocus	4	5.3	5.6	84.7
	Support the strategy	4	5.3	5.6	90.3
	Adoption/Implementation	7	9.2	9.7	100.0
	Total	72	94.7	100.0	
Missing	System	4	5.3		
Total		76	100.0		

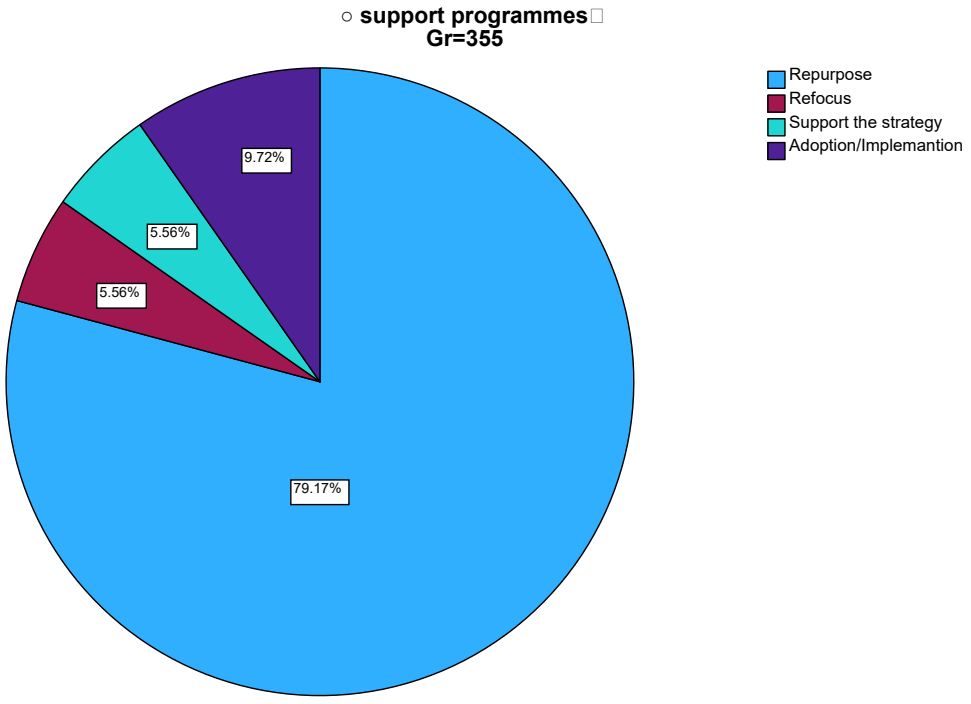

Figure 5. 42: Support programmes Gr=355

In the realm of support programmes, respondents exhibit diverse perspectives. The majority (75.0%) advocate for repurposing existing programmes, emphasising the importance of utilising resources efficiently. Additionally, 5.3% suggest refocusing current initiatives, indicating a desire for strategic redirection. Another 5.3% support the existing strategy, demonstrating confidence in its efficacy. Meanwhile, 9.2% advocate for the adoption or implementation of new programmes, signalling a call for innovation and expansion. These responses underscore the dynamic nature of waste management strategies, with respondents expressing a range of opinions on how best to optimise support programmes. The data highlight the need for flexibility and adaptability in addressing waste management challenges, ensuring that strategies align with evolving needs and priorities.

5.2.43. Sustainability of waste management Gr=605

Table 5. 58: Sustainability of waste management Gr=605

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Repurpose	67	88.2	93.1	93.1
	Refocus	2	2.6	2.8	95.8
	Support the strategy	1	1.3	1.4	97.2
	Adoption/Implementation	2	2.6	2.8	100.0
	Total	72	94.7	100.0	
Missing	System	4	5.3		
Total		76	100.0		

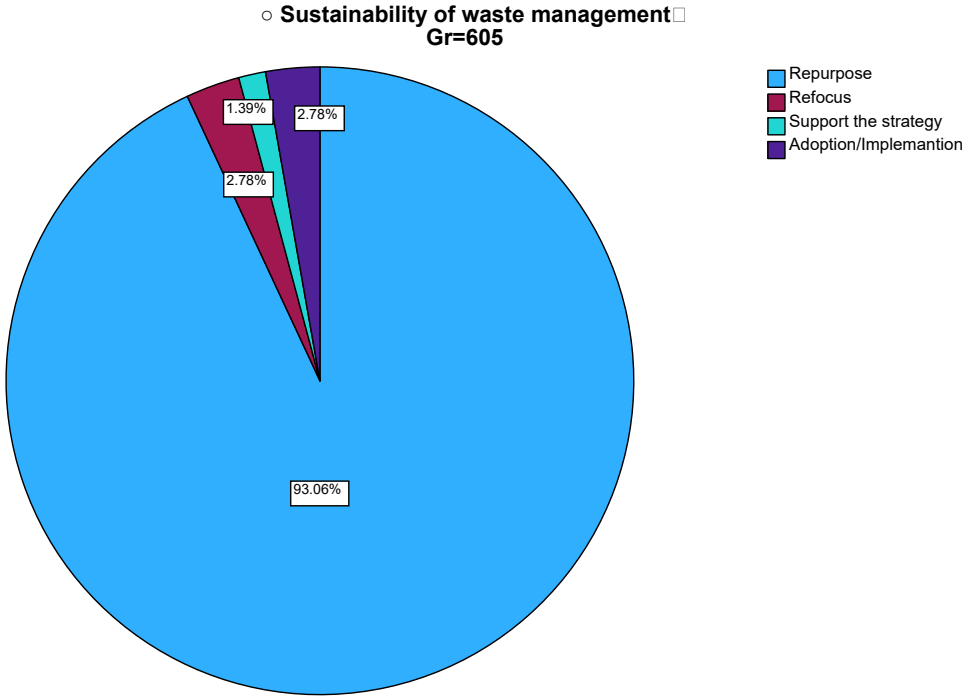

Figure 5. 43: Sustainability of waste management Gr=605

The data on the sustainability of waste management reveal a prevailing inclination towards repurposing existing strategies, with 88.2% of respondents advocating for this approach. This suggests a recognition of the value in optimising current practices to ensure long-term environmental viability. Additionally, 2.6% of respondents express a need to refocus efforts, indicating a desire for strategic adjustments to enhance sustainability initiatives. Meanwhile, 1.3% of respondents support the current strategy, signalling confidence in its effectiveness. Another 2.6% advocate for the adoption or implementation of new sustainability measures, highlighting a call for innovation and expansion in this domain. These findings underscore the importance of continual improvement and innovation in waste management practices to achieve sustainability objectives effectively.

5.2.44. Sustainable Developmental Goal 17 Gr=1

Table 5. 59: Sustainable developmental goal 17 Gr=1

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	1	1.3	1.4	1.4
	Repurpose	69	90.8	95.8	97.2
	Refocus	2	2.6	2.8	100.0
	Total	72	94.7	100.0	
Missing	System	4	5.3		
Total		76	100.0		

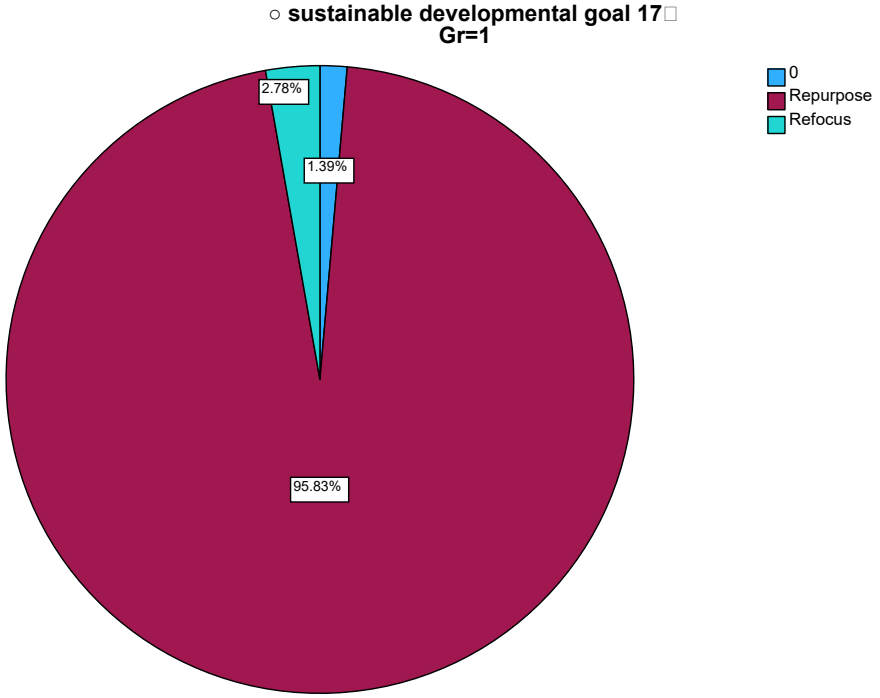

Figure 5. 44: Sustainable developmental goal 17 Gr=1

In the context of SDG 17, the data indicate a predominant preference for repurposing existing strategies, with 90.8% of respondents advocating for this approach. This suggests a recognition of the importance of leveraging current resources and frameworks to advance the objectives outlined in SDG 17, which focuses on partnerships for the goals. Additionally, 2.6% of respondents express a need to refocus efforts, indicating a desire for strategic adjustments to further enhance collaborative initiatives and partnerships.

These findings underscore the commitment to fostering partnerships, mobilising resources, and promoting collaboration among various stakeholders to achieve the ambitious targets set forth in SDG 17.

5.2.45. Sustainable environment Gr=18

Table 5. 60: Sustainable environment Gr=18

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	1	1.3	1.4	1.4
	Repurpose	62	81.6	86.1	87.5
	Refocus	5	6.6	6.9	94.4
	Change/Adjust strategy	2	2.6	2.8	97.2
	Support the strategy	1	1.3	1.4	98.6
	Adoption/Implementation	1	1.3	1.4	100.0
	Total	72	94.7	100.0	
Missing	System	4	5.3		
Total		76	100.0		

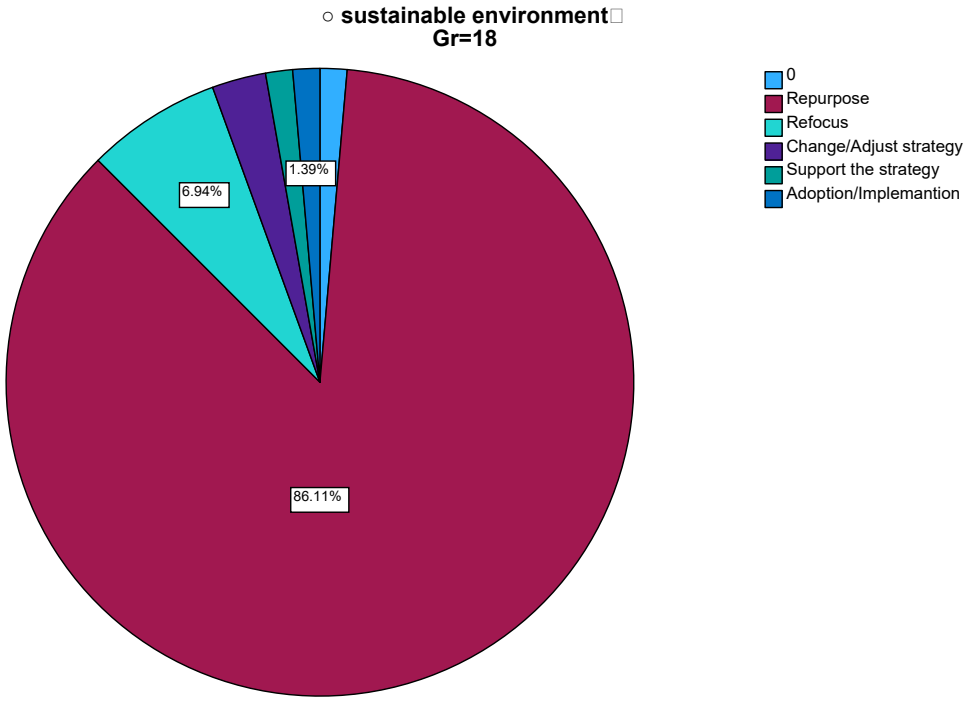

Figure 5. 45: Sustainable environment Gr=18

In the survey regarding sustainable environmental practices, the majority of respondents – 81.6% – advocate for repurposing existing strategies, indicating a recognition of the importance of building upon established frameworks. Additionally, 6.6% express a need to refocus efforts, suggesting a desire for strategic adjustments to align more effectively with environmental sustainability goals. Moreover, 2.6% of respondents recommend changing or adjusting strategies, indicating a willingness to adapt approaches to better address environmental challenges. Furthermore, 1.3% express support for existing strategies, while another 1.3% advocate for their adoption or implementation. These findings underscore a multifaceted approach to promoting environmental sustainability, emphasising the importance of leveraging existing resources, making strategic adjustments, and fostering widespread adoption of sustainable practices to address environmental concerns effectively.

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5.2.46. Sustainable supply chain Gr=72

Table 5. 61: Sustainable supply chain Gr=72

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Repurpose	66	86.8	91.7	91.7
	Change/Adjust strategy	4	5.3	5.6	97.2
	Support the strategy	1	1.3	1.4	98.6
	7	1	1.3	1.4	100.0
	Total	72	94.7	100.0	
Missing	System	4	5.3		
Total		76	100.0		

In the sustainable supply chain domain, 86.8% of respondents advocate for repurposing existing strategies, indicating a preference for leveraging and optimising current practices rather than reinventing the wheel. Additionally, 5.3% suggest changing or adjusting strategies, highlighting a recognition of the need for adaptation to evolving sustainability challenges. Furthermore, 1.3% express support for existing strategies, while another 1.3% advocate for their adoption or implementation. These findings underscore a nuanced approach to sustainability within supply chain management, emphasising the importance of both leveraging existing frameworks and making strategic adjustments to promote sustainability effectively. Overall, there is a consensus on the importance of continuous improvement and adaptation to address sustainability goals in the supply chain context.

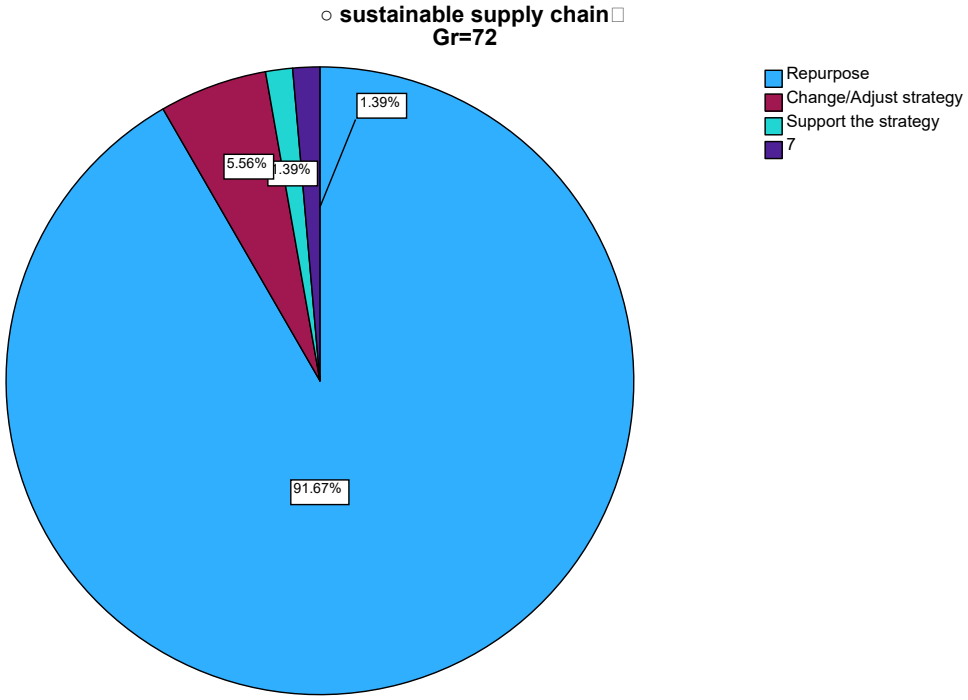

Figure 5. 46: Sustainable supply chain Gr=72

5.2.47. Types of waste management projects Gr=1

Table 5. 62: Types of waste management projects Gr=1

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Repurpose	71	93.4	98.6	98.6
	Adoption/Implementation	1	1.3	1.4	100.0
	Total	72	94.7	100.0	
Missing	System	4	5.3		
Total		76	100.0		

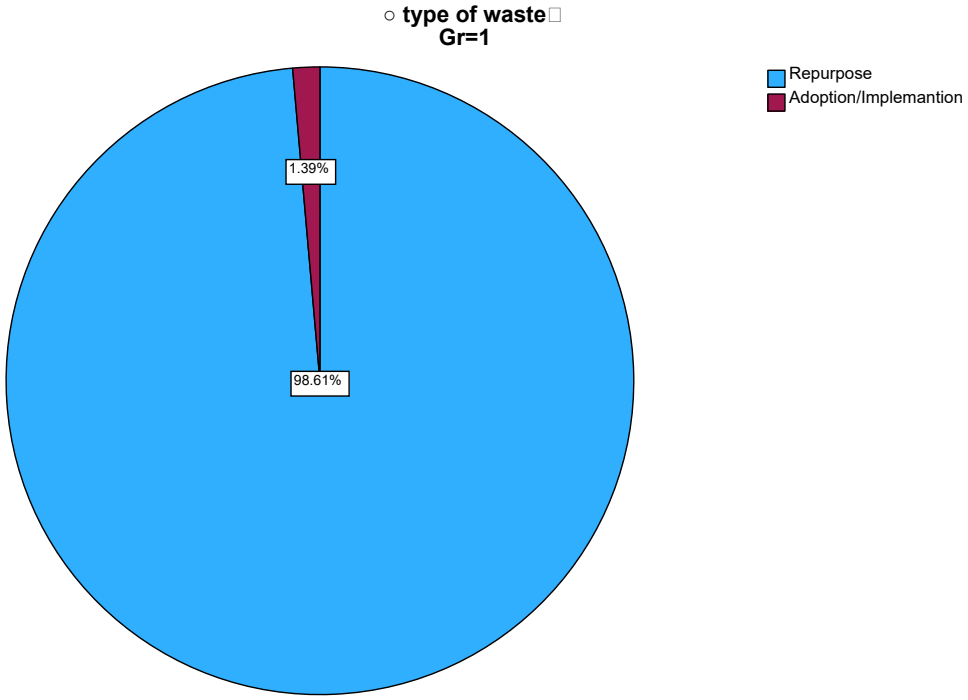

Figure 5. 47: Types of waste management projects Gr=1

The data show a strong preference for repurposing in waste management projects, with 93.4% of respondents advocating for this approach. Repurposing focuses on finding new uses or applications for existing resources or waste materials, emphasising sustainability and resource efficiency. Additionally, 1.3% of respondents support the adoption or implementation of new waste management projects, indicating a smaller but notable interest in introducing novel approaches. These findings underscore the importance of sustainability and innovation in waste management initiatives, with a predominant emphasis on maximising the value of existing resources through repurposing.

5.2.48. Waste disposal systems Gr=477

Table 5. 63: Waste disposal systems Gr=477

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Repurpose	53	69.7	73.6	73.6
	Refocus	8	10.5	11.1	84.7
	Change/Adjust strategy	4	5.3	5.6	90.3
	Support the strategy	2	2.6	2.8	93.1
	Adoption/Implementation	4	5.3	5.6	98.6

	7	1	1.3	1.4	100.0
	Total	72	94.7	100.0	
Missing	System	4	5.3		
Total		76	100.0		

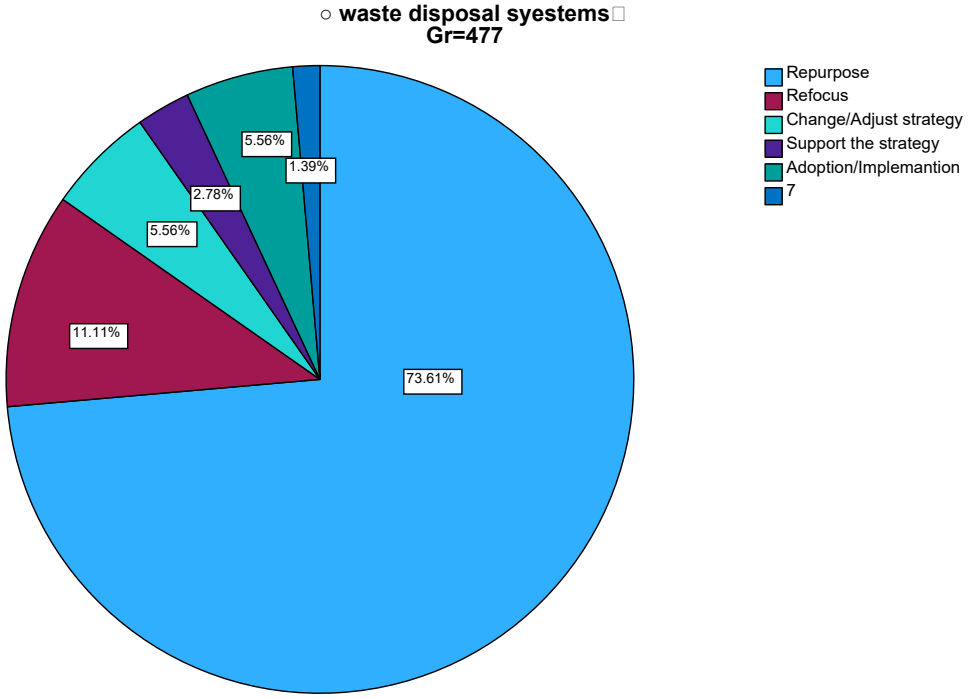

Figure 5. 48: Waste disposal systems Gr=477

The data on waste disposal systems highlight various strategies and attitudes towards waste management. The majority of respondents (69.7%) advocate for repurposing waste disposal systems, emphasising the importance of finding new uses or applications for waste materials. Additionally, 10.5% of respondents suggest refocusing existing waste disposal systems, indicating a desire to redirect efforts towards more sustainable practices. There is also a smaller percentage (5.3%) that prefers to change or adjust current strategies, signalling a recognition of the need for adaptation in waste disposal approaches. Moreover, 2.6% of the respondents support the existing strategies, while another 5.3% advocate for the adoption or implementation of new waste disposal methods. These findings underscore the complexity of waste management and the need for diverse approaches to address environmental challenges effectively.

5.2.49. Waste Management Gr=98

Table 5. 64: Waste Management Gr=98

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Repurpose	63	82.9	87.5	87.5
	Refocus	6	7.9	8.3	95.8
	Change/Adjust strategy	1	1.3	1.4	97.2
	Adoption/Implementation	2	2.6	2.8	100.0
	Total	72	94.7	100.0	
Missing	System	4	5.3		
Total		76	100.0		

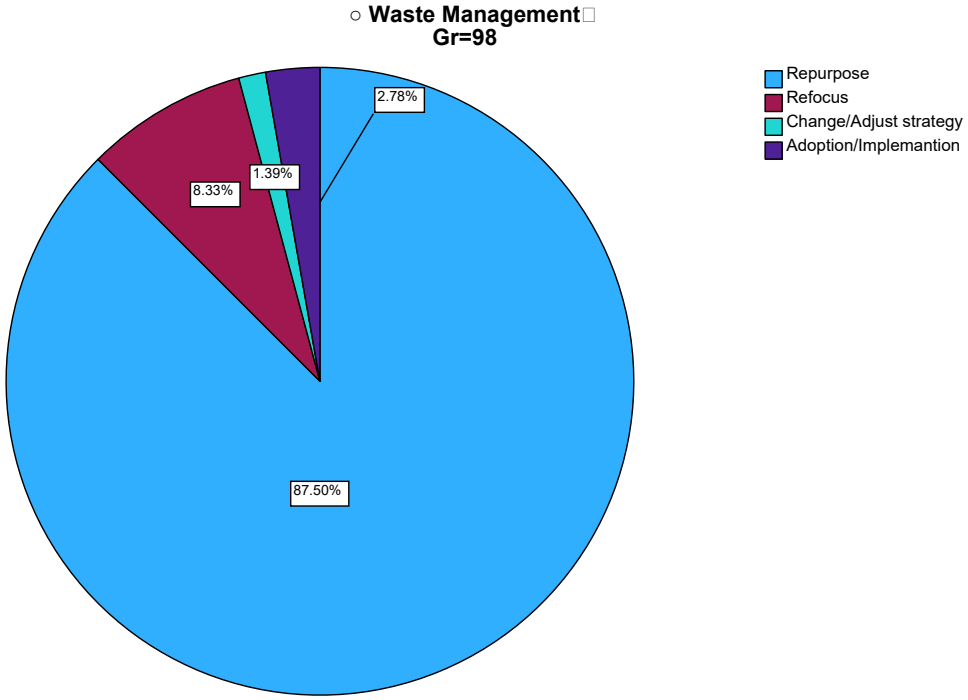

Figure 5. 49: Waste Management Gr=98

The data on waste management indicate diverse perspectives on addressing waste-related challenges. The majority (82.9%) advocate for repurposing waste, emphasising the importance of finding new uses or applications for waste materials to minimise environmental impact. Additionally, 7.9% suggest refocusing waste management efforts, possibly towards more sustainable practices. A smaller percentage (1.3%) proposes changing or adjusting current waste management strategies, signalling a recognition of the need

for adaptation. Moreover, 2.6% of respondents advocate for the adoption or implementation of new waste management approaches, underscoring the call for innovation in this field. These findings highlight the multifaceted nature of waste management and the importance of considering various strategies to address environmental concerns effectively.

5.2.50. Waste Management Act 2008 Gr=1

Table 5. 65: Waste Management Act 2008 Gr=1

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Repurpose	64	84.2	88.9	88.9
	Refocus	6	7.9	8.3	97.2
	Change/Adjust strategy	2	2.6	2.8	100.0
	Total	72	94.7	100.0	
Missing	System	4	5.3		
Total		76	100.0		

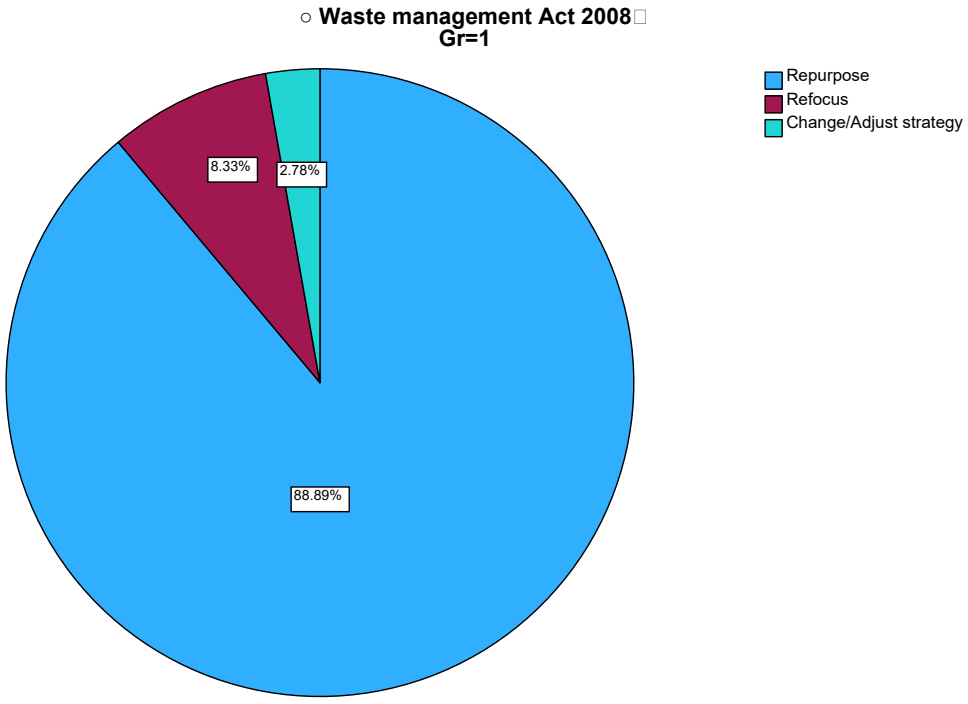

Figure 5. 50: Waste Management Act 2008 Gr=1

The data on the Waste Management Act of 2008 reveal a range of perspectives on its implementation and effectiveness. A significant portion (84.2%) advocates for repurposing the Act, suggesting a need to adapt or utilise it for new purposes or challenges in waste management. Additionally, 7.9% propose refocusing efforts related to the Act, possibly to address emerging issues or priorities in waste management. A smaller percentage (2.6%) suggests changing or adjusting the strategy outlined in the Act, indicating a recognition of its limitations or areas for improvement. Overall, these responses reflect the dynamic nature of waste management legislation and the ongoing efforts to ensure its relevance and effectiveness in addressing environmental concerns.

5.2.51. Waste management concepts Gr=182

Table 5. 66: Waste management concepts Gr=182

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Repurpose	64	84.2	88.9	88.9
	Refocus	2	2.6	2.8	91.7
	Change/Adjust strategy	1	1.3	1.4	93.1
	Support the strategy	1	1.3	1.4	94.4
	Adoption/Implementation	4	5.3	5.6	100.0
	Total	72	94.7	100.0	
Missing	System	4	5.3		
Total		76	100.0		

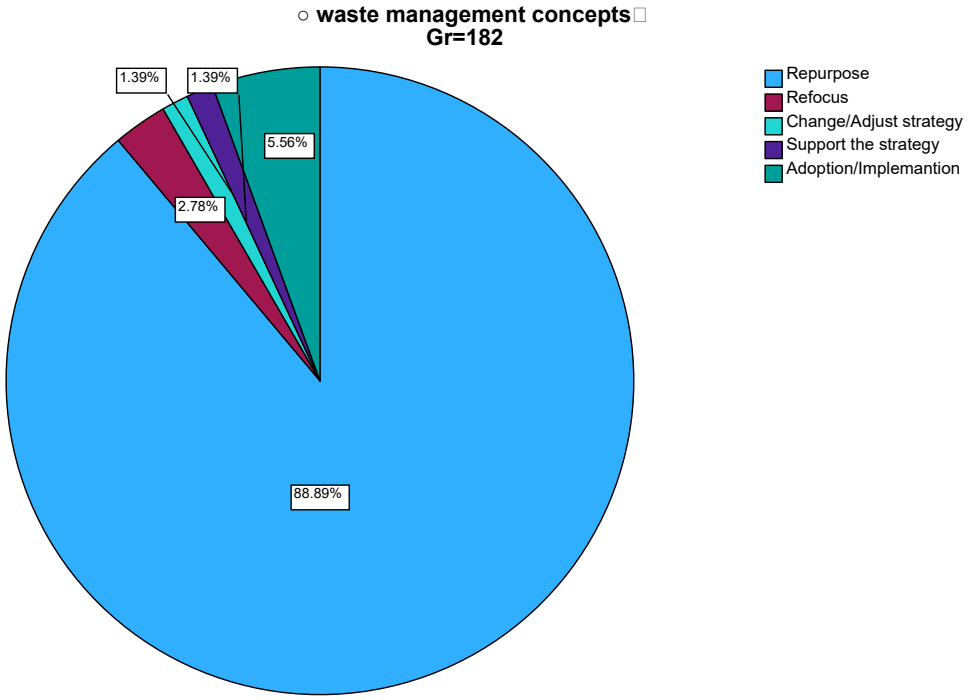

Figure 5. 51: Waste management concepts Gr=182

The data on waste management concepts reveal a range of perspectives on improving practices. A majority of respondents (84.2%) support repurposing existing concepts, indicating a desire to adapt or apply them to new challenges and opportunities in waste management. Additionally, a small percentage suggests refocusing efforts (2.6%) or changing/adjusting strategies (1.3%), reflecting an awareness of the need for flexibility and adaptation to evolving circumstances. There is also support for existing strategies (1.3%) and a call for their adoption and implementation (5.3%), underscoring the importance of action and practical application in addressing waste management challenges. Overall, these responses highlight the dynamic and multifaceted nature of waste management concepts and the ongoing efforts to optimise them for sustainable outcomes.

5.2.52. Waste management hierarchies Gr=3421

Table 5. 67: Waste management hierarchies Gr=3421

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Repurpose	27	35.5	37.5	37.5
	Refocus	8	10.5	11.1	48.6
	Change/Adjust strategy	13	17.1	18.1	66.7

	Support the strategy	6	7.9	8.3	75.0
	Adoption/Implementation	18	23.7	25.0	100.0
	Total	72	94.7	100.0	
Missing	System	4	5.3		
Total		76	100.0		

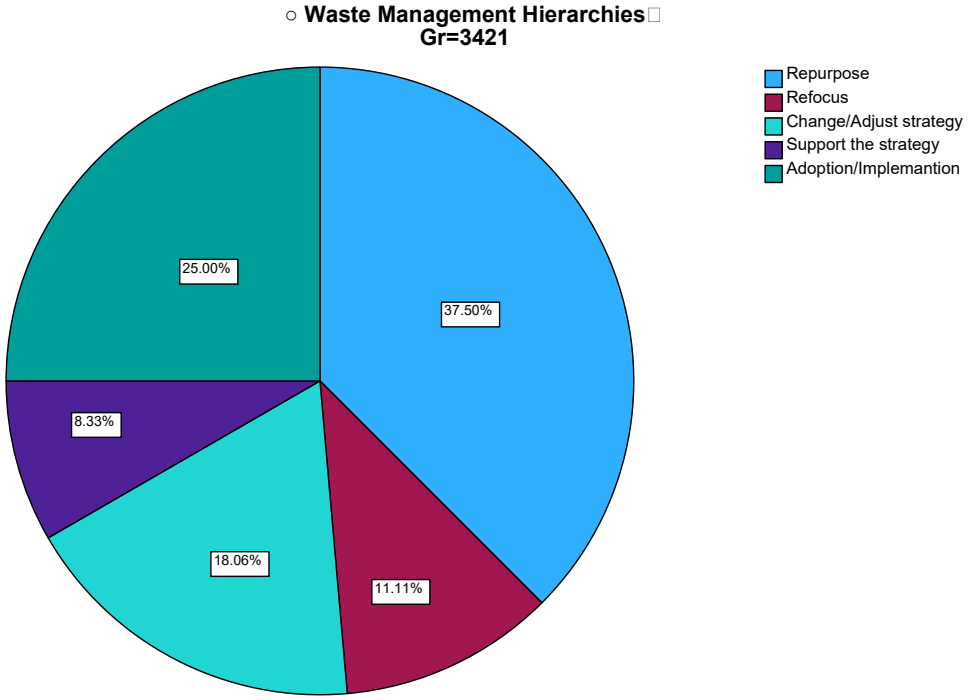

Figure 5. 52: Waste management hierarchies Gr=3421

The data on waste management hierarchies reveal a range of approaches to improving practices. A majority of respondents (35.5%) support repurposing existing hierarchies, suggesting a need to adapt them to current waste management challenges. Additionally, a notable proportion of respondents (23.7%) emphasise the importance of adopting and implementing new hierarchies, indicating a recognition of the need for proactive measures to enhance waste management systems. Further, there are indications of a desire to refocus efforts (10.5%) and change or adjust existing strategies (17.1%), reflecting a willingness to reassess and modify approaches as necessary. A smaller percentage (7.9%) express support for existing strategies, underscoring the value of maintaining and building upon proven methods. Overall, these responses highlight the diverse perspectives on waste management hierarchies and the importance of flexibility and innovation in tackling waste management challenges.

5.2.53. Waste management infrastructure Gr=16

Table 5. 68: Waste management infrastructure Gr=16

○ Waste Management Infrastructure Gr=16					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Agree	60	78.9	83.3	83.3
	Agree	4	5.3	5.6	88.9
	Neutral	2	2.6	2.8	91.7
	Disagree	5	6.6	6.9	98.6
	Strongly Disagree	1	1.3	1.4	100.0
	Total	72	94.7	100.0	
Missing	System	4	5.3		
Total		76	100.0		

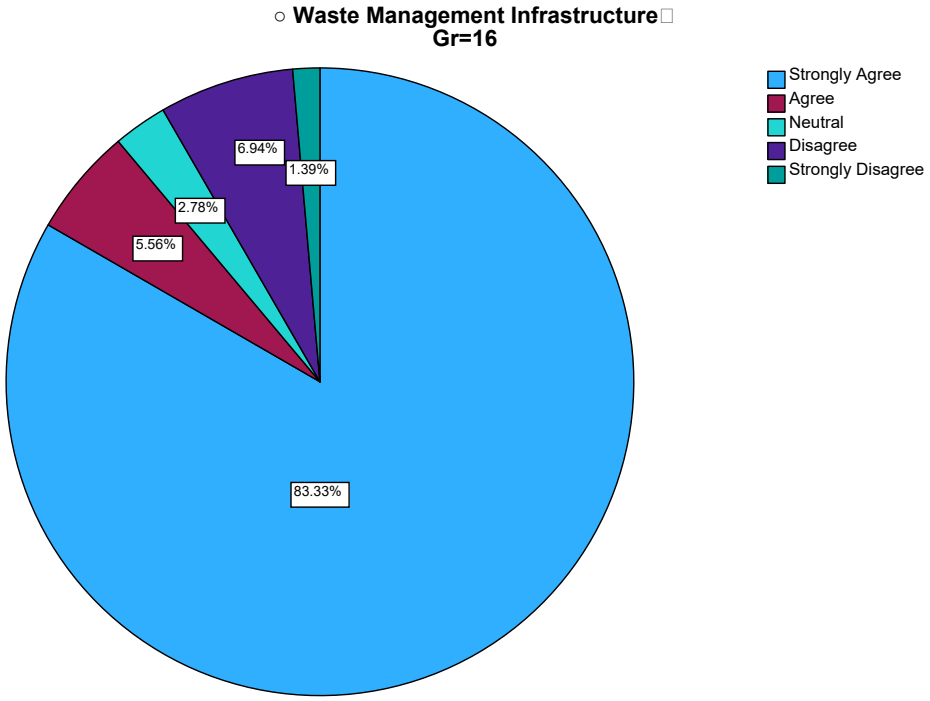

Figure 5. 53: Waste management infrastructure Gr=16

The data on WMI reveal varied perspectives on its effectiveness and suitability. A significant majority (78.9%) strongly agree on the importance and adequacy of existing infrastructure, suggesting a high level of confidence in its capacity to meet waste management needs. Additionally, a small percentage (5.3%)

also agree, further supporting the notion of sufficient infrastructure. However, some respondents express neutrality (2.6%) or disagreement (6.6%), indicating pockets of uncertainty or dissatisfaction with current infrastructure. A minority (1.3%) strongly disagree with the effectiveness of existing infrastructure, highlighting a perceived need for substantial improvements or a complete overhaul. These diverse perspectives underscore the complexity of WMI and the importance of ongoing evaluation and optimisation to address evolving needs and challenges effectively.

5.2.54. Waste management intervention Gr=63

Table 5. 69: Waste management intervention Gr=63

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Repurpose	70	92.1	97.2	97.2
	Refocus	2	2.6	2.8	100.0
	Total	72	94.7	100.0	
Missing	System	4	5.3		
Total		76	100.0		

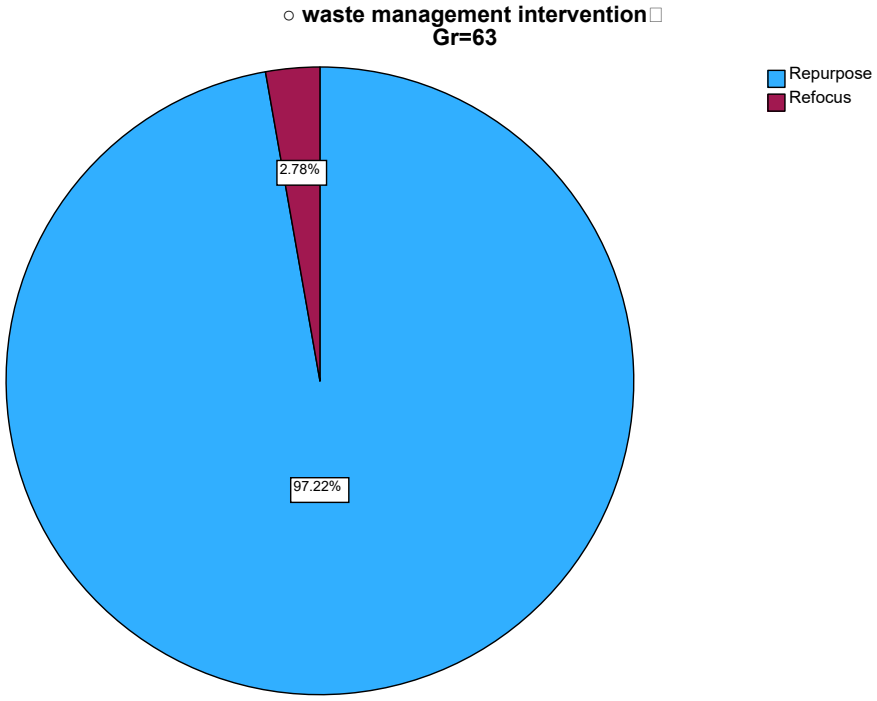

Figure 5. 54: Waste management intervention Gr=63

The data on waste management interventions highlight a strong inclination towards repurposing existing strategies, with 92.1% of respondents advocating for this approach. This suggests a recognition of the potential effectiveness of repurposing methods and resources to address waste management challenges. Additionally, a small percentage (2.6%) express a preference for refocusing strategies, possibly indicating a need to redirect efforts or resources towards specific areas of improvement. The absence of responses in other categories signifies a predominant focus on repurposing existing interventions rather than completely overhauling or introducing entirely new approaches. Overall, this data underscores the importance of adaptability and innovation in waste management practices to effectively address environmental concerns and resource utilisation.

5.2.55. Waste management initiatives Gr=13

Table 5. 70: Waste management initiatives Gr=13

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Repurpose	67	88.2	93.1	93.1
	Change/Adjust strategy	3	3.9	4.2	97.2
	Support the strategy	2	2.6	2.8	100.0
	Total	72	94.7	100.0	
Missing	System	4	5.3		
Total		76	100.0		

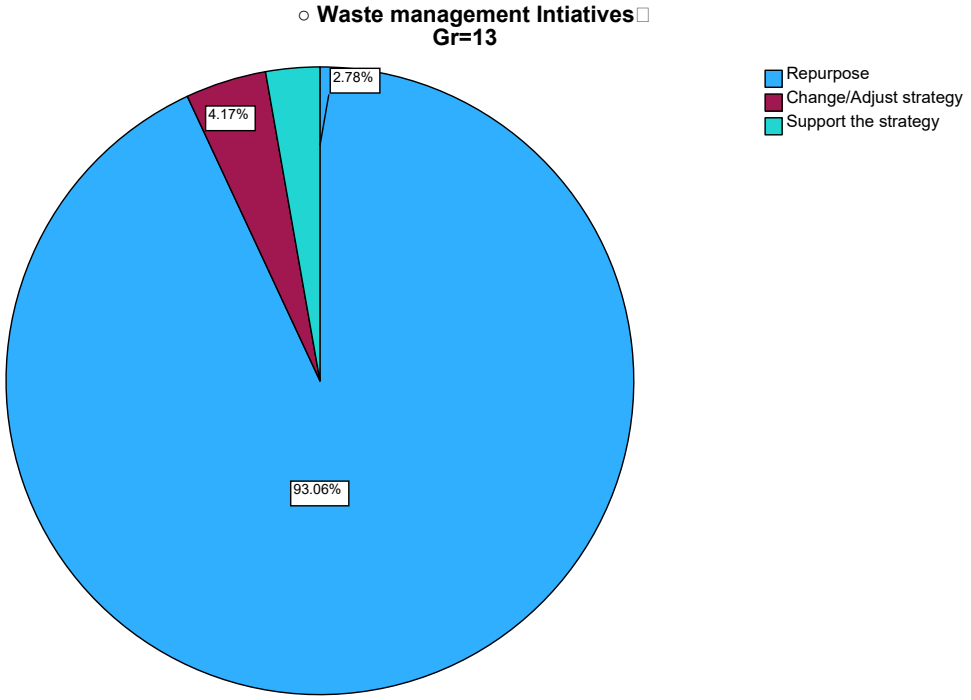

Figure 5. 55: Waste management initiatives Gr=13

The data on waste management initiatives reveal a strong preference for repurposing existing strategies, with 88.2% of respondents endorsing this approach. This indicates a widespread recognition of the value in refining and adapting current practices to tackle waste management challenges more effectively. A smaller group (3.9%) advocates for adjusting strategies, showing some openness to alternative approaches when necessary. Additionally, 2.6% express confidence in the effectiveness of current strategies. The absence of responses in other categories underscores a predominant focus on enhancing and leveraging existing initiatives rather than developing entirely new ones. Overall, the data underscore the importance of flexibility and innovation in effectively addressing waste management issues.

5.2.56. Waste Management Model (WMM) Gr=7

Table 5. 71: Waste Management Model (WMM) Gr=7

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Repurpose	58	76.3	80.6	80.6
	Refocus	6	7.9	8.3	88.9
	Change/Adjust strategy	1	1.3	1.4	90.3
	Support the strategy	6	7.9	8.3	98.6

	Adoption/Implementation	1	1.3	1.4	100.0
	Total	72	94.7	100.0	
Missing	System	4	5.3		
Total		76	100.0		

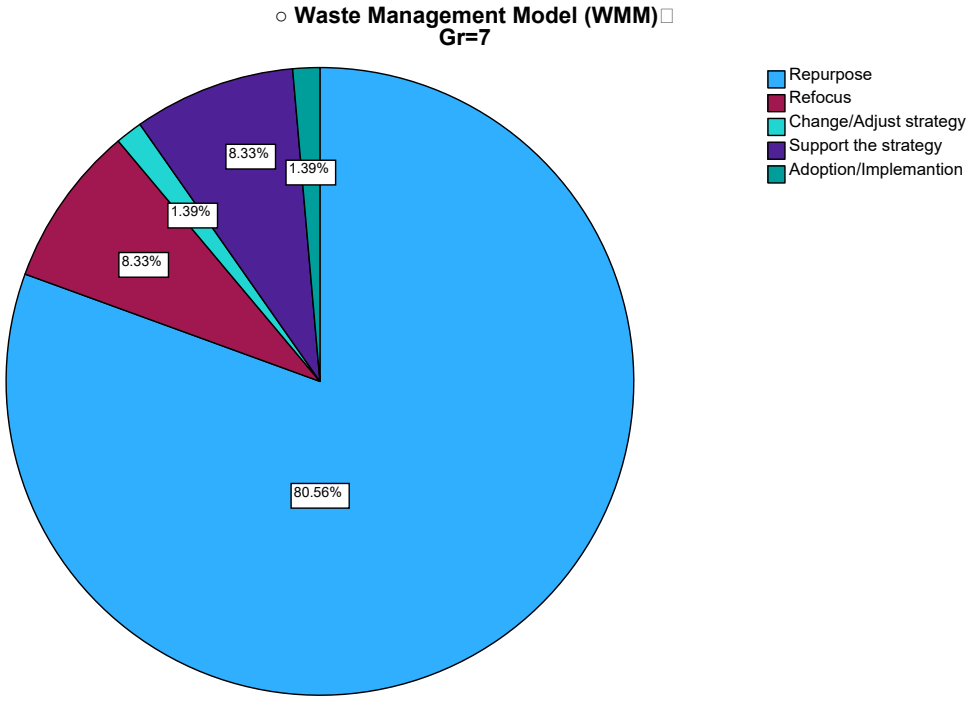

Figure 5. 56: Waste Management Model (WMM) Gr=7

The data on WMM preferences indicate a strong inclination toward repurposing existing models, with 76.3% of respondents favouring this approach. These preferences highlight a recognition of the value in adapting and optimising current models to meet evolving waste management needs. Additionally, a smaller segment of respondents (7.9%) advocate for refocusing existing models, signalling a willingness to redirect attention and resources to specific areas of improvement. Furthermore, there are indications of support for current models, with 7.9% of respondents expressing a desire to maintain and enhance their effectiveness. The distribution of responses across these categories suggests a multi-faceted approach to waste management, emphasising both the adaptation and reinforcement of existing frameworks, alongside openness to adjustments or innovations where necessary. Overall, the data underscore the importance of flexibility and strategic planning in waste management practices.

5.2.57. Waste management best practice Gr=64

Table 5. 72: Waste management best practice Gr=64

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Agree	58	76.3	80.6	80.6
	Agree	5	6.6	6.9	87.5
	Neutral	5	6.6	6.9	94.4
	Disagree	2	2.6	2.8	97.2
	Strongly Disagree	2	2.6	2.8	100.0
	Total	72	94.7	100.0	
Missing	System	4	5.3		
Total		76	100.0		

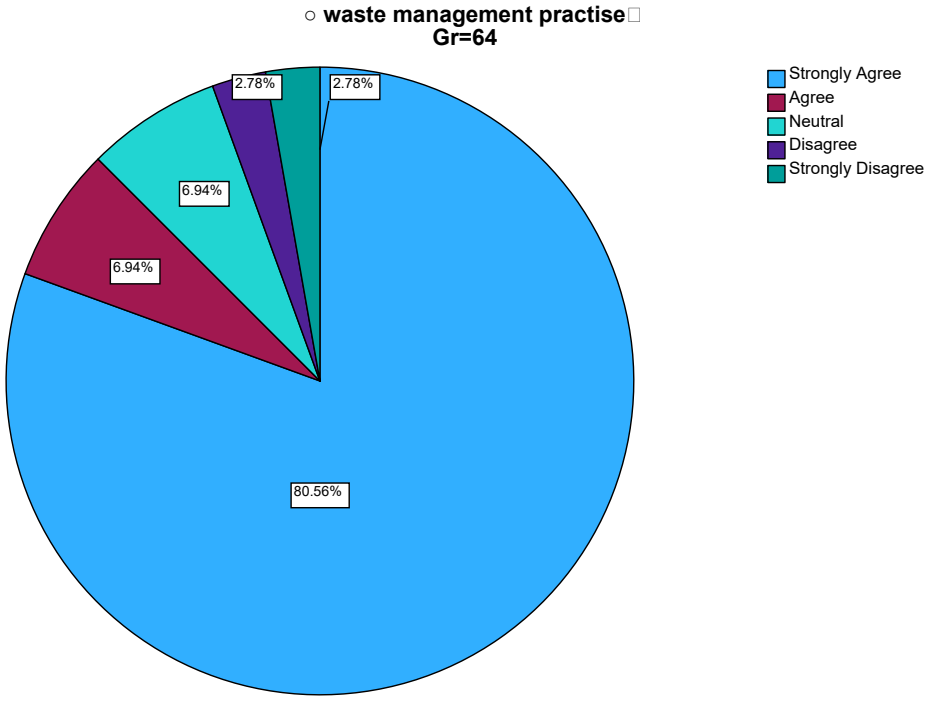

Figure 5. 57: Waste management best practice Gr=64

The data on waste management best practices reveal that a significant majority (76.3%) of respondents strongly agree with the current best practices, indicating a high level of confidence and satisfaction with the strategies and methodologies currently in place. Additionally, a smaller proportion of respondents (6.6%) agree with these practices, reinforcing the overall positive reception. However, the presence of

neutrality (6.6%) and disagreement (2.6%) suggests that perspectives on the effectiveness or suitability of these practices may vary across different contexts or stakeholders. A small percentage (2.6%) strongly disagrees with the current best practices, signalling areas for improvement or differing views within the respondent group. Overall, the data underscore the importance of continuous evaluation and adaptation of best practices in waste management to address diverse needs and concerns effectively.

5.2.58. Waste management programmes Gr=98

Table 5. 73: Waste management programmes Gr=98

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Repurpose	66	86.8	91.7	91.7
	Refocus	6	7.9	8.3	100.0
	Total	72	94.7	100.0	
Missing	System	4	5.3		
Total		76	100.0		

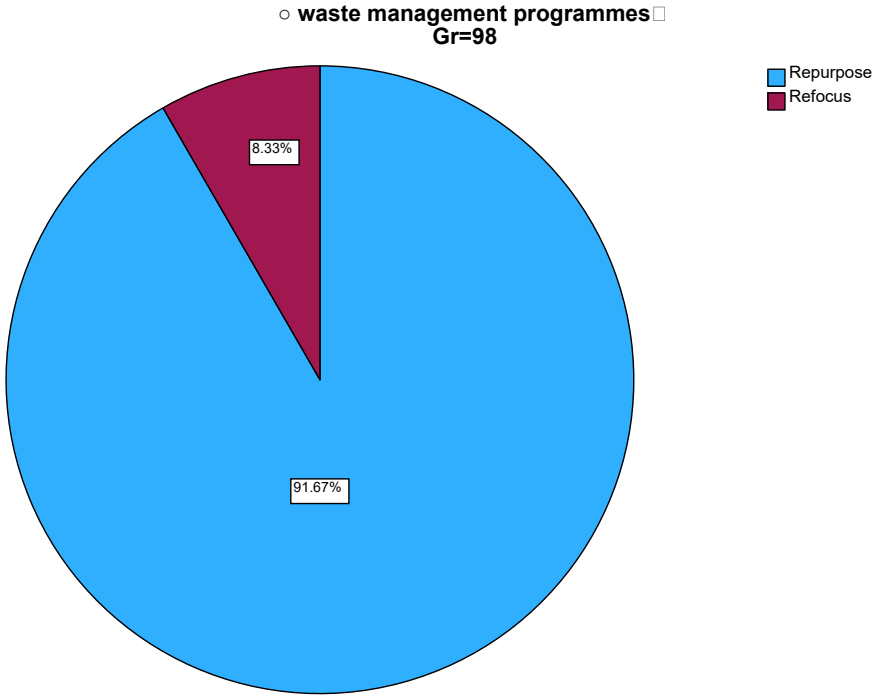

Figure 5. 58: Waste management programmes Gr=98

The data on waste management programmes show that a majority of respondents (86.8%) support repurposing existing programmes, reflecting a preference for adapting and reusing current initiatives to address waste management challenges. Additionally, a smaller proportion (7.9%) suggests the need to refocus these programmes, possibly signifying a desire for realignment or redirection of efforts within waste management initiatives. Collectively, these responses highlight the importance of continuous evaluation and adjustment to ensure programme effectiveness and relevance. Notably, there are also missing data points (5.3%), which may imply non-response or incomplete data collection. This underscores the need for comprehensive data collection and analysis to support informed decision-making in waste management planning and implementation.

5.2.59. Waste management systems Gr=19

Table 5. 74: Waste management systems Gr=19

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Repurpose	62	81.6	86.1	86.1
	Refocus	4	5.3	5.6	91.7
	Change/Adjust strategy	5	6.6	6.9	98.6
	Adoption/Implementation	1	1.3	1.4	100.0
	Total	72	94.7	100.0	
Missing	System	4	5.3		
Total		76	100.0		

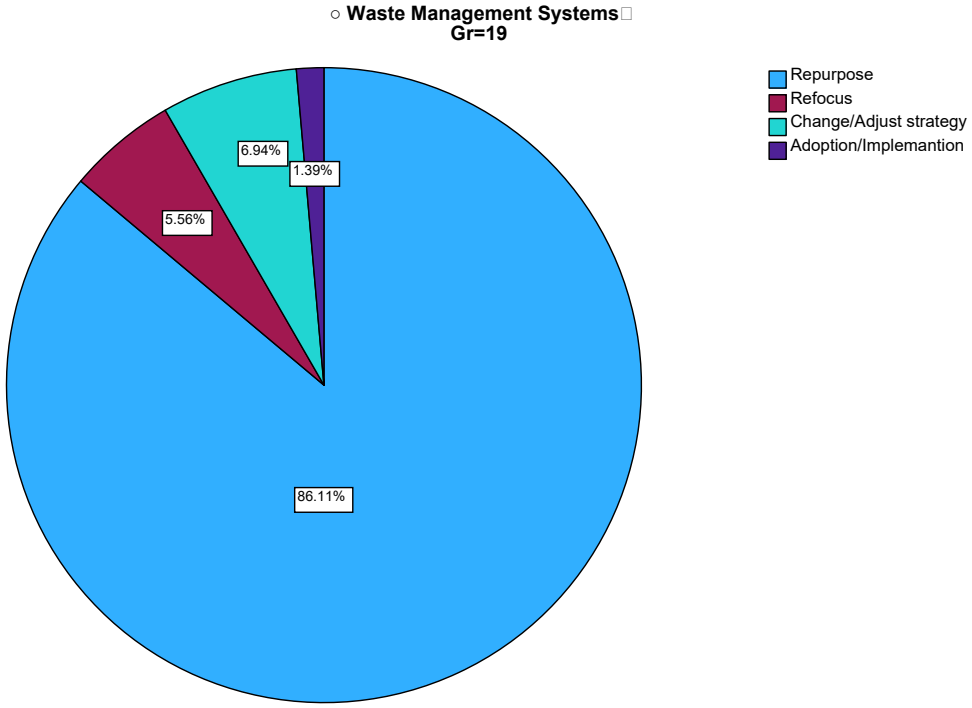

Figure 5. 59: Waste Management Systems Gr=19

The data on waste management systems reveal diverse perspectives on potential strategies. A majority of respondents (81.6%) advocate for repurposing existing systems, indicating a preference for adapting current infrastructure and practices to enhance waste management. A smaller percentage (5.3%) suggests refocusing efforts, possibly signalling a need to redirect resources or attention within the existing framework. Additionally, 6.6% propose changing or adjusting strategies, acknowledging the need for modifications or optimisations in waste management approaches. A minor percentage (1.3%) emphasises adopting or implementing new systems, reflecting an openness to innovation and integrating novel solutions into waste management frameworks. The presence of missing data (5.3%) highlights the need for further investigation into non-responses or incomplete data collection to support thorough analysis and informed decision-making in waste management planning.

5.2.60. Waste prevention measures Gr=1

Table 5. 75: Waste prevention measures Gr=1

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	4	5.3	5.6	5.6
	Repurpose	66	86.8	91.7	97.2
	Refocus	2	2.6	2.8	100.0
	Total	72	94.7	100.0	
Missing	System	4	5.3		
Total		76	100.0		

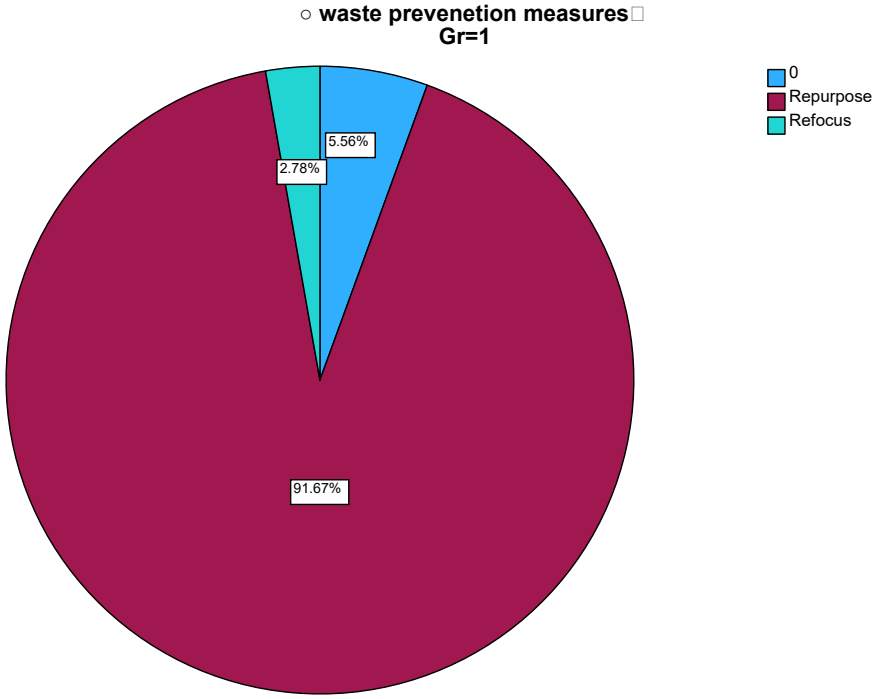

Figure 5. 60: Waste prevention measures Gr=1

5.2.61. Waste service Gr=1

Table 5. 76: Waste service Gr=1

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Repurpose	70	92.1	97.2	97.2
	Refocus	2	2.6	2.8	100.0
	Total	72	94.7	100.0	
Missing	System	4	5.3		
Total		76	100.0		

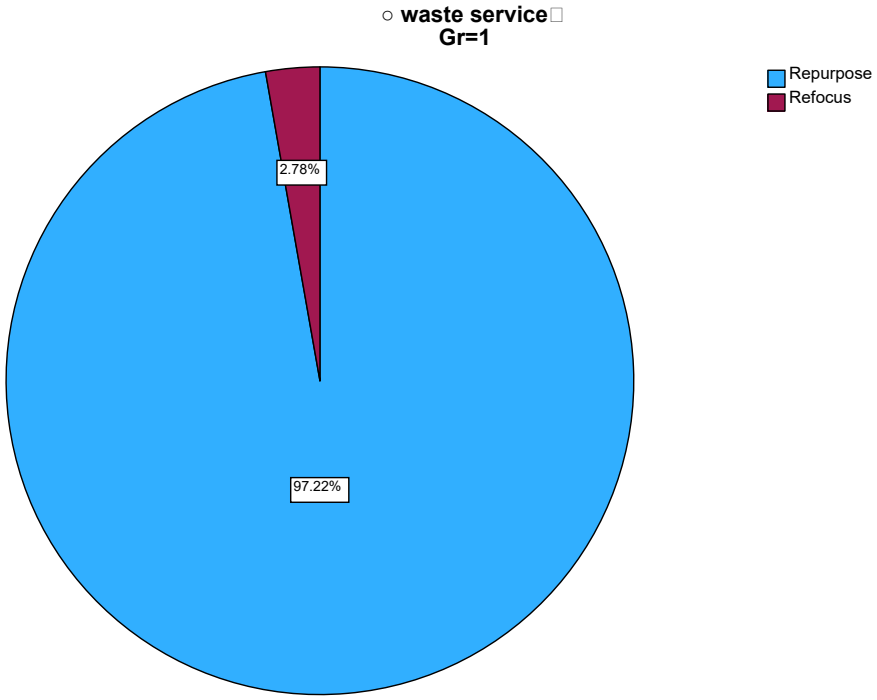

Figure 5. 61: Waste service Gr=1

In the context of waste services, the data indicates a strong preference for repurposing existing services, with 92.1% of respondents supporting this approach. This inclination suggests a desire to adapt or modify current waste services to better meet evolving needs and tackle emerging challenges. Additionally, a smaller percentage of respondents (2.6%) advocate for refocusing waste services, potentially indicating a need to redirect resources or priorities within the current framework. The presence of missing data (5.3%) highlights the importance of further investigation to gain a comprehensive understanding of waste service needs and effectively address any gaps in service provision

5.2.62. Wholesale & Retail Gr=120

Table 5. 77: Wholesale & Retail Gr=120

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	1	1.3	1.4	1.4
	Repurpose	41	53.9	56.9	58.3
	Refocus	29	38.2	40.3	98.6
	Change/Adjust strategy	1	1.3	1.4	100.0
	Total	72	94.7	100.0	
Missing	System	4	5.3		
Total		76	100.0		

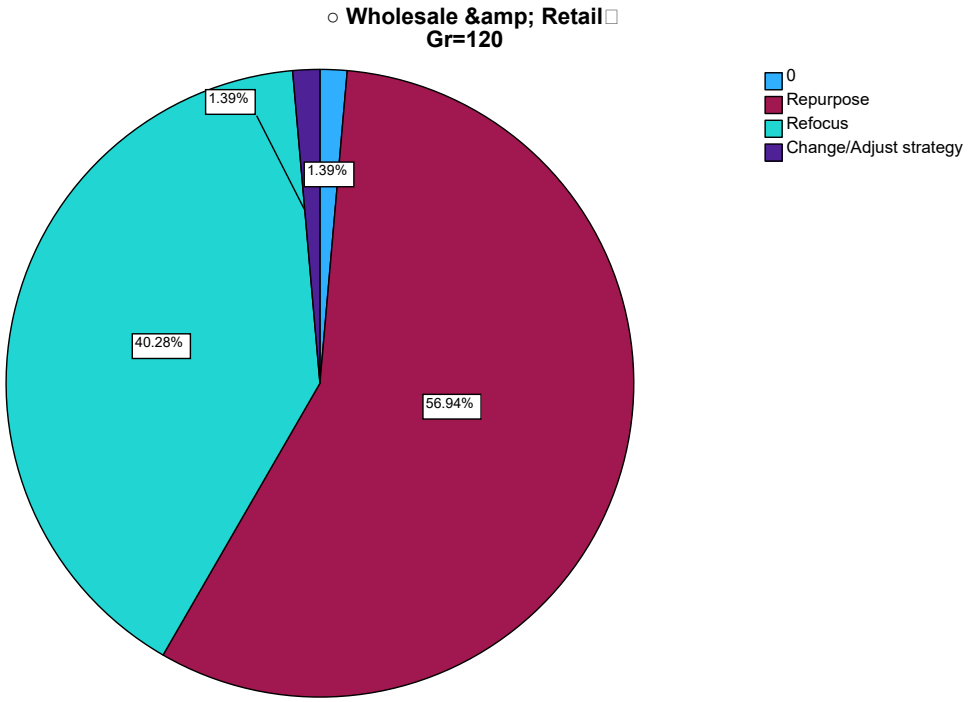

Figure 5. 62: Wholesale & Retail Gr=120

In the W&R sector, the data suggest a predominant preference for repurposing strategies, with 53.9% of respondents endorsing this approach. This likely involves adapting or optimising existing resources and systems within the sector to address waste management challenges or improve efficiency. Additionally, 38.2% of respondents advocate for refocusing strategies, signalling a desire to redirect priorities or resources within wholesale and retail operations to strengthen waste management practices. The presence

of missing data (5.3%) highlights the need for further investigation to gain a comprehensive understanding of waste management practices within the sector and to address any potential gaps effectively.

5.2.63. Wholesale & Retail food market Gr=1

Table 5. 78: Wholesale & Retail food market Gr=1

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Repurpose	72	94.7	100.0	100.0
Missing	System	4	5.3		
Total		76	100.0		

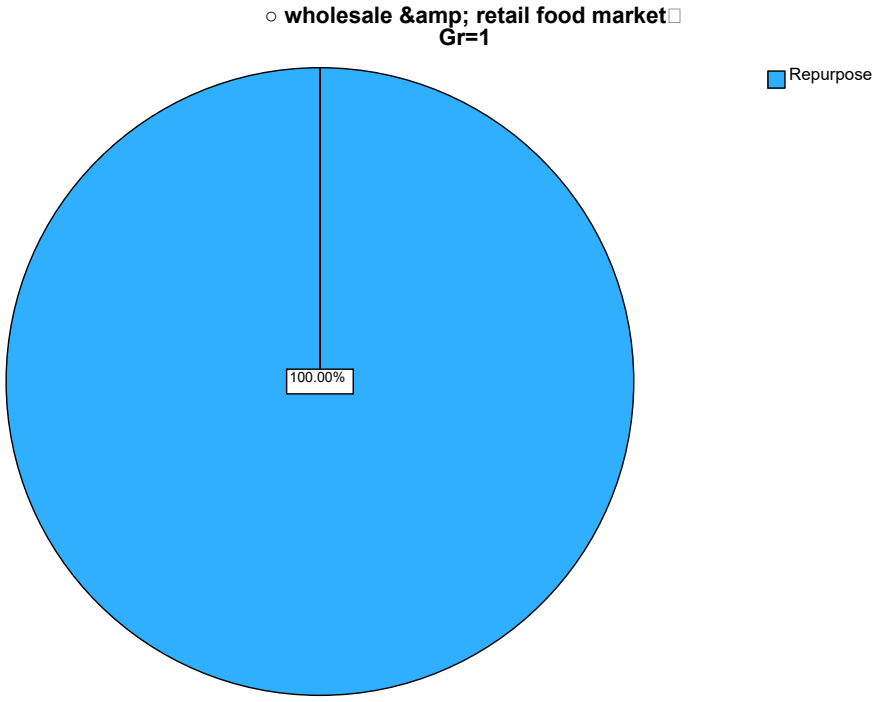

Figure 5. 63: Wholesale & Retail food market Gr=1

In the W&R food market, an overwhelming majority of respondents (94.7%) advocate for repurposing strategies, reflecting a strong consensus on the importance of utilising existing resources and systems to address waste management challenges effectively. Repurposing likely involves innovative approaches to maximise food resource efficiency, reduce waste generation, and enhance sustainability practices. The presence of missing data (5.3%) underscores the need for further investigation to ensure a comprehensive

understanding of waste management practices within the W&R food market sector and to identify any potential areas for improvement or intervention.

5.2.64. Wholesale & Retail sector Gr=6

Table 5. 79: Wholesale & Retail sector Gr=6

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Repurpose	69	90.8	95.8	95.8
	Refocus	1	1.3	1.4	97.2
	Adoption/Implementation	2	2.6	2.8	100.0
	Total	72	94.7	100.0	
Missing	System	4	5.3		
Total		76	100.0		

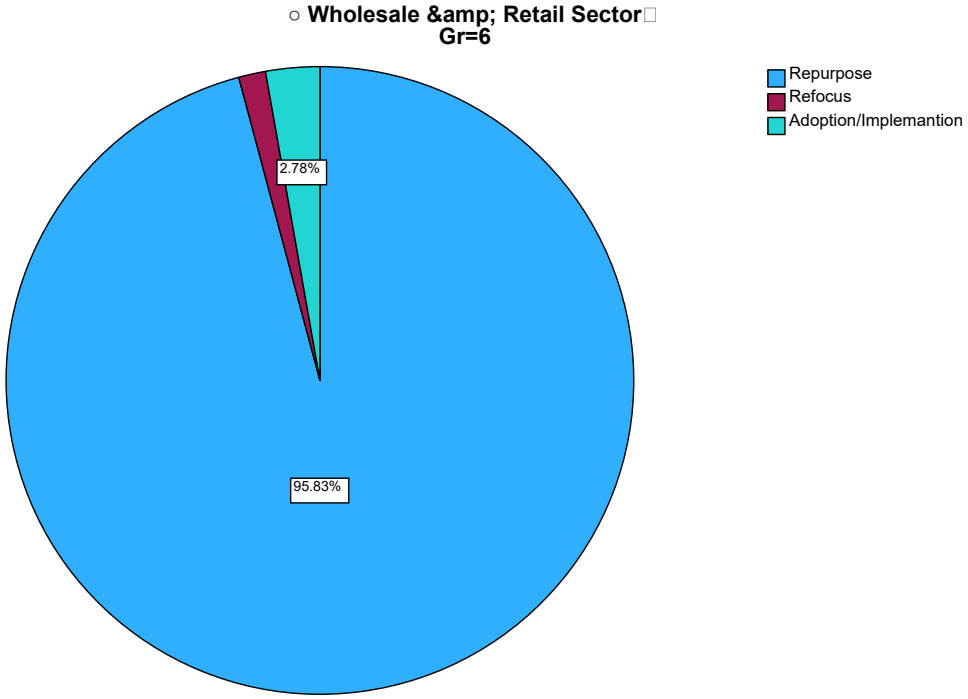

Figure 5. 64: Wholesale & Retail sector Gr=6

In the W&R sector, here is a strong inclination toward repurposing strategies, with 90.8% of respondents supporting such approaches. This reflects a recognition of the importance of utilising existing resources or systems in innovative ways to address waste management challenges effectively within this sector.

Additionally, a small percentage of respondents (1.3%) indicate the need to refocus, suggesting a potential shift in priorities or strategies. Furthermore, 2.6% of respondents emphasised the importance of adoption and implementation, indicating a recognition of the need to integrate new waste management practices or technologies. The presence of missing data (5.3%) highlights the importance of thorough data collection and analysis to gain a comprehensive understanding of waste management practices within the W&R sector.

5.2.65. W&RS governance Gr=2

Table 5. 80: W&RS governance Gr=2

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Repurpose	67	88.2	93.1	93.1
	Refocus	3	3.9	4.2	97.2
	Change/Adjust strategy	1	1.3	1.4	98.6
	Support the strategy	1	1.3	1.4	100.0
	Total	72	94.7	100.0	
Missing	System	4	5.3		
Total		76	100.0		

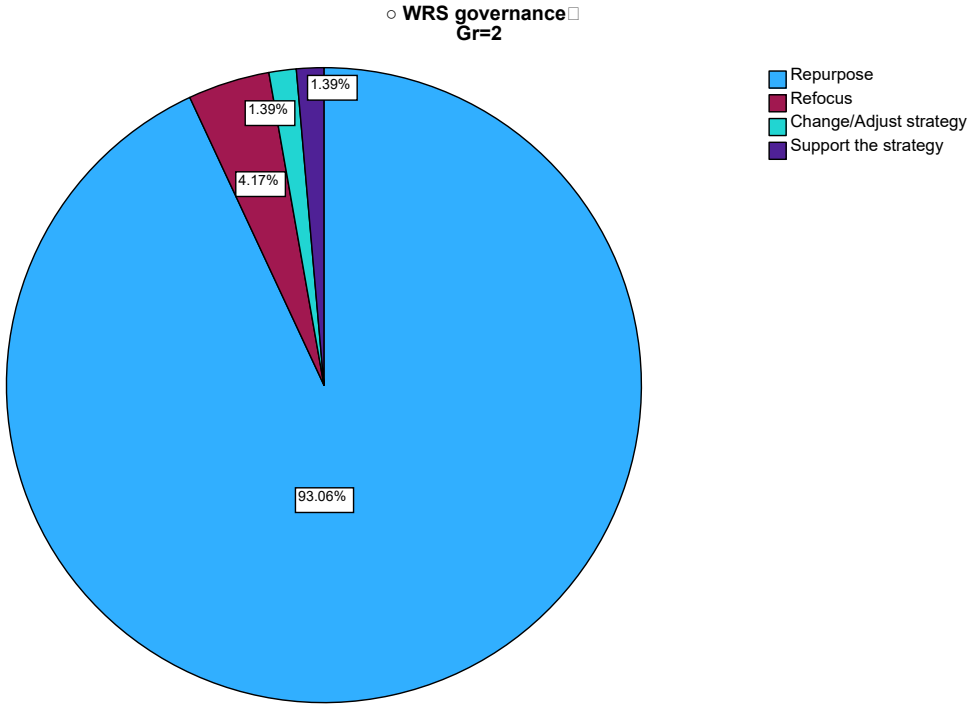

Figure 5. 65: W&RS governance Gr=2

In Waste Reduction and Prevention Strategies (WRS) governance, the predominant sentiment is towards repurposing, with 88.2% of respondents advocating for this approach. This indicates a widespread recognition of the importance of reusing resources and materials to minimise waste generation and promote sustainability. Additionally, a smaller percentage of respondents (3.9%) mentioned the need to refocus, suggesting a potential shift in focus or priorities within governance structures. Moreover, there is a minimal emphasis on changing or adjusting strategies (1.3%) and supporting existing strategies (1.3%). The presence of missing data (5.3%) underscores the importance of ensuring comprehensive data collection to fully understand and address governance issues in waste reduction and prevention strategies.

5.2.66. W&RS requirements Gr=2

Table 5. 81: W&RS requirements Gr=2

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Agree	70	92.1	97.2	97.2
	Agree	2	2.6	2.8	100.0
	Total	72	94.7	100.0	
Missing	System	4	5.3		

Total	76	100.0		

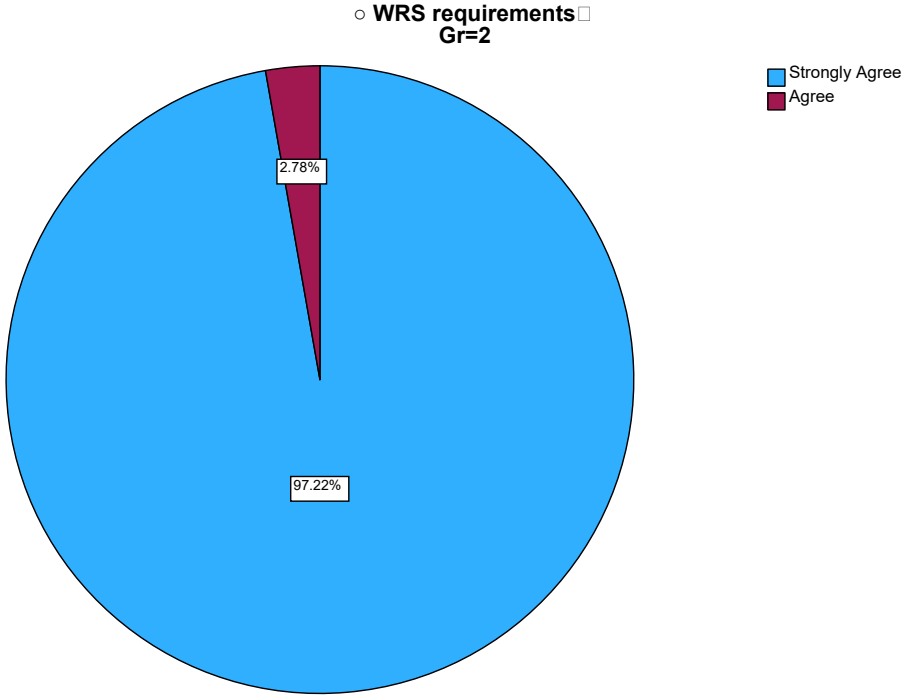

Figure 5. 66: WRS requirements Gr=2

In WRS requirements, a significant majority (92.1%) strongly agree with the identified requirements, reflecting a high level of consensus among respondents on what is essential for effective waste reduction and prevention strategies. This suggests a clear understanding of the key components and factors that contribute to successful waste management initiatives. Additionally, a small percentage (2.6%) agree with these requirements, further reinforcing the overall consensus on the importance of these identified factors. The presence of missing data (5.3%) highlights the need for comprehensive data collection to ensure a thorough understanding of stakeholder perspectives on WRS requirements. Overall, the strong agreement among respondents underscores the importance of addressing these requirements in the development and implementation of waste management strategies.

5.2.67. Zero Energy Cold Chamber (ZECC) Gr=84

Table 5. 82: Zero Energy Cold Chamber (ZECC) Gr=84

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Agree	60	78.9	83.3	83.3

	Agree	7	9.2	9.7	93.1
	Neutral	5	6.6	6.9	100.0
	Total	72	94.7	100.0	
Missing	System	4	5.3		
Total		76	100.0		

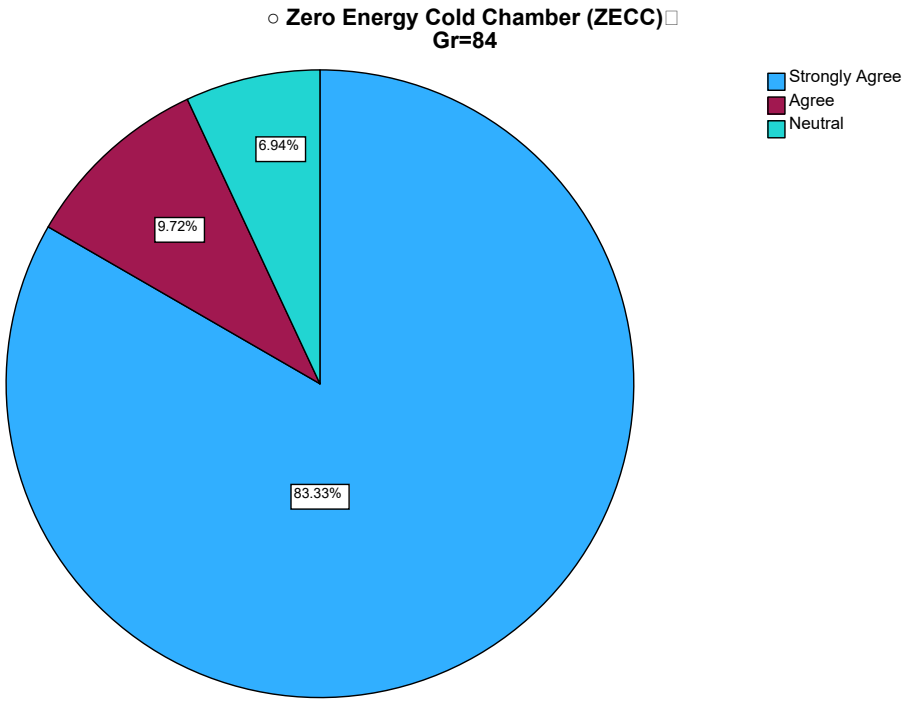

Figure 5. 67: Zero Energy Cold Chamber (ZECC) Gr=84

The ZECC received strong support among respondents, with 78.9% strongly agreeing that it is an effective solution. An additional 9.2% agreed with its efficacy, bringing cumulative agreement to 83.3%. However, 6.6% of respondents expressed neutrality toward ZECC, indicating some uncertainty or lack of opinion on its effectiveness. The presence of missing data (5.3%) highlights the importance of complete responses to ensure a comprehensive understanding of stakeholder perspectives. Overall, the majority support suggests that ZECC holds potential value in addressing cold storage needs while minimising energy consumption.

5.2.68. Zero Food Waste Act Gr=84

Table 5. 83: Zero Food Waste Act Gr=84

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Agree	57	75.0	79.2	79.2
	Agree	6	7.9	8.3	87.5
	Neutral	9	11.8	12.5	100.0
	Total	72	94.7	100.0	
Missing	System	4	5.3		
Total		76	100.0		

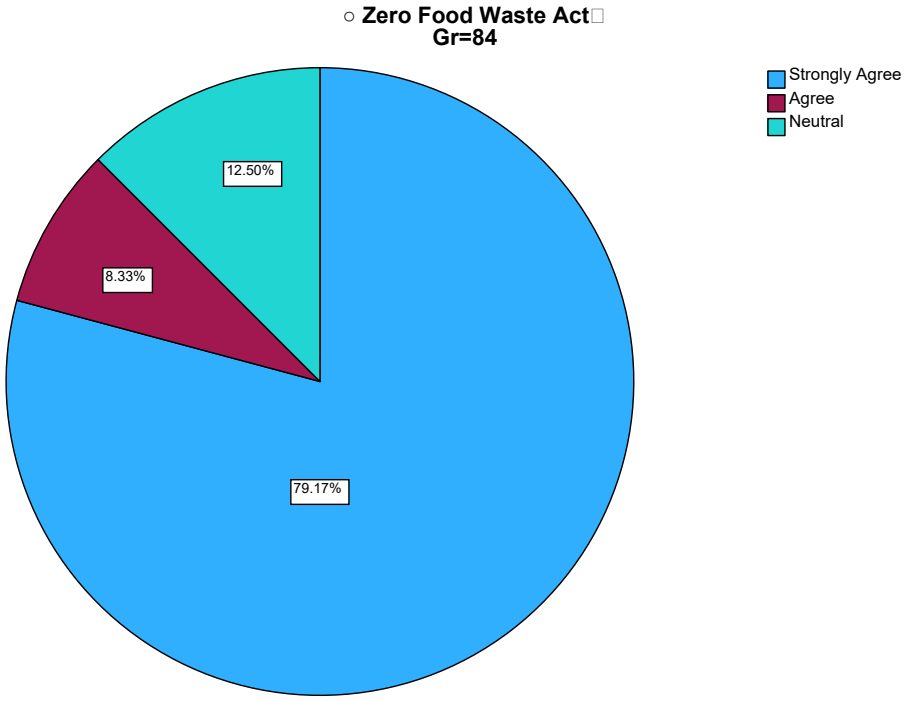

Figure 5. 68: Zero Food Waste Act Gr=84

The Zero Food Waste Act received considerable support, with 75.0% of respondents strongly agreeing that it is favourable. An additional 7.9% agreed with its principles, bringing cumulative agreement to 79.2%. However, 11.8% of respondents expressed neutrality, suggesting some uncertainty or lack of opinion regarding its effectiveness. The presence of missing data (5.3%) underscores the need for complete responses to gain a comprehensive understanding of stakeholder perspectives. Overall, the strong support suggests that respondents recognise the Act's potential to address food waste issues effectively.

5.2.69. Zero Waste tolerance Gr=84

Table 5. 84: Zero Waste tolerance Gr=84

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Agree	65	85.5	90.3	90.3
	Agree	5	6.6	6.9	97.2
	Neutral	1	1.3	1.4	98.6
	Strongly Disagree	1	1.3	1.4	100.0
	Total	72	94.7	100.0	
Missing	System	4	5.3		
Total		76	100.0		

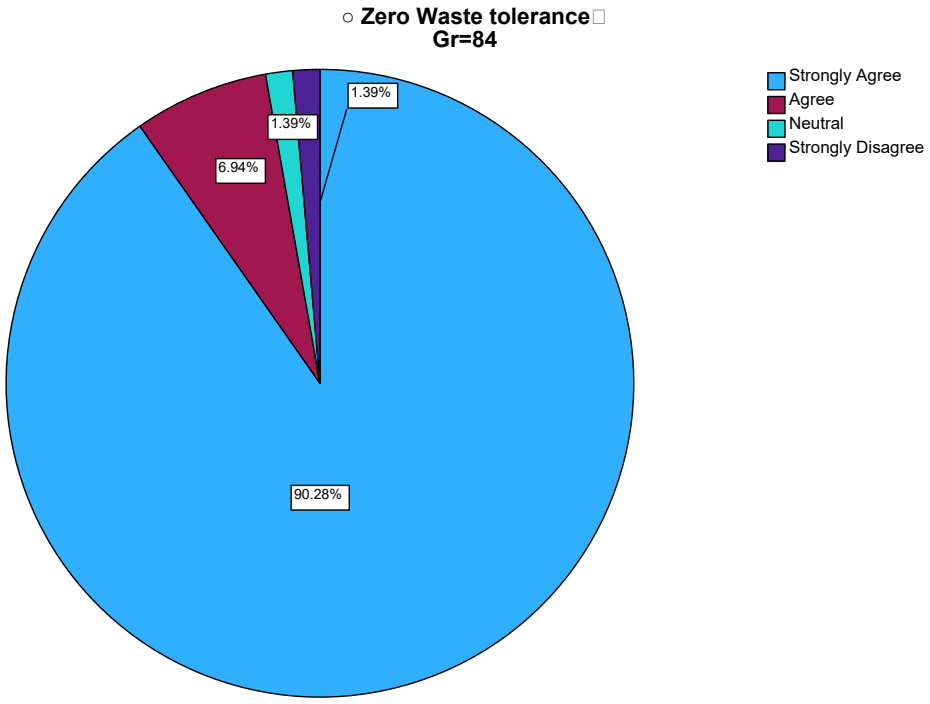

Figure 5. 69: Zero Waste tolerance Gr=84

The survey on Zero Waste tolerance shows a strong inclination toward acceptance, with 85.5% of respondents expressing strong agreement with the concept. An additional 6.6% agreed, bringing cumulative agreement to 90.3%. A small portion (1.3%) remained neutral, possibly reflecting indecision or a lack of a firm stance. Notably, 1.3% of respondents strongly disagreed with the Zero Waste concept,

indicating a minority viewpoint. Overall, the overwhelming support highlights a growing recognition of Zero Waste's importance in promoting sustainable waste management practices.

5.2.70. Smart support markets Gr=355

Table 5. 85: Smart support markets Gr=355

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Repurpose	59	77.6	81.9	81.9
	Refocus	4	5.3	5.6	87.5
	Change/Adjust strategy	1	1.3	1.4	88.9
	Support the strategy	1	1.3	1.4	90.3
	Adoption/Implementation	7	9.2	9.7	100.0
	Total	72	94.7	100.0	
Missing	System	4	5.3		
Total		76	100.0		

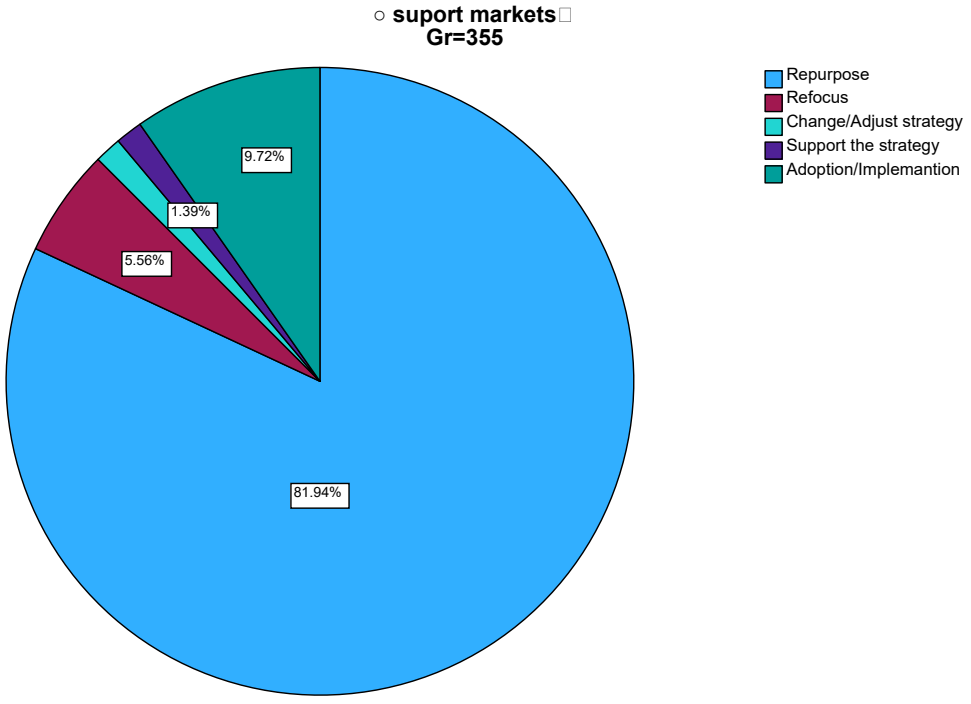

Figure 5. 70: Smart support markets Gr=355

The data on smart support markets in waste management indicate a predominantly positive outlook, with 77.6% of respondents expressing a willingness to repurpose existing strategies to adapt to smart support markets. An additional 9.2% advocate for the adoption and implementation of these strategies, contributing to a cumulative agreement of 100%. A small percentage (1.3%) suggest refocusing or adjusting strategies, indicating a minority viewpoint. This data suggests a general inclination toward utilising smart support markets in waste management, highlighting a promising avenue for innovation and efficiency improvement. The presence of missing data (5.3%) underscores the importance of comprehensive responses to fully capture perspectives on integrating smart support technologies into waste management initiatives.

5.2.71. Waste reduction and prevention strategies Gr=74

Table 5. 86: Waste reduction and prevention strategies Gr=74

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Repurpose	58	76.3	80.6	80.6
	Refocus	2	2.6	2.8	83.3
	Change/Adjust strategy	2	2.6	2.8	86.1
	Support the strategy	5	6.6	6.9	93.1
	Adoption/Implementation	5	6.6	6.9	100.0
	Total	72	94.7	100.0	
Missing	System	4	5.3		
Total		76	100.0		

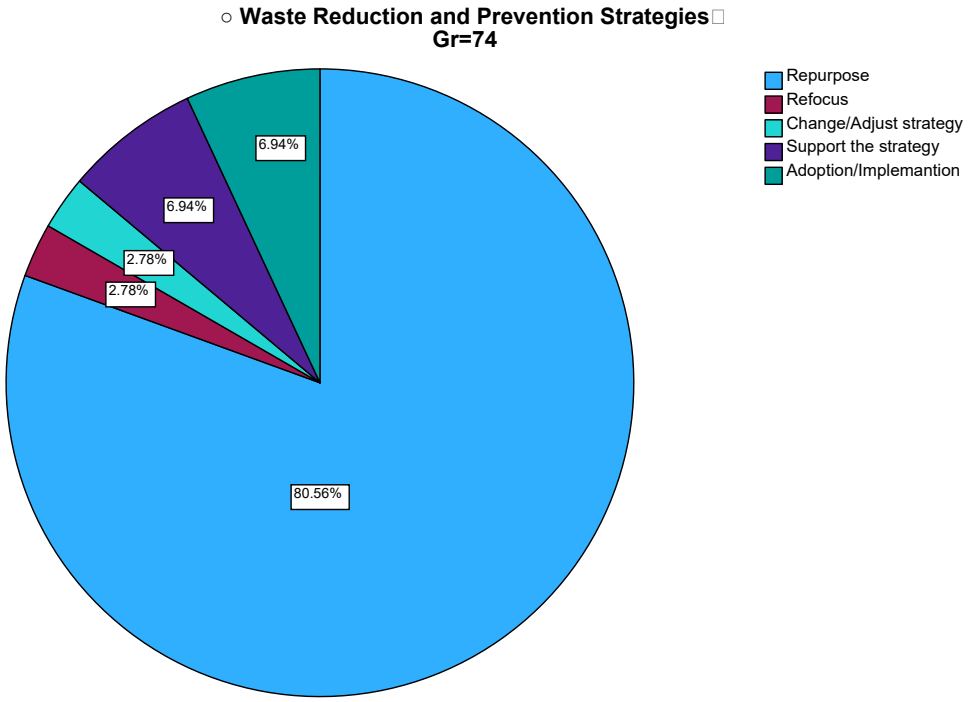

Figure 5. 71: Waste reduction and prevention strategies Gr=74

The data on waste reduction and prevention strategies highlight several approaches favoured by respondents. The majority (76.3%) advocate for repurposing existing strategies, suggesting a preference for reusing or reimagining current methods to minimise waste generation. Additionally, a smaller percentage recommend refocusing efforts (2.6%) or adjusting strategies (2.6%), potentially indicating a need to redirect resources or modify existing approaches for greater effectiveness in waste reduction. Additionally, a proportion of respondents (6.6%) emphasise the importance of supporting current strategies, underscoring a collaborative approach to implementing and sustaining waste reduction initiatives. Another 6.6% highlight the need for adopting or implementing new strategies, indicating a readiness to explore innovative solutions for waste prevention. The presence of missing data (5.3%) warrants further investigation to ensure a comprehensive understanding and to support effective decision-making in waste reduction efforts.

5.3. Fieldwork Data Collection

The primary beneficiaries of the waste management programme are the nation's citizens. Participation in this programme is compulsory, requiring citizens to register to access its benefits. Upon registration, they receive a waste management programme card, granting them free access to healthcare services at accredited private or public health institutions located near their residences. However, if citizens choose

healthcare facilities that are not affiliated with the programme, do not follow its protocols, or seek services outside its coverage, they will need to pay for these services out of pocket or through their medical insurance schemes.

This structure encourages citizens to use the designated programme pathways and adhere to its guidelines to access healthcare services seamlessly and at no additional cost. By linking healthcare access with waste management programme participation, this initiative promotes responsible waste management practices while enhancing citizens' access to essential healthcare services, fostering a healthier and more sustainable society.

5.3.1. Waste management interconnectedness

Waste management interconnectedness refers to the concept of examining the relationships, dependencies, and interactions among various research topics, disciplines, and methodologies (Transnet, 2022; Zhang, 2020). It involves acknowledging the interconnected nature of different fields and understanding how they influence and shape one another. By exploring these interconnections, researchers can uncover hidden patterns, identify interdisciplinary connections, and gain a deeper understanding of complex phenomena. This approach encourages cross-disciplinary collaboration, fosters innovation, and promotes holistic problem-solving (Singh, Kumar & Gupta, 2022; Papademetriou & Hooper, 2019; Culot, 2019).

For example, in the context of sustainable waste management, interconnectedness may involve examining the relationships between environmental science, economics, public health, and policymaking. Understanding how these fields intersect can lead to more comprehensive and effective solutions for addressing waste management challenges. Similarly, interconnectedness can be observed in qualitative and quantitative research methodologies, where mixed methods approach combines the strengths of both approaches to provide a more nuanced understanding of research questions.

The data appear to be a tabular representation of interconnectedness analysis, likely derived from a research project on a systematic review focusing on waste management (Jagannathan et al., 2020; Putri & Aswar, 2022). Each row represents a specific aspect related to waste management, while the columns represent the counts and coefficients associated with the interconnectedness of these aspects. Each aspect appears to have varying degrees of interconnectedness with others, as indicated by the coefficients linked to each pair of aspects. These coefficients likely represent the strength or degree of interconnectedness in terms of environmental science, economics, public health, and policymaking. Overall, this analysis provides insights into the multifaceted nature of waste management and the interconnectedness of its various

dimensions. It can aid in understanding the complex dynamics involved in devising effective waste management strategies and policies (Wang & Yang, 2021; Fidelity Services Group, 2021). Embracing interconnectedness in research encourages a holistic and integrative approach, enabling researchers to tackle complex issues from multiple perspectives and generate innovative solutions that have a real-world impact.

5.3.2. Report outcome and interpretation

The final research report comprehensively presents the current state of FLW in the W&R sector in SA (Version, 2021). It includes an in-depth analysis of existing data, reports, and literature to clarify the scale and drivers of FLW within the sector, highlighting the economic, social, and environmental impacts. Furthermore, the report describes waste management strategies and practices implemented in developed countries such as the USA, Canada, Germany, the UK, and Australia. Case studies and successful initiatives were examined to identify key approaches that have proven effective in reducing food waste and promoting sustainable waste management in the retail sector. Finally, evidence-based recommendations are provided on waste management strategies and practices that SA's W&R sector could implement in a post-COVID-19, technology-driven environment (Wang & Yang, 2021; Kang, Kim & Cho, 2023). These recommendations are tailored to address the specific challenges and opportunities faced by the sector, considering lessons learned from the COVID-19 pandemic and leveraging emerging technologies to optimise waste management processes and minimise FLW (Wang & Yang, 2021; Kang et al., 2023; European Investment Bank, 2023; Mcleish, Johnstone & Schot, 2022).

5.3.3. Interpretation and analysis of the table

The provided list includes various codes related to waste management, environmental sustainability, and associated topics. Each code is accompanied by information on its groundedness, density, and modification date. Below is an interpretation and analysis of some key codes:

- Food Waste Management Strategies (Codes: 24): This code has a high groundedness score of 7, indicating strong empirical support for food waste management strategies. It suggests substantial research on the practical implementation of strategies to manage food waste effectively.
- Global waste management challenges (Codes: 40): This code also has a high groundedness score of 7, reflecting robust empirical support for the challenges associated with waste management in environmental sustainability. It implies that global challenges in this area are well-documented and widely recognised.

- Human Health (Codes: 143): With a groundedness score of 3, this code indicates moderate empirical support for the relationship between waste management and human health. There is some evidence on research available on how waste management practices can impact human health.
- Recycling and Resource Recovery (Codes: 373): Although this code has a groundedness score of 0, it likely represents a well-established concept on practice within waste management. The absence of groundedness may be due to the code's broad or generic nature, rather than a lack of empirical support.
- Sustainable Waste Management Practice (Codes: 5856): Interestingly, this code has a groundedness score of 0, suggesting a lack of empirical support or evidence for sustainable waste management practices. However, given the importance and prevalence of sustainability efforts, this may be an anomaly or an oversight in the coding or repurposing process.

Overall, the analysis of these codes provides insights into the level of empirical support and significance of various aspects of waste management and environmental sustainability. It highlights areas where more research or practical implementation may be needed, as well as areas where existing knowledge and practices are well-established.

Table 5. 87: Code List

Code	Grounded	Density	Modified
Collaboration and Stakeholder Engagement	139	1	4/1/2024
Education and training in waste management	138	1	4/1/2024
financial resources	789	0	4/1/2024
Food Waste Management Strategies	24	7	4/1/2024
general waste	1	2	4/1/2024
global challenges	40	7	4/1/2024
health and food security	20	1	4/1/2024
human health	143	3	4/1/2024
human health risk	143	0	4/1/2024
human interventions	144	4	4/1/2024
plastic waste pollution	12	3	4/1/2024
pollution impact and side effects	373	0	4/1/2024
pollution levels	299	3	4/1/2024
post-Covid 19	1	0	4/1/2024
potential solution to waste management	1	2	4/1/2024
potential threat	2	2	4/1/2024
prevent food waste	3	0	4/1/2024
problems of waste management	11	0	4/1/2024
Recycling and Resource Recovery	373	0	4/1/2024
reduce waste management generation	17	0	4/1/2024
strategies	64	2	4/1/2024
sustainable supply chain	72	1	4/1/2024
Sustainable waste management practice	5856	0	4/1/2024
type of waste	1	0	4/1/2024
waste disposal syestems	477	0	4/1/2024
Waste Management	98	0	4/1/2024
Waste management Act 2008	1	0	4/1/2024
waste management concepts	182	0	4/1/2024
Waste Management Hierarchies	3421	0	4/1/2024
Waste Management Model (WMM)	20	0	4/2/2024
Zero Food Waste Act	84	1	4/1/2024
Zero Waste tolerance	84	1	4/1/2024

5.3.4. Retail initiatives in waste management

Retail initiatives in waste management encompass a range of strategies aimed at reducing waste generation, promoting sustainability, and engaging stakeholders within the W&R sector (Transnet, 2022). These initiatives often include packaging reduction, where retailers strive to minimise packaging materials and promote eco-friendly alternatives, such as biodegradable or recyclable packaging, to reduce environmental impact. Additionally, retailers implement measures to prevent food waste at various stages of the supply chain, including improved inventory management, donation programmes for surplus food, and composting initiatives. Many retailers also establish recycling programmes within their stores to encourage customers and employees to recycle materials like paper, plastic, and glass, thereby diverting waste from landfills. Moreover, retailers prioritise sourcing products from suppliers that adhere to sustainable practices, such as using renewable materials, reducing carbon emissions, and supporting ethical labour practices (Alipour & Rahimpour, 2020; Jagannathan et al., 2020). They engage consumers through educational campaigns, product labelling, and in-store signage to raise awareness about waste reduction, recycling, and sustainable consumption habits.

Furthermore, retailers cooperate with local communities, non-profit organisations, and government agencies to organise clean-up events, recycling drives, and other initiatives aimed at promoting environmental stewardship (Madrid-Guijarro & Duréndes, 2023; Transnet, 2022; Takacs, Brunner & Frankenberger, 2022). By leveraging technology solutions such as data analytics, smart packaging, and inventory management systems, retailers optimise operations, reduce waste, and improve sustainability performance. Overall, by implementing these strategies, retailers not only contribute to environmental conservation and waste reduction but also enhance their brand reputation, customer loyalty, and long-term profitability.

5.3.5. Designing for end-of-life

Designing products with consideration for their end-of-life is essential for minimising waste and promoting sustainability (Kossewska, 2018; Design, Series, Lafors & Allende, 2021). Firstly, retailers can reduce the use of single-use plastics and minimise the volume of packaging materials, thereby reducing the amount of waste generated. Secondly, adopting alternative materials such as bioplastics or biodegradable plastics can facilitate the decomposition of packaging, reducing environmental impact. Additionally, promoting circular product design involves incorporating recycled or repurposed materials into packaging production, thereby closing the loop on material used, and minimising waste. By implementing these strategies, retailers can contribute to the reduction of plastic pollution, promote the adoption of eco-friendly materials, and move towards a more sustainable approach to packaging design and waste management.

5.3.6. In-store waste reduction

Reducing in-store waste is essential for retailers to minimise their environmental footprint and promote sustainability (Transnet, 2022; Zhang, 2020; Andrianda et al., 2021). Implementing naked food aisles, where products are displayed without single-use packaging, can significantly reduce plastic waste. Retailers can also replace single-use plastics with sustainable alternatives, such as paper and wood for packaging materials. Utilising dry-misting technology for fresh produce displays eliminates the need for plastic packaging while maintaining product freshness. Additionally, removing plastic bags at the checkout and encouraging the use of reusable alternatives can further reduce plastic waste generation. By adopting these strategies, retailers can demonstrate their commitment to environmental responsibility, meet consumer demand for sustainable practices, and contribute to a healthier planet.

5.3.7. Green buildings and offices

Implementing green practices within buildings and offices is crucial for retailers to reduce their environmental impact and promote sustainability (DHET, 2013.). This can be achieved by adopting strategies such as reducing, reusing, and recycling office-related waste, including paper products. Additionally, retailers can implement water-saving measures like rainwater collection and greywater reuse to minimise water consumption. Reducing energy usage through the installation of solar power systems, energy-efficient lighting, and appliances can significantly lower the carbon footprint of retail operations. Creating green spaces around office premises further enhances environmental sustainability and employee well-being. Moreover, appointing a waste management company with expertise in waste reduction and recycling can streamline waste management processes and ensure compliance with sustainability goals (South Africa. Department of Health, 2020; Adom, Hussain & Agyem, 2018). By incorporating these green building and office practices, retailers can demonstrate their commitment to environmental stewardship while fostering a more sustainable business environment.

5.4. Comprehensive Analysis of Waste Management

In framing the analytical context of the waste management project, it is evident that there is a global trend towards "green retailing", motivated primarily by the imperative to address climate change. Green retailing encompasses a management approach that seeks environmental protection, cost reduction, and increased revenue concurrently (Sinha, Chaudhuri & Dhume, 2019). This approach considers the entire supply chain, logistics, facilities, customer-facing components, and post-consumer behaviours. Drivers for corporate environmental sustainability in retail include global and national environmental policies, stakeholder pressures, and the potential impact on profitability (Naidoo & Gasparatos, 2018). Green retailing not only reduces costs and increases revenue but also enhances efficiencies along the supply chain, minimises packaging waste, conserves energy, and appeals to sustainability-conscious consumers (Naidoo & Gasparatos, 2018). Moreover, the emerging trend of green retailing presents opportunities for new businesses to assist in waste reduction, recovery, and value addition for retailers.

Wastage, particularly in the form of packaging and food waste, significantly affects green retailing and socio-economic conditions. The waste economy contributes substantially to SA's gross domestic product (GDP), job creation, and livelihoods (Department of Environmental Affairs, 2017). Retailers play a pivotal role in generating packaging waste, with major corporations like Coca Cola, PepsiCo, and Nestle identified as top polluters globally (Break Free From Plastic, 2018). Food and beverage packaging alone constitutes a significant portion of retail packaging waste, with substantial amounts being recycled annually in SA

(Packaging SA, 2018). However, waste poses various negative impacts, including air and water pollution, reduced land availability, littering, and financial burdens on municipalities (Raworth, 2018).

Food waste exacerbates socio-economic challenges, with a significant portion occurring at the distribution and retail stages of the food value chain .The Council for Scientific and Industrial Research (CSIR) highlights the triple negative effect of food waste, impacting the economy, food security, and climate change (CSIR, 2019). Major drivers of food waste in the retail sector include inefficiencies in the distribution system, date labelling practices, ordering systems, packaging failures, product recalls, and quality specifications (CSIR, 2019). However, interventions at the retail stage, such as optimised ordering systems, in-store processing of surplus food, and donations to organisations like Food Forward SA, can mitigate food waste and its adverse effects (CSIR, 2019).

Globally, various policy frameworks and initiatives aim to address food and packaging waste, offering insights for retailers to adopt sustainable practices. The SDGs provide a comprehensive framework for achieving food security, reducing waste, and combating climate change (UN, 2015). European nations have implemented legislation and strategies to reduce food and packaging waste, emphasising measures such as awareness campaigns, incentives for food donations, and sustainable packaging design (European Union, 2018a). In SA, national policies like the National Waste Management Strategy (NWMSS) and the National Environmental Management: Waste Act (NEMWA) mandate EPR and industry waste management plans (IndWMPs) to address packaging and food waste (SA, 2011; SA, 2008). Despite recent changes in waste management legislation, retailers are expected to play a proactive role in waste reduction and management, aligning with national objectives and global best practices.

5.4.1. Challenges in retail waste reduction

The challenges in retail waste reduction within SA's W&R sector are multifaceted (Brooks, 2012; UN, 2015; Sides & Skelly, 2021). A lack of alignment among industry stakeholders, coupled with insufficient data and standardised measurement methods, impedes effective waste management (Alipour & Rahimpour, 2020; Dania et al., 2007). The absence of clear waste reduction targets and industry-wide strategies further complicates the issue. Inconsistent policies across the African continent, particularly regarding plastic bans, pose additional hurdles for retailers expanding their operations.

Food waste presents unique challenges, with inefficiencies occurring throughout the food value chain, including within retail establishments. Inadequate staff training and poor merchandising practices exacerbate food waste, as does the disposal of grade 3 produce and excessive packaging. Retailers struggle

to accurately measure, and report waste due to limited transparency and cooperation, hindering targeted waste reduction efforts. Moreover, the cost-sensitive nature of the retail industry often conflicts with waste reduction initiatives, while reliance on waste management companies focused on cost containment limits progress.

Challenges in plastic and paper packaging waste stem from rising disposal costs, a lack of alternatives, and inconsistent recycling practices (Kossewska, 2018; Ma, 2023; Gregori, Holsmann & Wdowiak, 2021). The circular economy model is hindered by a shortage of skilled designers and misaligned incentives. Additionally, retailers face pressure from consumers and regulatory bodies to address plastic waste, although cost considerations remain a primary driver. Addressing these challenges requires collaborative efforts across the industry, including standardised labelling, improved packaging design, and enhanced recycling infrastructure. Retailers must prioritise waste reduction, transparency, and collaboration to achieve meaningful progress toward a more sustainable future.

Based on the data provided, it is evident that there are significant challenges and opportunities in addressing waste within the retail sector in SA. The arguments provide a breakdown of key points and potential solutions. Retailers in the W&R sector encounter several challenges hindering the adoption of green initiatives. Firstly, there is a scarcity of available alternatives and inadequate governmental support for incentives, limiting retailers' options for sustainable practices. Financial constraints further exacerbate the situation, as many retailers struggle to afford investments in green retailing. Resistance from both consumers and suppliers poses another hurdle, necessitating changes in business practices and behaviours (Rietse & Sacher, 2022; Huang, 2022). Additionally, the reluctance of property landlords to invest in green practices inhibits progress, as their willingness to commit to sustainable initiatives remains lacking. Overcoming these challenges requires collaborative efforts between stakeholders, including policymakers, retailers, consumers, and suppliers, to address financial barriers, increase awareness, and foster a supportive environment for sustainable practices within the W&R sector.

5.4.2. Problem of waste management policy review

The problem statement highlights the significant challenges posed by food waste in SA's W&R sector, emphasising its adverse effects on food security, economic resources, and environmental sustainability (Chlebna & Mattes, 2022; Kalonda et al., 2021). An estimated 10 million tonnes of food are wasted annually, accompanied by substantial water and energy losses, placing the country in a paradox of food insecurity amidst abundance. This issue is further compounded by methane and carbon dioxide emissions from food disposal, intensifying climate change concerns.

The COVID-19 pandemic introduced additional challenges, disrupting supply chains, altering consumer behaviour, and impacting the hospitality industry. While initial disruptions led to temporary reductions in food waste, subsequent changes in demand patterns and supply chain adjustments now call for a reassessment of waste management practices. Lockdown measures and increased power outages have further complicated matters, causing cold chain failures and accelerating food spoilage and waste generation.

Beyond environmental concerns, food waste carries profound economic implications, diminishing profitability and increasing strain on vulnerable households (Rohe Oltmer, Wolter, Gmeiner & Tschersich, 2022; Municipality et al., 2023). However, there exists potential for positive change, as evidenced by the economic incentives driving corporate environmental sustainability among SA retailers. When implementing sustainable waste management strategies, retailers can mitigate food waste while enhancing their brand image and profitability (Chlebna & Mattes, 2022; Wang & Yang, 2021). Given these multifaceted challenges, there is an urgent need to investigate current practices and identify feasible solutions tailored to the post-COVID-19 context. This involves examining global best practices and adapting them to address the unique challenges and opportunities within the SA W&R sector. By addressing issues such as overstocking, expiration management, and cold chain failures, stakeholders can work towards the dual goals of reducing food surplus and alleviating food insecurity. Moreover, by aligning with global and local policies aimed at reducing food waste (Tuomi et al., 2021), the W&R sector can contribute to broader sustainability efforts and mitigate its adverse impacts on both the economy and the environment (Janker & Thieme, 2021; Portela & Olsen, 2023), as illustrated in the waste management policy model in Figure 11.

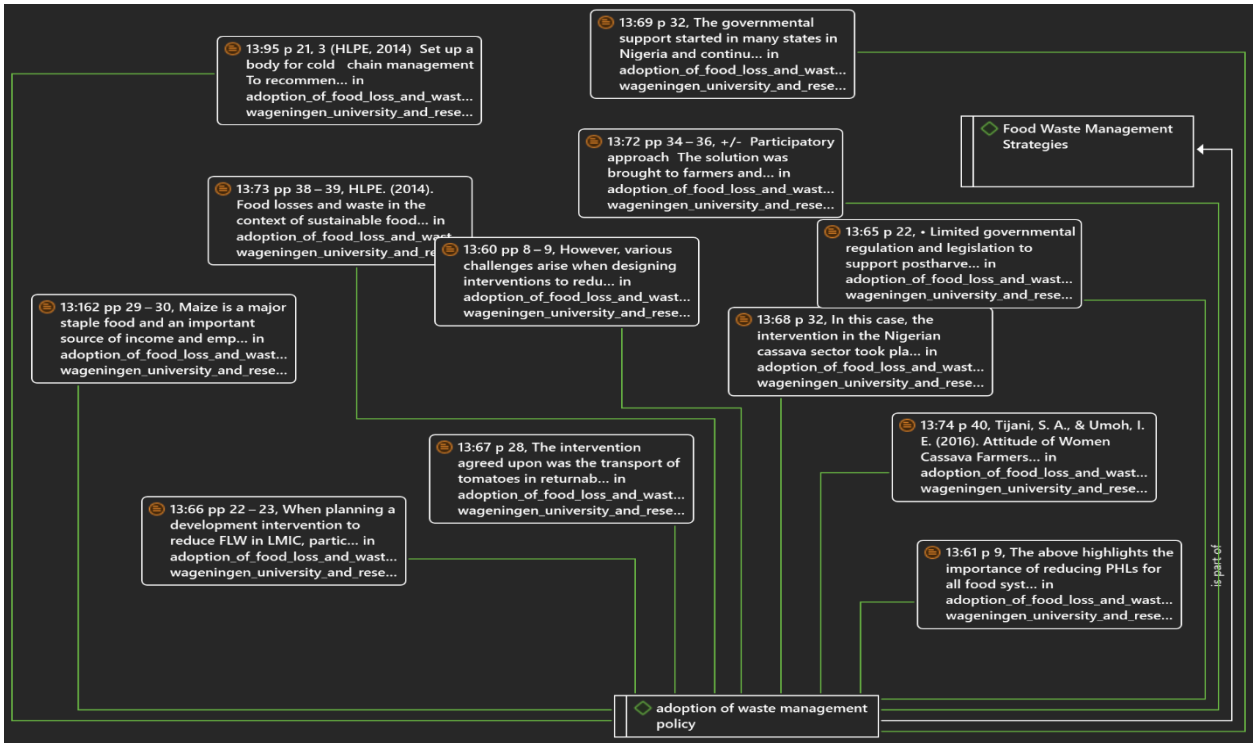

Figure 5. 72: Waste management policy review

5.4.3. Sustainable W&R supply chains

Implementing sustainable W&R supply chain practices is imperative for reducing environmental impact and enhancing efficiency within the retail sector (Ali, 2021; Mohammed & Alawi, 2022). Firstly, prioritising local suppliers can significantly diminish transportation distances, thereby lowering carbon emissions linked to logistics. Secondly, improving demand forecasting accuracy is essential to avoid overstocking, thereby minimising excess inventory that could lead to waste (Verwijs & Russo, 2023; Roth, 2019; Msiza, 2022). Thirdly, optimising cold-chain management ensures the preservation of perishable goods throughout the supply chain, reducing the risk of spoilage and waste. Additionally, sourcing directly from farmers and aligning products with seasonal availability not only supports local agriculture but also reduces the carbon footprint associated with long-distance transportation.

By embracing these sustainable W&R supply chain practices (Mokwena, 2021; Pavelkova, Homolka, Knapkova, Kolman & Pham, 2018; Mohammed & Alawi, 2022), retailers can mitigate environmental harm, improve operational efficiency, and contribute to a more sustainable future (Ali, 2021; Mohammed & Alawi, 2022; Ufua et al., 2022). These measures not only benefit the environment but also enhance the resilience and competitiveness of retail businesses in an increasingly environmentally conscious market.

Thus, integrating sustainability into supply chain management is essential for fostering a more responsible and sustainable retail sector.

5.4.4. Potential waste management strategies and solutions

To effectively tackle the challenges associated with waste management in the retail sector, SA retailers can implement a range of potential solutions (Dania et al., 2007; Ufua et al., 2022; Martínes, Errasti, Rudberg & Mediavilla,, 2014; Madrid-Guijarro & Duréndes, 2023). Firstly, investing in research and development for packaging redesign and sustainable alternatives can drive innovation and reduce environmental impact. Secondly, accessing financial support through government or industry-led mechanisms can alleviate affordability barriers that hinder the adoption of green practices. Thirdly, regulatory measures, including mandated incentives for waste reduction, can provide a framework for retailers to operate sustainably. Additionally, fostering stakeholder engagement with consumers, suppliers, and property landlords is crucial for promoting collaboration and understanding towards waste reduction goals, as illustrated in the figure below. Lastly, developing training programmes for staff and suppliers can enhance product handling and display practices, thereby minimising food waste. By embracing these solutions and fostering collaboration among various stakeholders, SA retailers can make significant strides in reducing waste, contributing to both environmental sustainability and socio-economic development goals.

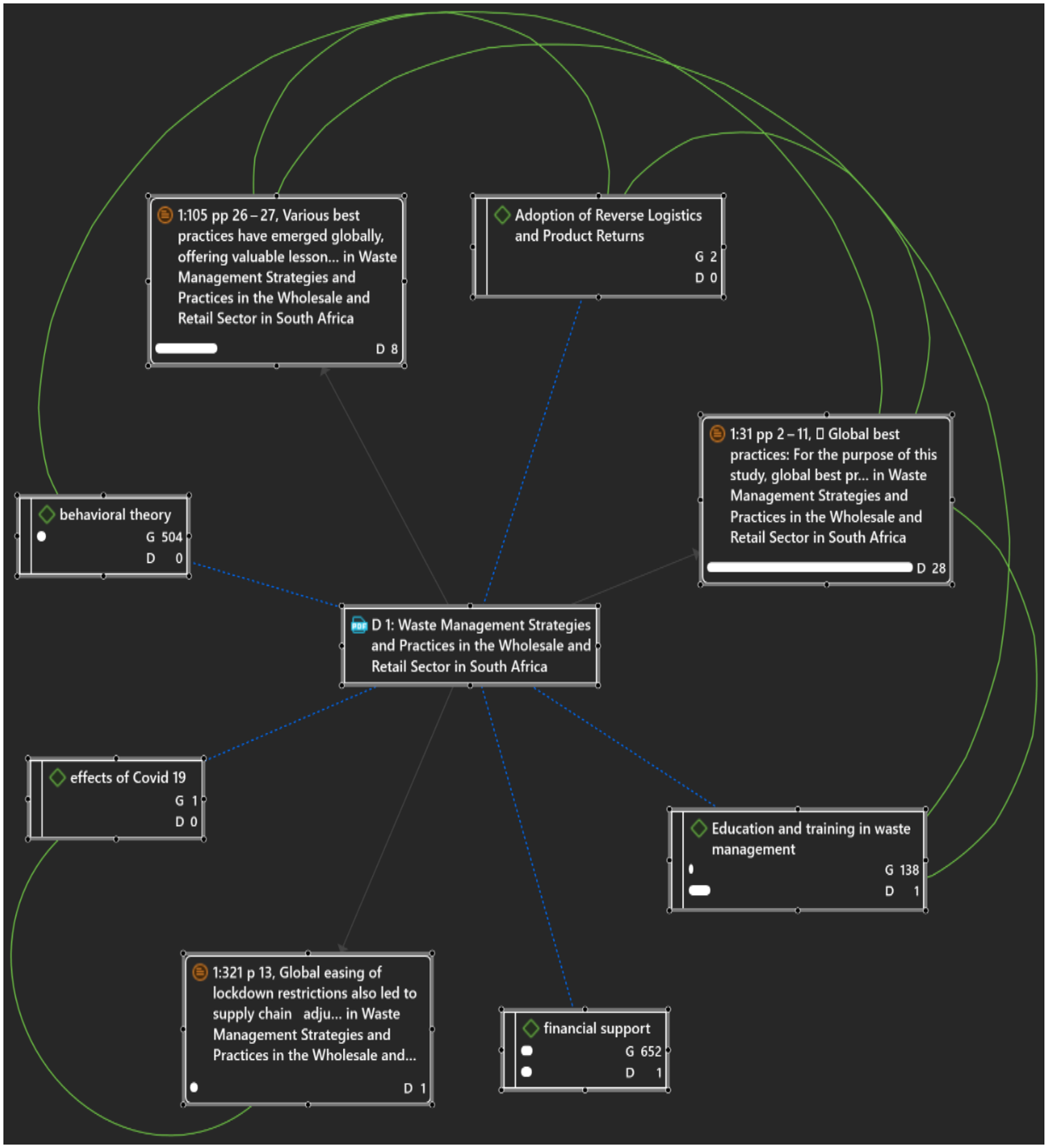

Figure 5. 73: Waste management strategies and practices in the W&R sector in SA

Researcher's Design

5.4.5. Global waste management practices

Global practices in waste management include various strategies such as supply chain optimisation, circular economy principles (Alipour & Rahimpour, 2020; Transnet, 2022; Biswas, 2021), and consumer education initiatives aimed at reducing waste generation and promoting sustainability within the W&R

sector. Developed countries like the USA, Canada, Germany, the UK, and Australia have implemented successful waste management practices, including innovative packaging designs, efficient inventory management systems, and robust recycling programmes (Krishnan & Wahab, 2019; Kalonda et al., 2021; Mnembe, 2022). In contrast, SA retail initiatives have focused on similar objectives but face unique challenges such as limited infrastructure, socioeconomic disparities, and regulatory constraints. Nonetheless, SA retailers have made strides in implementing sustainable practices, including waste minimisation strategies, packaging redesigns, and community engagement programmes. Collaborative efforts between global best practices and localised initiatives in SA can further advance sustainable waste management in the W&R sector (Wasman et al., 2022; Fidelity Services Group, 2021; Jones, 2019), fostering environmental stewardship and economic resilience (Transnet, 2022).

5.4.6. Education and waste management training

Implementing education and waste management training initiatives is essential for retailers to promote waste reduction and recycling practices among both staff and consumers (Oumran et al., 2021;, Alipour & Rahimpour, 2020). Retailers can provide comprehensive training programmes for staff to raise awareness about the importance of waste reduction and recycling, as well as to equip them with the necessary knowledge and skills to implement these waste management practices effectively (Nsamat, 2020; Mnembe, 2022; Zhang, 2020). Additionally, educating consumers about waste reduction initiatives and proper recycling methods through various channels, such as signage, informational materials, and digital platforms, can help instil environmentally responsible behaviours. By investing in education and training, retailers can empower their workforce and customers to actively participate in waste reduction efforts, ultimately contributing to a more sustainable retail industry and environment.

5.4.7. Collaboration and waste management advocacy

In addition to the collaboration and waste management advocacy strategies (DHET, 2013; Businesses & Employees, 2020; Menon & Hartz-Karp, 2019), retailers should collaborate with other stakeholders within the supply chain to drive sustainable design and waste reduction initiatives collectively. When working together with suppliers, manufacturers, and distributors, retailers can leverage their combined expertise and resources to implement more effective and comprehensive WRS. Furthermore, advocating for policy changes and infrastructure improvements at local, national, and even international levels can help create a supportive regulatory environment for waste management efforts. It is crucial for retailers to carefully evaluate these recommendations in the context of their specific operational environments and consumer behaviours before implementation. Moreover, continuous monitoring and assessment of the effectiveness

of these initiatives was essential for making necessary adjustments and ensuring long-term sustainability in waste management practices.

5.5. Analysis of the SA Waste Management Act

The analysis of the SA Waste Management Act involves a comprehensive examination of its provisions, implementation, and effectiveness in addressing waste management challenges in the country (South Africa. National Treasury, 2022; Garsa-Reyes, 2012). This process comprises several essential steps. Firstly, there is a thorough review of the legal framework, encompassing the Act's objectives, scope, and key provisions related to waste prevention, minimisation, recycling, and disposal. Following this, an assessment of the Act's implementation across different levels of government and sectors is conducted to gauge the extent to which its provisions have been put into practice. This assessment includes evaluating the roles and responsibilities of stakeholders, enforcement mechanisms, and compliance with regulatory requirements. Subsequently, an impact evaluation is undertaken to analyse the Act's effects on waste reduction, environmental protection, public health, and socio-economic development (Alipour & Rahimpour, 2020; Jagannathan et al., 2020; Rohe et al., 2022). Any gaps, weaknesses, or challenges in implementation and enforcement are identified, such as inadequate funding, limited capacity, and regulatory loopholes. Finally, based on the analysis, recommendations are formulated to strengthen the Act and address current and emerging waste management challenges. These recommendations may involve legislative amendments, capacity-building initiatives, public education campaigns, and enhanced enforcement measures. Overall, the analysis aims to provide valuable insights into the Act's efficacy, with the goal of promoting sustainable waste management practices and safeguarding the environment for future generations (Brooks, 2012).

5.6. SA W&R Sector Waste Food Management Indicators

SA W&R sector key waste food management indicators serve as essential metrics to evaluate the efficacy of food waste management practices(Municipality et al., 2023.). These indicators offer insights into various facets of food waste generation, handling, and disposal, empowering stakeholders to track progress, pinpoint areas for enhancement, and make well-informed decisions (Municipality et al., 2023). Within the SA W&R sector, significant indicators include the following:

- Food Waste Generation Rate: Quantifies the volume of food waste generated per unit of production or sales, providing an overarching assessment of wasted food volume.
- Food Waste Composition: Identifies the types and sources of food waste, including perishable items, packaged goods, and prepared foods, aiding in targeted WRS.

- Food Waste Diversion Rate: Measures the percentage of food waste diverted from landfills through recycling, composting, donation, or other alternative methods, indicating the effectiveness of diversion efforts in mitigating environmental impact.
- Food Loss and Spoilage Rate: Evaluates the percentage of food lost or spoiled across the stages of the supply chain, shedding light on opportunities for refining handling and storage practices.
- Food Recovery Rate: Reflects the proportion of surplus or unsold food recovered for donation or redistribution, addressing food waste while tackling food insecurity.
- Food Waste Reduction Targets: Establishes specific goals for reducing food waste over time, enabling progress tracking and fostering continuous improvement in waste management practices.
- Cost of Food Waste: Assesses the financial implications of food waste, encompassing disposal fees, revenue loss, and resource wastage, guiding decisions regarding efficient waste management strategies.

Monitoring these key waste food management indicators empowers stakeholders in the SA W&R sector to gauge performance, foster accountability, and implement targeted measures promoting sustainable food waste management and environmental conservation.

5.7. Summary of Data Analysis, Findings, and Discussions

The analysis of the research data, findings, and discussions illuminate the pressing issues surrounding waste management in the W&R sector, especially in SA, while presenting notable challenges and opportunities for improvement. Firstly, the project reveals the significant volume of waste generated in the sector, attributable to overstocking, excessive packaging, and inefficient supply chains. This waste not only impacts the environment but also imposes economic burdens through resource depletion and financial losses (Jagannathan et al., 2020; Das, Salam, Lassi, Khan, Mahmood, Patel & Bhutta, 2016; Markey, Ravenswood & Webber, 2012; Tuomi et al., 2021; Work & Toolkit, 2006; Ma, 2023; Yin & Boyd, 2021; Anon, n.d.; Moleli, 2018; Rohe et al., 2022). Drawing insights from developed nations, the research highlights effective waste management strategies, such as optimised supply chains and consumer education initiatives, suggesting their potential applicability in the SA context. However, barriers to implementation, including limited support, financial constraints, and resistance from stakeholders, pose formidable challenges. The field of waste management encompasses a wide array of benefits, challenges, and strategies aimed at addressing environmental, economic, and social concerns. On the positive side, effective waste management offers numerous benefits such as resource recovery, reduction of pollution levels, and promotion of sustainable practices. Collaboration and stakeholder engagement play crucial

roles in achieving these benefits, as they enable diverse perspectives and resources to be leveraged (South Africa. Department of Small Business Development, 2023; Fidelity Services Group, 2021; Nadkarni & Prügl, 2021). Additionally, education and training initiatives are essential for building the capacity needed to implement effective waste management practices, including the adoption of technological solutions.

However, waste management also presents significant challenges. Financial burdens often strain the resources of governments and organisations, requiring careful allocation of financial resources and support. Global challenges, including plastic waste pollution and the side effects of pollution, demand coordinated efforts across borders to mitigate their impact. Local challenges, such as waste disposal systems and human interventions, underscore the need for tailored approaches that address specific community needs and behaviours. Moreover, waste management practices directly impact human health and food security. Risks associated with improper waste disposal can lead to environmental contamination and health hazards, highlighting the importance of implementing sustainable waste management practices. Strategies for waste reduction and prevention, including the adoption of reverse logistics and product returns, are integral to minimising waste generation and promoting a circular economy. Despite the complexities involved, sustainable waste management practices offer a pathway towards environmental stewardship and resilience. By embracing innovative solutions, fostering collaboration, and prioritising education and awareness, societies can work towards a future where waste is minimised, resources are conserved, and human well-being is safeguarded. Nonetheless, the project identifies promising opportunities for improvement, including investment in research, regulatory measures, and stakeholder engagement. Ultimately, the findings emphasise the urgent need for collaborative action to tackle waste generation, advocating for the adoption of recommended strategies to foster sustainability and mitigate environmental impact within the W&R sector.

CHAPTER 6: RECOMMENDATIONS

This chapter presents recommendations based on global best practices and survey results. Recommendations for retailers, the government, and other stakeholders arising from the findings will be provided.

6.1. Introduction to the Impact of Wastage Management Practice

This report serves as a culmination of the extensive investigation into the impact of wastage management practices on green retail, socio-economic development, and food security within SA. Building upon the insights garnered from the preceding chapters, this concluding section synthesises key findings to derive meaningful conclusions and propose additional recommendations for stakeholders in the W&R sector. By examining the implications of wastage on environmental sustainability, economic stability, and societal well-being, this chapter aims to underscore the urgency and necessity of implementing sustainable waste management practices. Moreover, it delves into the effects of such practices on enhancing green retail operations, fostering socio-economic progress, and ensuring food security for vulnerable populations.

Drawing upon the initiatives and recommendations outlined throughout the report, this chapter endeavours to provide actionable insights and guidance for retailers, policymakers, and other relevant entities to navigate the challenges posed by wastage effectively. Through a comprehensive analysis and synthesis of the research findings, this chapter seeks to offer a holistic perspective on the importance of waste reduction efforts within the W&R sector and paves the way for a more sustainable and resilient future for SA.

The issue of wastage, particularly in the retail sector, has significant implications for SA's economy, environment, and society. While some progress has been made in implementing waste reduction initiatives, there is still considerable room for improvement. Retailers play a crucial role in driving these initiatives, but they face challenges such as limited alternatives, insufficient government support, and resistance from consumers and suppliers. However, with the right strategies and collaboration, retailers can contribute to reducing wastage, improving sustainability, and enhancing socio-economic conditions.

6.2. Relevance of Waste Management Impact

The project on sustainable waste management practices within the W&R sector is anticipated to have a significant impact on various stakeholders and sectors (George, 2020; Mnembe, 2022; Wang & Yang, 2021; Biswas, 2021). Firstly, by highlighting the current challenges and opportunities for improvement in waste management, the project can raise awareness among retailers, policymakers, and consumers about

the importance of sustainable practices. This increased awareness can lead to behavioural changes, such as reduced overstocking and increased adoption of environmentally friendly packaging. Additionally, the recommendations provided in the project offer practical guidance for implementing sustainable waste management strategies (Biswas, 2021; Kochina, 2019; Kumar Lim & Sureka, 2023), which can lead to cost savings for retailers and contribute to environmental conservation efforts. Furthermore, by fostering collaboration among stakeholders and advocating for supportive policies, the project has the potential to catalyse systemic change within the W&R sector, promoting a culture of sustainability and resilience. Overall, the project's impact is expected to extend beyond the research realm, influencing industry practices, policy decisions, and societal attitudes towards waste management and environmental stewardship.

6.3. Parliament Evaluation of Waste Management Policy

Parliamentary evaluation of waste management policy involves the legislative body assessing the effectiveness, efficiency, and impact of existing waste management policies and regulations. This evaluation typically includes a comprehensive review of relevant legislation, government reports, and stakeholder feedback to identify strengths, weaknesses, and areas for improvement in waste management practices. Parliamentary committees or subcommittees responsible for environmental affairs often oversee this evaluation process, conducting hearings, inquiries, and consultations with experts, government officials, and affected communities to gather information and insights. The aim is to assess whether current waste management policies align with national goals, international commitments, and best practices in environmental sustainability. Through this evaluation, Parliament aims to hold government agencies accountable for their waste management efforts, identify policy gaps or deficiencies, and propose amendments or new legislation to address emerging challenges such as plastic pollution, electronic waste, and landfill management. Ultimately, parliamentary evaluation of waste management policy plays a crucial role in shaping legislative priorities, driving policy reforms, and promoting more effective and sustainable waste management practices to protect public health and the environment.

6.4. Government Institutions on Sustainable Waste Management

Government institutions play a pivotal role in waste management, overseeing policies, regulations, and infrastructure development to ensure the effective management of waste at local, regional, and national levels. These institutions are responsible for formulating and implementing waste management strategies, enforcing waste-related laws and regulations, and providing essential services for waste collection, treatment, and disposal. Government agencies tasked with waste management often collaborate with local

authorities, environmental agencies, and other stakeholders to address various aspects of waste management, including waste reduction, recycling, composting, and hazardous waste disposal.

Additionally, government institutions play a crucial role in raising public awareness about waste management issues, promoting sustainable practices, and fostering partnerships with businesses, communities, and non-NGOs to achieve waste management goals. Through research, monitoring, and policy development, these institutions strive to mitigate environmental pollution, protect public health, and promote a circular economy approach to waste management, in which resources are conserved, reused, and recycled to minimise waste generation and maximise resource efficiency.

Overall, effective governance and coordination among government institutions are essential for achieving sustainable waste management outcomes and addressing the complex challenges associated with waste management on a global scale.

6.4.1. Sustainable waste management goals and W&R support programmes

In the W&R sector, sustainable waste management goals aim to reduce environmental impact and promote resource efficiency. These goals include minimising waste sent to landfills through strategies such as waste reduction, reuse, and recycling. Additionally, there is a focus on increasing recycling rates to divert waste from landfills and encourage material reuse. Embracing circular economy principles such as product redesign and remanufacturing, further contributes to waste minimisation and resource optimisation. Moreover, efforts are directed towards minimising the environmental footprint of W&R operations by implementing energy-efficient practices and optimising transportation logistics. Support programmes are instrumental in assisting businesses in achieving these goals by offering services such as waste audits, the development of recycling infrastructure, employee training, and public awareness campaigns (Helo & Hao, 2022; Péres Lagos & Fernando, 2022). These programmes, which can be initiated by government agencies, industry associations, non-profit organisations, or private companies, facilitate collaboration among stakeholders in the W&R sector. Through collective efforts involving retailers, suppliers, consumers, and waste management companies, the sector can progress towards sustainable waste management practices, reduce environmental impact, and transition to a circular and resource-efficient economy.

6.4.2. Success and failure of waste food management programmes in W&R

The successes and failures of waste food management programmes in the W&R sector vary depending on factors such as implementation strategies, stakeholder engagement, and resource allocation. Successful programmes often achieve significant reductions in food waste generation within W&R establishments

through improved inventory management, donation programmes, and consumer education initiatives. These programmes also promote higher rates of recycling and food waste recovery, diverting waste from landfills and promoting resource conservation and circular economy principles.

Cost savings are another benefit, as efficiently managed food waste can lead to reduced disposal fees, minimised overstocking, and optimised operational efficiency, benefiting W&R businesses. Furthermore, effective food waste management programmes contribute to environmental sustainability by reducing GHG emissions, conserving natural resources, and mitigating pollution associated with food waste disposal.

However, several challenges and failures may arise. Limited stakeholder engagement, including insufficient buy-in or participation from key stakeholders like retailers, suppliers, and consumers, can hinder the effective implementation and adoption of waste management practices. Moreover, inadequate infrastructure, such as composting facilities or recycling centres, coupled with limited financial resources, may impede the scalability and impact of food waste management programmes. Behavioural barriers pose another challenge, as changing consumer and employee behaviour regarding food waste disposal and management can be difficult and may require extensive education, incentives, and cultural shifts. Additionally, regulatory barriers, such as inconsistent or stringent waste disposal regulations and a lack of supportive policies, may hinder the effectiveness of food waste management programmes, limiting innovation and compliance efforts. The success or failure of food waste management programmes in the W&R sector hinges on factors such as the alignment of strategies with stakeholder needs, investment in infrastructure and resources, effective communication and education, and supportive regulatory frameworks to facilitate sustainable waste management practices.

6.4.3. Waste reduction and prevention strategies

These strategies have been proven effective in mitigating waste generation across various sectors. By implementing measures such as efficient inventory control and the adoption of eco-friendly packaging materials, businesses can significantly reduce the volume of waste generated during production and distribution processes. Moreover, promoting sustainable product design encourages the development of goods that are less resource-intensive and more environmentally friendly throughout their lifecycle. By incorporating these waste reduction and prevention strategies into their operations, organisations can not only minimise their environmental footprint but also realise cost savings and enhance their overall sustainability performance. Thus, this project emphasises the importance of adopting proactive measures

to address waste generation at its source as a key step towards achieving sustainable waste management practices in the W&R sector.

6.5. Department of Waste Management Programmes

The Department of Waste Management oversees a diverse array of programmes aimed at efficiently managing waste and fostering environmental sustainability. These initiatives encompass waste reduction, recycling, resource recovery, and safe disposal. Waste Reduction Campaigns focus on raising awareness and fostering partnerships to encourage sustainable consumption habits and minimise waste generation. Recycling Programmes incentivise individuals and businesses to recycle materials such as paper, plastics, and metals to conserve resources and divert waste from landfills. Composting Initiatives promote the composting of organic waste for use in gardening and landscaping. Hazardous Waste Management programmes ensure the safe handling and disposal of hazardous materials. Waste-to-Energy Projects explore innovative technologies for converting waste into renewable energy sources. Public Education and Outreach efforts engage communities and businesses to promote responsible waste management practices. Finally, Policy Development and Regulation activities involve drafting legislation and enforcing regulations to ensure compliance with environmental standards. These programmes collectively contribute to promoting sustainability, protecting public health, and advancing towards a circular economy characterised by minimised waste and optimised resource use.

6.5.1. Evaluation of potential solution to waste management strategies

The evaluation of the project involves a critical assessment of its methodology, findings, contributions, and limitations. Firstly, the project's methodological rigour, encompassing data collection methods, sampling techniques, and analytical approaches, is scrutinised for its appropriateness and validity in achieving the research objectives. Secondly, the significance, relevance, and originality of the project's findings are evaluated, considering their contribution to advancing knowledge in waste management and sustainability within the W&R sector. Strengths and limitations of the project are identified to understand its overall quality and reliability, with strengths such as comprehensive data analysis and limitations including sample biases or methodological constraints. Moreover, the project's practical implications are assessed in terms of their potential impact on stakeholders, industry practices, and policy decisions, elucidating how findings can be translated into actionable recommendations. Lastly, considering future research directions based on the project's insights helps identify areas for further investigation and knowledge advancement, contributing to the ongoing scholarly discourse in the field. Overall, a balanced evaluation of the project informs decisions regarding its reliability, significance, and potential implications for practice and policy in waste management and sustainability within the W&R sector.

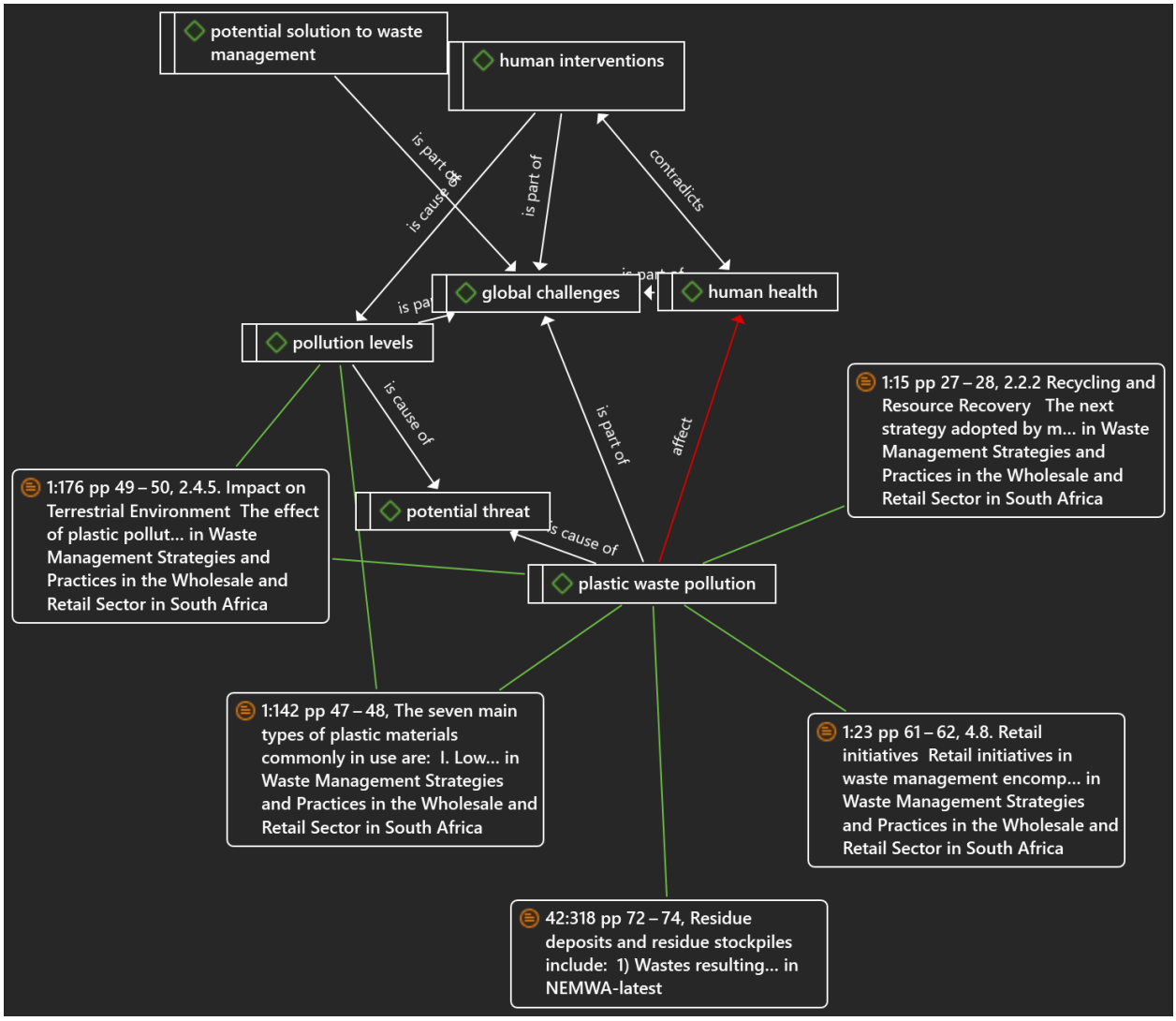

Figure 6. 1: Evaluation of potential solution to waste management strategies

6.5.2. Successful stories on waste management programmes

Successful cases of food waste management support programmes in SA and abroad showcase innovative approaches and effective strategies to tackle food waste while promoting sustainability. In SA, initiatives such as the FoodForward SA programme have made significant strides in reducing food waste by redistributing surplus food to vulnerable communities through partnerships with retailers, farmers, and food manufacturers. This programme not only addresses food insecurity but also prevents edible food from ending up in landfills, thereby reducing environmental impact. Similarly, the Pick n' Pay Food Waste Reduction Programme has successfully implemented measures to minimise food waste across its supply

chain, including improved inventory management, donation programmes, and consumer education campaigns.

Abroad, initiatives like the UK's FareShare and Australia's OsHarvest have demonstrated remarkable success in rescuing surplus food and redistributing it to those in need, leveraging technology, logistics networks, and community partnerships to maximise impact. Furthermore, international collaborations such as the European Union's REFRESH project have facilitated knowledge exchange and best practice sharing among countries to develop innovative solutions for reducing food waste throughout the value chain. These successful cases highlight the importance of multi-stakeholder partnerships, technological innovation, and community engagement in addressing food waste challenges both locally and globally, underscoring the potential for scalable and sustainable solutions to mitigate food waste and promote food security.

6.7. Waste Management Strategic Themes

- **Which stakeholders are involved in the waste management process in the W&R sector in SA?**

In the waste management process within SA's W&R sector, several stakeholders play critical roles. Retailers and wholesalers are central to waste generation, handling packaging waste, expired products, and damaged goods resulting from their operations. Producers and manufacturers contribute by designing products with sustainability in mind, adopting eco-friendly packaging, and actively participating in recycling schemes. Waste management companies handle waste collection, transportation, sorting, and processing, ensuring compliance with environmental regulations. Recycling facilities play a vital role in recycling materials collected from the sector, reducing the need for new resources. Government agencies establish waste management policies, issue permits, and enforce compliance with environmental laws. NGOs may raise awareness and advocate for improved waste management practices. Lastly, consumers influence waste management by making sustainable purchasing decisions, reducing packaging waste, and participating in recycling programmes. Collaborative engagement among these stakeholders is essential to implement effective waste management strategies that prioritise sustainability, environmental responsibility, and resource efficiency within the W&R sector.

- **What waste management strategies are currently being implemented in the W&R sector is SA?**

Various waste management strategies are currently being implemented in the W&R sector in SA to tackle waste generation and disposal challenges. These strategies encompass source reduction efforts such as minimising packaging materials and optimising inventory management, alongside recycling programmes that target materials like cardboard, plastics, glass, and metals. Additionally, initiatives to reduce food waste through redistribution to charities, composting, and utilisation for animal feed are gaining traction. Some companies are also exploring waste-to-energy projects to convert organic waste into renewable energy sources. Moreover, EPR programmes are being advocated for, holding manufacturers accountable for product lifecycle management. These strategies collectively aim to minimise waste generation, promote recycling, and reduce environmental impact, underscoring the importance of collaboration among stakeholders for effective implementation and long-term sustainability in waste management practices.

- **Who is responsible for developing these strategies in SA?**

In SA, the development of waste management strategies in the W&R sector is a shared responsibility among governmental bodies, industry associations, NGOs, and individual businesses. Government departments, such as the Department of Environment, Forestry, and Fisheries (DEFF) and municipal authorities, lead the formulation of policies, regulations, and guidelines, set waste reduction targets, and ensure compliance with environmental laws. Industry associations collaborate with government bodies to develop sector-specific strategies, promote best practices, and advocate for supportive policies. NGOs contribute through research, advocacy, and public education to raise awareness and push for policy reforms. Individual businesses play a crucial role in implementing waste management strategies tailored to their operations, including waste audits, recycling programmes, and innovative initiatives such as waste-to-energy projects. Through collaborative efforts, these stakeholders aim to prioritise sustainability, environmental protection, and resource efficiency in the W&R sector, fostering comprehensive waste management approaches in SA.

- **Who is responsible for implementing these strategies?**

The implementation of waste management strategies in SA's W&R sector involves a collective effort among various stakeholders. While government bodies, such as municipal authorities, oversee regulatory compliance and policy enforcement, individual businesses within the sector bear direct responsibility for executing these strategies. This entails integrating waste reduction measures, implementing recycling programmes, and exploring innovative solutions, such as waste-to-energy initiatives. Additionally, industry associations provide support and guidance to businesses, facilitating the implementation process. NGOs also play a role by raising awareness, providing resources, and fostering collaboration among stakeholders. Through coordinated action, these entities work together to ensure the effective

implementation of waste management strategies, promoting sustainability and environmental responsibility in the W&R sector.

- **What challenges are being faced by the W&R sector in SA in terms of developing and implementing waste management strategies?**

The W&R sector in SA faces various challenges in developing and implementing waste management strategies. One significant obstacle is the lack of awareness and understanding among stakeholders regarding the importance of waste management and sustainable practices. Limited financial resources and infrastructure also pose barriers, particularly for smaller businesses, hindering their ability to invest in waste management initiatives. Additionally, regulatory complexities and compliance burdens present challenges for businesses navigating waste management regulations. Inadequate collaboration and coordination among stakeholders further exacerbate these issues, hindering the development of cohesive strategies. Moreover, cultural and behavioural factors, such as consumer attitudes towards waste, contribute to the difficulty in implementing effective waste management practices. Addressing these challenges requires concerted efforts from government, industry players, NGOs, and consumers to foster awareness, provide support, and streamline regulatory frameworks for sustainable waste management in the W&R sector.

- **What is the gap between what is being developed and implemented in SA and what is being developed and implemented in the developed world?**

The gap between what is being developed and implemented in SA compared to the developed world primarily lies in the level of infrastructure, resources, and regulatory frameworks available for waste management. In the developed world, countries have established advanced waste management systems supported by robust infrastructure for collection, recycling, and disposal, along with comprehensive regulations and policies to govern waste practices. They often have greater access to technology, funding, and expertise, enabling the implementation of innovative solutions such as waste-to-energy projects and circular economy initiatives. Additionally, public awareness and participation in waste management are generally higher in developed countries, leading to more widespread adoption of sustainable practices. In contrast, SA faces challenges related to limited infrastructure, funding constraints, and regulatory gaps, which hinder the development and implementation of efficient waste management strategies. There is a need for increased investment, capacity-building, and policy support to bridge this gap and align SA's waste management practices with global standards. Collaboration with international partners and the adoption of best practices from developed countries can also facilitate progress in closing this disparity.

- **What are the benefits of sustainable waste management practices?**

Sustainable waste management practices provide environmental benefits by reducing pollution, conserving resources, and mitigating climate change through waste reduction, recycling, and composting. Economically, these practices result in cost savings, revenue generation from recycled materials, and job creation in the waste management sector. Socially, they enhance public health by minimising exposure to hazardous substances and fostering community engagement in waste reduction efforts. Equitable access to waste management services ensures that all members of society benefit from cleaner living environments. Overall, these practices offer a holistic approach to addressing environmental challenges while promoting economic growth and social cohesion, creating healthier, more resilient, and sustainable societies for future generations.

- **How can waste management strategies assist the W&R sector in improving its environmental footprint and also its profitability?**

Waste management strategies in the W&R sector offer dual benefits of enhancing environmental sustainability and increasing profitability. These strategies include waste reduction, recycling, and composting, which minimise the waste sent to landfills, conserve resources, and lower GHG emissions. Cost savings arise from optimised resource use, reduced disposal costs, and revenue generation from recycled materials. Moreover, adopting sustainable practices enhances brand reputation, attracts eco-conscious consumers, and drives sales. By complying with regulations and mitigating risks, businesses safeguard their operations while demonstrating environmental stewardship. Integrating these strategies positions W&R businesses for long-term success, contributing to environmental conservation, social responsibility, and financial viability in a sustainable manner.

6.8. Recommendations for the W&R Sector in SA

- To establish the current state of food wastage and loss in the W&R sector in SA, the following recommendations can be considered:
    - Large Scale Data Collection and Analysis: Conduct comprehensive research and data collection initiatives to gather information on FLW within the W&R sector. This should include data on the volume, types, and causes of food wastage at various stages of the supply chain, from production and distribution to retail and consumer levels. Utilise both qualitative and quantitative research methods to obtain a comprehensive understanding of the issue.

- Waste Management Stakeholder Engagement: Engage with key stakeholders in the W&R sector, including producers, wholesalers, retailers, food service providers, and consumers, to gather insights and perspectives on FLW. Collaborate with industry associations, government agencies, non-profit organisations, and academic institutions to facilitate data sharing and collaboration in addressing the issue.
- Benchmarking and Comparative Analysis: Benchmark the FLW rates in the SA W&R sector against international standards and best practices. Compare the findings with data from other countries or regions to identify areas of improvement and potential strategies for reducing FLW in SA.
- Policy and Regulatory Review: Review existing policies, regulations, and industry standards related to FLW in SA. Identify gaps, inconsistencies, and barriers that may hinder efforts to address the issue effectively. Advocate for policy reforms and regulatory measures that promote food waste reduction, resource recovery, and sustainable practices within the W&R sector.
- Capacity Building and Awareness Campaigns: Invest in capacity building initiatives and awareness campaigns to educate stakeholders about the environmental, social, and economic impacts of FLW. Provide training, resources, and tools to empower businesses and individuals to adopt more sustainable practices and reduce food wastage throughout the supply chain.

When implementing these recommendations, stakeholders can gain valuable insights into the current state of FLW in the SA W&R sector and develop targeted strategies and interventions to address this critical issue effectively.

- To conduct an exploratory project on sustainable waste management strategies and practices implemented in developed countries such as the USA, Canada, Germany, the UK, and Australia, the following recommendations should be considered:
    - Successful Case Studies and Best Practices: Select representative successful case studies from each of the target countries to examine effective examples of sustainable waste management practices. Identify key stakeholders involved, such as government agencies, local authorities, businesses, non-profit organisations, and communities. Analyse the strategies, policies, technologies, and collaborative efforts that have contributed to the success of these initiatives and extract best practices applicable to the SA context.

- Stakeholder Interviews and Surveys: Conduct interviews and surveys with stakeholders involved in waste management at various levels, including government officials, industry representatives, waste management professionals, researchers, and community leaders. Gather insights, perspectives, and first-hand experiences to understand the challenges, opportunities, and lessons learned from implementing sustainable waste management practices in different countries.
- Regular Site Visits and Observations: Arrange site visits to key waste management facilities, recycling centres, composting sites, waste-to-energy plants, and other relevant infrastructure in the target countries. Observe operations, processes, and technologies in action to gain practical insights into how sustainable waste management practices are implemented on the ground. Document observations, take photographs, and collect data to supplement findings from interviews and literature reviews.
- Constant Scan on Policy and Regulatory Analysis: Analyse the policy frameworks, regulations, incentives, and standards governing waste management in the target countries. Compare and contrast the approaches adopted by each country in promoting sustainability, resource recovery, and circular economy principles. Identify common themes, trends, and innovative policy measures that could inform the development of effective waste management policies and strategies in SA.
- Strategic Alliances, Collaboration and Knowledge Sharing: Foster alliances, collaboration, and knowledge sharing with international partners, research institutions, and relevant stakeholders involved in waste management. Participate in conferences, workshops, webinars, and networking events to exchange ideas, share findings, and learn from global experiences. Establish partnerships for future research collaborations, capacity-building initiatives, and technology transfer programmes to support the implementation of sustainable waste management practices in SA.

By following these recommendations, researchers can conduct a comprehensive exploratory project on sustainable waste management strategies and practices in developed countries, ultimately informing the development of evidence-based policies and interventions to enhance waste management practices in SA.

- To identify and recommend sustainable waste management strategies and practices for the SA W&R sector in a post-COVID-19 environment, the following recommendations should be considered:

- Assessment of post COVID-19 Impacts: Conduct a thorough assessment of the impacts of the COVID-19 pandemic on waste generation, management practices, and supply chains within the W&R sector in SA. Evaluate changes in consumer behaviour, product demand, packaging preferences, and waste volumes to understand the specific challenges and opportunities arising from the pandemic.
- Integration of Waste management Digital Solutions: Explore the integration of waste management digital technologies and online platforms to streamline waste management processes, optimise inventory management, and reduce unnecessary packaging within the W&R sector. Implement digital tools for real-time monitoring of waste generation, inventory levels, and customer preferences to facilitate data-driven decision-making and resource allocation.
- Promotion of Circular Economy Principles: Promote the adoption of circular economy principles within the W&R sector by emphasising waste reduction, reuse, and recycling initiatives. Encourage retailers to implement circular packaging solutions, such as refillable containers, eco-friendly materials, and packaging-free options, to minimise waste generation and promote sustainable consumption practices among consumers.
- Collaborative Supply Chain Partnerships: Foster collaborative partnerships across the W&R supply chain, including manufacturers, distributors, retailers, and waste management service providers, to optimise resource efficiency, minimise waste generation, and facilitate the recovery of valuable materials. Implement joint initiatives for product stewardship, packaging redesign, and reverse logistics to promote closed-loop systems and reduce environmental impacts.
- Employee Training and Awareness: Provide comprehensive training and awareness programmes for W&R sector employees on sustainable waste management practices, hygiene protocols, and health safety measures in the post-COVID-19 environment. Empower staff members to actively participate in waste reduction initiatives, proper waste segregation, and sanitation protocols to ensure workplace safety and environmental responsibility.
- Public waste management Engagement and Consumer Education: Engage with consumers through targeted educational campaigns, social media platforms, and community outreach initiatives to raise awareness about sustainable waste management practices, food WRS, and responsible consumption habits. Encourage consumers to make informed choices, support local businesses, and prioritise eco-

friendly products and packaging options to minimise waste generation and environmental impact.

- Policy Support and Regulatory Frameworks: Advocate for the development and implementation of supportive policy frameworks, incentives, and regulations to promote sustainable waste management practices within the W&R sector. Collaborate with government agencies, industry associations, and advocacy groups to advance EPR schemes, waste diversion targets, and eco-labelling requirements to drive industry-wide change and innovation.
- Continuous Monitoring and Evaluation: Establish mechanisms for ongoing monitoring, evaluation, and adaptation of sustainable waste management initiatives within the W&R sector to track progress, identify areas for improvement, and address emerging challenges in a dynamic post-COVID-19 landscape. Collect feedback from stakeholders, analyse performance metrics, and benchmark against industry standards to ensure continuous improvement and resilience in waste management practices.

When implementing these recommendations, the SA W&R sector can develop robust and adaptive strategies for sustainable waste management in the aftermath of the COVID-19 pandemic, contributing to environmental resilience, social responsibility, and economic prosperity.

- Other recommendations government and industry stakeholders
  - Waste Management Policy Advocacy: Retailers should actively engage with government and industry stakeholders to advocate for supportive policies and incentives aimed at waste reduction initiatives. This could include lobbying for tax incentives, subsidies for sustainable practices, and stricter regulations on packaging and waste management.
  - Consumer Waste Management Education Programmes: Invest in comprehensive consumer education campaigns to raise awareness of the importance of waste reduction, proper recycling practices, and the environmental impact of packaging choices. Empowering consumers with knowledge can lead to changes in behaviour and preferences towards more sustainable products and packaging options.
  - Supplier Waste Management Collaboration: Work closely with suppliers to promote sustainable sourcing practices, minimise packaging waste, and optimise product distribution to reduce carbon footprints. Collaborative efforts along the supply chain can lead to innovative solutions and shared responsibility for waste reduction.

- Continuous Waste Management Improvement: Implement a system for the continuous monitoring, evaluation, and improvement of waste reduction initiatives. Regular assessments of the effectiveness of implemented strategies enable retailers to identify areas for enhancement and refine their approach to achieve better outcomes.
- Investment in Waste Management Research and Innovation: Allocate resources to research and development initiatives focused on finding innovative solutions to packaging waste, food loss, and supply chain inefficiencies. Investing in new technologies, materials, and processes can unlock opportunities for sustainable growth and differentiation in the retail sector.
- Implement Comprehensive Waste Reduction Policies: Governments and relevant authorities should prioritise the implementation of comprehensive waste reduction policies that align with the principles of the "Reduce, Reuse, Recycle" (3Rs) framework. These policies should focus on incentivising businesses to adopt source reduction techniques in manufacturing processes and promote local sourcing practices in the wholesale and retail sectors. Additionally, regulations should be introduced to encourage the production of products that are easy to compost, repair, and reuse, thereby reducing overall waste generation at the source. Furthermore, imposing fees for solid waste disposal and enforcing cradle-to-grave accountability laws can further incentivise responsible waste management practices across industries.
- Invest in WMI and Governance: To enhance recycling rates and reduce overall waste generation, it is crucial to invest in robust WMI and governance mechanisms, particularly in impoverished nations where informal recycling is prevalent. Governments and relevant stakeholders should allocate resources towards the development of recycling facilities, waste collection systems, and public awareness campaigns to promote recycling practices. Additionally, strengthening regulatory frameworks and enforcement mechanisms can help ensure compliance with recycling protocols and improve waste management practices at both local and national levels. By addressing these gaps in WMI and governance, countries can move towards more sustainable waste management practices, thereby mitigating environmental impacts and promoting resource conservation on a global scale.

When adopting these recommendations and building upon existing waste management initiatives, retailers in SA can make meaningful contributions to reducing wastage, enhancing environmental sustainability, and fostering socio-economic development for the benefit of present and future generations. The W&R

sector encompasses wholesalers, retailers, and e-commerce platforms that sell consumer goods such as food, clothing, and household items. In this context, waste refers to both packaging and food waste generated within this sector. Sustainable waste management involves an approach to waste handling and disposal that prioritises environmental conservation, public health, and the well-being of future generations. Food loss occurs at various stages before reaching retail shelves, including during production, processing, and transportation. Conversely, food waste specifically refers to the loss of consumable food at the retail stage or during consumption. Global best practices denote guidelines established and successfully implemented in developed countries, aimed at preventing, handling, and disposing of waste effectively. These practices serve as benchmarks for addressing waste-related challenges and improving sustainability efforts within the W&R sector globally.

CHAPTER 7: CONCLUSION

This chapter concludes the report by summarising the research objectives and findings. It also presents recommendations, highlights the limitations of the project, and offers suggestions for further studies in the area.

7.1. Definition of Sustainable W&R Waste Management Best Practices

Sustainable W&R waste management refers to the systematic and environmentally conscious handling, treatment, and disposal of waste materials with the aim of minimising environmental impact, conserving resources, and promoting long-term ecological balance. This approach to waste management prioritises practices that reduce waste generation, maximise recycling and reuse, and minimise reliance on landfill disposal (Zhang, 2020). Sustainable waste management strategies often involve adopting circular economy principles, such as product redesign, resource recovery, and waste-to-energy technologies, to minimise waste generation and maximise resource efficiency. Additionally, sustainable waste management considers social equity and economic viability, aiming to meet present needs without compromising the ability of future generations to meet their own needs. Overall, sustainable waste management seeks to integrate environmental, social, and economic considerations to create a more resilient and regenerative waste management system (Helo & Hao, 2022; Péres et al., 2022).

7.2. Methodologies on Waste Food Management Evaluation Impact

Evaluating the impact of food waste management initiatives encompasses a blend of quantitative and qualitative methodologies to gauge effectiveness comprehensively. Key methods include quantitative waste audits, which assess changes in food waste quantity and composition before and after the implementation of waste management strategies. Surveys and interviews provide qualitative insights from stakeholders, such as retailers, consumers, and waste management personnel, capturing perceptions and attitudes towards food waste reduction efforts. Monitoring waste diversion rates quantifies the success of initiatives in diverting food waste from landfills through recycling, composting, and donation. Environmental impact assessments measure benefits such as reduced greenhouse gas emissions and energy consumption resulting from waste management programmes. Cost-benefit analyses weigh the economic implications by comparing implementation costs with savings from reduced waste disposal and increased resource recovery. Case studies and best practices from similar initiatives offer qualitative insights into success factors and challenges, aiding in programme improvement. Longitudinal studies track programme sustainability and effectiveness over time, analysing key performance indicators. By employing these methodologies collectively, stakeholders can conduct a comprehensive evaluation, identifying areas for

improvement and making informed, data-driven decisions to enhance the outcomes of food waste management initiatives.

7.3. Research Purpose and Objectives

The three main objectives are as follows: Firstly, it seeks to evaluate the status of FLW within SA's W&R sector. This involves a thorough examination of available data, reports, and literature to grasp the scale and causes of FLW in this sector. Secondly, it aims to conduct an exploratory project on sustainable waste management strategies and practices implemented in developed nations such as the USA, Canada, Germany, the UK, and Australia. This entails analysing case studies, policies, and initiatives aimed at curbing food wastage and promoting sustainable waste management in the retail sector of these countries. Lastly, the research endeavours to identify and recommend sustainable waste management strategies and practices that could be adopted by the SA W&R sector in a post-COVID-19 context. This involves synthesising findings from the assessment of SA's current situation and the exploration of international best practices.

The recommendations are tailored to address the specific context and challenges of the SA W&R sector, considering the impacts and lessons learned from the COVID-19 pandemic. The aim of this project is to investigate waste management strategies and practices within SA's W&R sector, drawing insights from global best practices. The objective is to develop a comprehensive guide that enables retailers to implement sustainable waste management initiatives, particularly in light of the challenges posed by the post-COVID-19 landscape. By examining both local and international approaches, the project seeks to identify effective strategies and recommendations tailored to the unique context of the SA retail sector. Ultimately, the aim is to facilitate the adoption of sustainable waste management practices that promote environmental stewardship, economic efficiency, and resilience in the face of future disruptions.

7.4. Reflecting on the Waste Management Methods

Qualitative analysis in the context of sustainable waste management in the W&R sector highlights several key themes and corresponding codes:

- *Collaboration and Stakeholder Engagement*: Effective waste management requires active collaboration among stakeholders, government bodies, and local communities (South Africa. National Treasury, 2022; Rabetino, Huikkola & Kohtam, 2023). Such collaboration ensures a holistic approach to waste management, incorporating diverse perspectives and fostering interconnectedness.

- *Education and Training in Waste Management:* Equipping employees with the skills and knowledge necessary for effective waste management is crucial (Systemic, 2019; Oumran et al., 2021). Education and training empower employees to participate in workplace sustainability efforts, enhancing overall waste management outcomes.
- *Financial Investment Waste Management Projects:* Adequate financial resources are essential for implementing sustainable waste management practices (Western Cape Government Provincial Treasury, 2023; Ufua et al., 2022; KfW Group, 2024). Investments in infrastructure, such as recycling programmes and composting facilities, are critical to the long-term sustainability of waste management policies.
- Food Waste *Management Strategies:* Addressing food waste requires targeted strategies, such as surplus food redistribution and composting organic waste, to significantly reduce food waste in the W&R sector (Transnet, 2022; Takacs et al., 2022; Fidelity Services Group, 2021).
- *Global waste management challenges*: The W&R sector faces global challenges, including pollution, policy sustainability, and complex waste management requirements (Ufua et al., 2022; Wang & Yang, 2021; Heiberg et al., 2022). Overcoming these obstacles requires collaborative efforts and innovative solutions.
- *Human Health and Pollution Impact*: Ineffective waste management can pose significant risks to human health and exacerbate pollution (Lekše et al., 2023; Kwilinski, Lyulyov, Pimonenko, Dswigol & Abasov, 2022; Ugland et al., 2022; Wang & Yang, 2021). A comprehensive approach is necessary to address these impacts on both health and the environment.
- *Strategies for Waste Management Practices:* Implementing effective strategies such as waste reduction, recycling programmes, composting, and advocating for EPR programmes is crucial for efficient waste management (Madrid-Guijarro & Duréndes, 2023; Zhang, 2020; Dania et al., 2007).
- *Models of Sustainable Waste Food Management*: Developing models for sustainable waste food management is essential (Transnet, 2022; Takacs et al., 2022). These models should focus on factors like food waste reduction, recycling, and collaboration with food banks and charities.

Analysing these qualitative themes and codes provides stakeholders with valuable insights into the challenges and opportunities tied to sustainable waste management in the W&R sector. By implementing targeted strategies and fostering collaboration among key players, the sector can achieve significant improvements in waste management practices, enhancing both environmental sustainability and financial viability.

7.5. Contribution of the Project

The project makes significant contributions to waste management in SA's W&R sector across multiple dimensions:

1. Advancing knowledge: It consolidates insights from local and global best practices, deepening the understanding of effective waste management strategies tailored to the W&R sector, especially in the aftermath of the COVID-19 pandemic.

2. Providing practical guidance: The project offers actionable recommendations and guidelines for retailers to implement sustainable waste management practices, supported by real-world case studies and expert opinions.

3. Driving environmental, social, and economic impact: By promoting waste reduction, recycling initiatives, and responsible resource utilisation, the project fosters positive environmental, social, and economic outcomes within the sector.

4. Building resilience: The project equips retailers with strategies to enhance adaptability and mitigate risks associated with ongoing challenges, such as those posed by the COVId-19 pandemic.

Together, these contributions drive the adoption of more sustainable and resilient waste management practices in SA's W&R sector, aligning with broader socio-economic and environmental objectives.

7.5.1. Contributing to waste management theories

The project makes significant theoretical contributions to the field of waste management and sustainability within the W&R sector in several key ways:

- Development of a comprehensive conceptual framework

By integrating theories and concepts from waste management, sustainability, and retail management literature, the project constructs a robust framework that serves as a theoretical foundation for understanding the dynamics of waste generation, management strategies, and their implications within the W&R sector.

- Adoption of a systems thinking perspective

The project applies systems thinking to analyse the interconnected factors influencing waste generation and management in the sector. This approach identifies feedback loops, unintended consequences, and leverage points for effective interventions, enhancing the understanding of the complexity of WMSS.

- Exploration of behavioural economics and psychology

Drawing from behavioural economics and psychology literature, the project explores consumer and retailer behaviour related to waste generation and management, offering insights into effective interventions and policy measures.

- Focus on innovation and technology adoption

Additionally, the project examines the role of innovation and technology adoption, utilising theories of innovation diffusion to identify barriers and drivers of innovation in sustainable waste management practices.

- Application of institutional theory

Lastly, by employing institutional theory, the project investigates the influence of regulations, norms, and institutional arrangements on waste management practices within the W&R sector, providing insights into compliance, governance mechanisms, and opportunities for institutional change.

Overall, these theoretical contributions provide a robust foundation for addressing waste management and sustainability challenges in the W&R sector, informing future research and policy initiatives.

7.5.2. Waste food management practical contribution

In the SA context, the W&R sector faces unique challenges and opportunities in waste management and sustainability. With a growing population and expanding consumer demand, retailers are under increasing pressure to address environmental concerns while maintaining operational efficiency and profitability. The project's practical contributions are tailored to this context, offering guidance and solutions that align with the specific needs and circumstances of SA retailers. Implementation guidance derived from global best practices and case studies provides actionable steps for retailers to adopt sustainable waste management strategies, considering local regulations, infrastructure, and market dynamics.

Operational efficiency is paramount in a market where resources are often scarce, making the adoption of sustainable practices not only environmentally responsible but also economically advantageous. Moreover,

enhancing brand reputation through environmental stewardship is crucial in a consumer landscape where sustainability is becoming an increasingly important factor in purchasing decisions. By assisting retailers in navigating regulatory requirements and fostering community engagement through initiatives such as food donation programmes and recycling campaigns, the project facilitates a holistic approach to waste management that encompasses social, environmental, and economic considerations.

These practical contributions empower SA retailers to play a proactive role in driving positive change, both within their organisations and in the broader community, ultimately contributing to a more sustainable and resilient future for the W&R sector in SA.

7.7. Develop of a Sustainable Waste Food Management Model in SA's W&R

Several cases were reviewed to redefine a models of sustainable waste food management have emerged within the SA W&R sector (Transnet, 2022; Takacs et al., 2022), each offering unique approaches to address food waste challenges while promoting environmental sustainability and social responsibility (Ramsuraj, 2023; Andrianda et al., 2021; Köhler et al., 2021; Takacs et al., 2022).

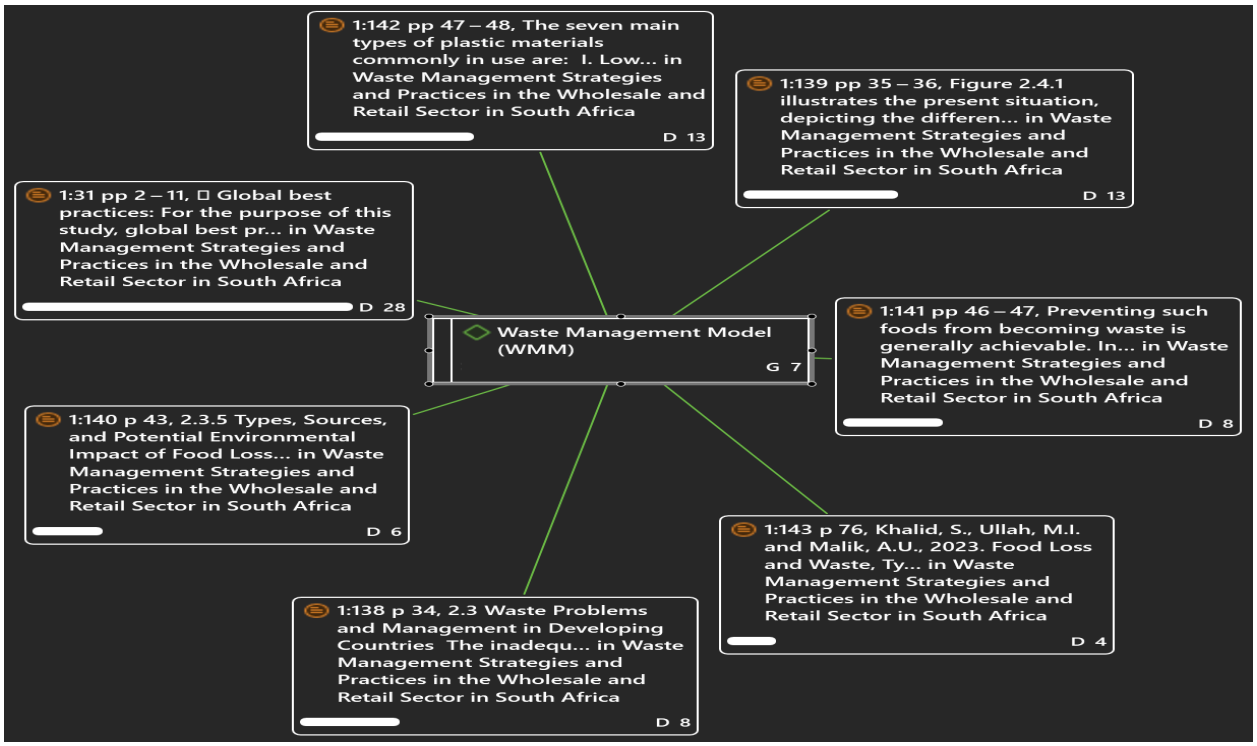

Figure 6. 2: Waste Management Model

Source: Researcher's Design

- Closed-Loop Systems: Some W&R businesses have adopted closed-loop systems, where food waste is recycled or repurposed within the supply chain. For instance, surplus food may be diverted to food banks or local charities for redistribution to vulnerable communities, thereby reducing waste while addressing food insecurity.
- Source Reduction Strategies: Source reduction strategies aim to minimise food waste generation at the source by optimising inventory management, reducing overstocking, and improving expiration management practices. By preventing food waste before it occurs, W&R businesses can mitigate environmental impact and enhance operational efficiency.
- Waste-to-Energy Initiatives: Waste-to-energy initiatives involve converting food waste into renewable energy through anaerobic digestion or composting processes. This approach not only reduces waste sent to landfills but also generates clean energy for onsite use or distribution to the grid, contributing to renewable energy goals and reducing GHG emissions.
- Collaborative Partnerships: Collaborative partnerships between W&R businesses, government agencies, non-profit organisations, and community stakeholders are crucial for promoting sustainable food waste management. These partnerships facilitate knowledge sharing, resource pooling, and collective action to address food waste challenges holistically.
- Consumer Education and Engagement: Engaging consumers through educational campaigns, labelling initiatives, and incentivised programmes raises awareness about food waste issues and encourages responsible consumption practices. By empowering consumers to make informed choices and minimise food waste, W&R businesses can foster a culture of sustainability and reduce their environmental footprint.
- Policy and Regulatory Support: Government policies and regulations play a vital role in shaping food waste management practices within the W&R sector. Supportive policies, such as tax incentives for food donation or landfill diversion targets, can incentivise businesses to adopt sustainable practices and invest in waste reduction technologies.

By integrating these models and approaches, W&R businesses in SA can develop comprehensive and effective strategies for sustainable waste food management, contributing to environmental conservation, social welfare, and economic prosperity.

7.7.1. Impact of plastic pollution on ecosystem

Plastic pollution has severe and far-reaching consequences for ecosystems worldwide, jeopardising biodiversity, ecosystem health, and human well-being. One of its most significant impacts is habitat

degradation, where plastic waste accumulates in terrestrial and aquatic environments, leading to the deterioration and fragmentation of habitats. This disruption weakens ecosystem functions and diminishes biodiversity.

Furthermore, wildlife entanglement and ingestion present critical threats to both marine and terrestrial species. Animals often become trapped in plastic debris or mistake it for food, leading to injuries, suffocation, digestive blockages, internal damage, and, in many cases, starvation.

Plastic pollution also exacerbates chemical contamination, as toxic additives in plastics leach into the environment, endangering organisms across all trophic levels. This issue is further intensified by the disruption of essential ecosystem services, such as nutrient cycling, water purification, and carbon sequestration. Plastic debris obstructs water flow and alters sedimentation patterns, undermining the productivity and resilience of aquatic ecosystems. Additionally, plastic pollution facilitates the spread of invasive species and imposes considerable economic burdens on communities and industries that depend on healthy ecosystems. These costs include lost revenue from tourism, fisheries, and recreation, as well as expenses associated with cleanup efforts and damage mitigation.

Effectively addressing this pervasive crisis demands a coordinated response at local, national, and global levels. Priorities include reducing plastic production, improving waste management systems, and promoting sustainable alternatives to single-use plastics. Such efforts are crucial for safeguarding ecosystems and preserving the vital services they provide to humanity.

7.8. Lessons Learned from Global Intervention Practices

This project has yielded several key insights that deepen our understanding of waste management and sustainability within the W&R sector.

Collaboration among stakeholders emerged as a cornerstone for effective waste management. Initiatives involving diverse actors – such as retailers, suppliers, policymakers, and consumers – tend to produce more comprehensive and sustainable outcomes.

Flexibility and adaptability in waste management strategies were also underscored, particularly in navigating dynamic external factors like the COVID-19 pandemic. Retailers must be able to adjust their practices and systems to accommodate changing consumer behaviours, supply chain disruptions, and regulatory requirements.

The project also highlighted the **critical role of data-driven decision-making** in waste management. Accurate, timely, and relevant data are essential for shaping policies and guiding operational planning, ensuring that strategies are both effective and responsive to real-world conditions.

Additionally, the findings emphasised the value of **consumer education and engagement**. By fostering awareness and incentivising sustainable consumption, retailers can empower consumers to adopt environmentally responsible behaviours, contributing to a broader culture of waste reduction and recycling.

Lastly, the project stressed the importance of **continuous improvement and innovation**. To remain effective, retailers must proactively explore new technologies, strategies, and partnerships that optimise resource use and minimise waste generation.

Collectively, these lessons offer valuable guidance for stakeholders in the W&R sector, providing a roadmap for advancing sustainability and resilience in waste management practices.

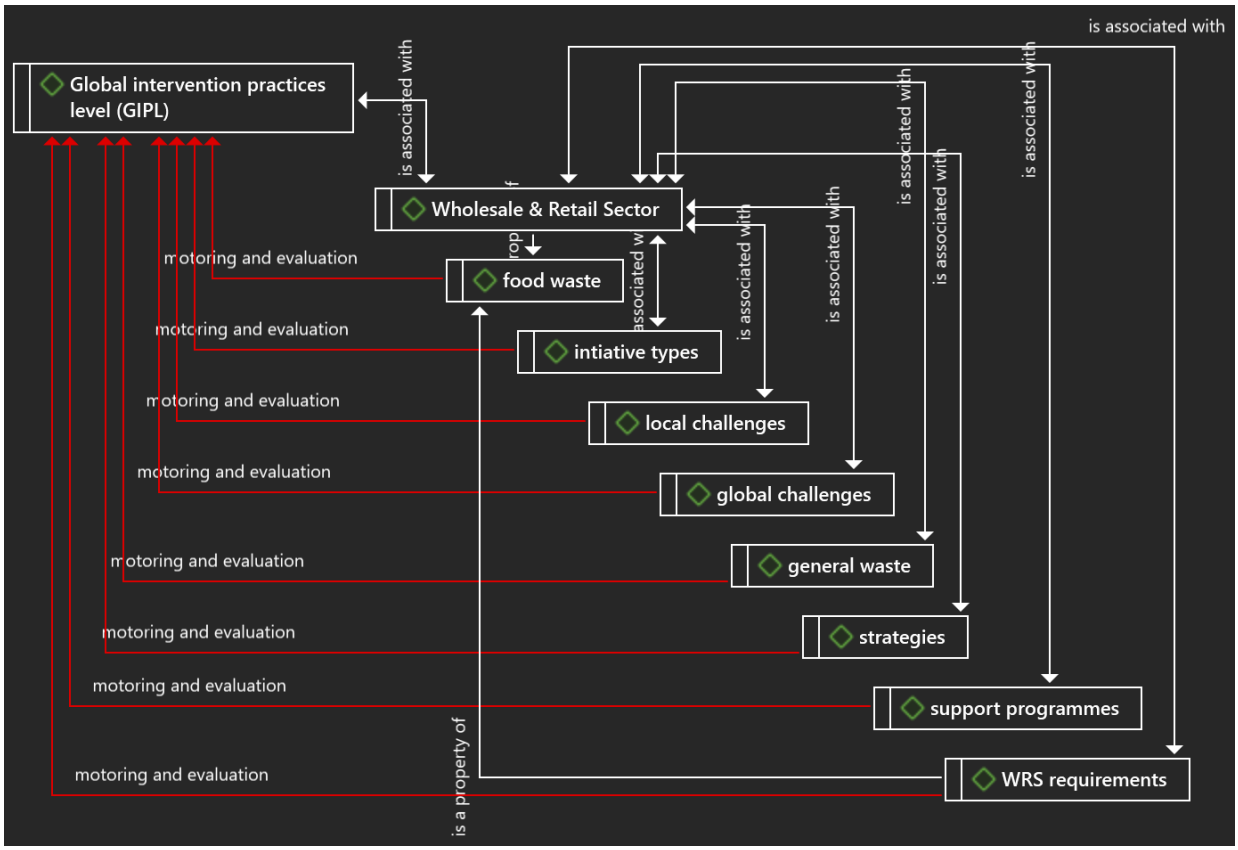

Figure 6. 3: Lessons learned from Global intervention practices.

Source: Researcher's Design

7.9. Identified Gaps in Previous Studies

Previous studies on waste management and sustainability in the W&R sector have made significant contributions, but several gaps remain:

- Limited Focus on SA Context: Many studies have explored waste management practices in the W&R sector globally, but there is a lack of research specifically focused on the SA context. This gap hinders the development of tailored solutions that address the unique challenges and opportunities faced by retailers in SA.
- Insufficient Attention to Post-COVID-19 Challenges: The COVID-19 pandemic has brought unprecedented disruptions to supply chains, consumer behaviours, and waste management practices. However, few studies have examined the impact of the pandemic on waste generation and management in the W&R sector, particularly in the SA context.
- Lack of Comprehensive Policy Frameworks: Existing studies often provide fragmented insights into waste management practices without offering a comprehensive framework for understanding the interconnectedness of factors influencing waste generation and management in the W&R sector. A holistic framework would enable a more systematic analysis and identification of effective strategies.
- Limited Examination of Regulatory Frameworks: While some studies mention regulatory aspects of waste management, there is a lack of in-depth analysis of the regulatory frameworks governing waste management practices in the W&R sector. Understanding regulatory requirements and compliance challenges is crucial for developing effective waste management strategies.
- Underrepresentation of Stakeholder Perspectives: Previous studies have primarily focused on the perspectives of retailers and consumers, overlooking the insights of other stakeholders such as waste management service providers, government agencies, and non-profit organisations. Incorporating diverse stakeholder perspectives can enrich the understanding of waste management challenges and facilitate collaborative solutions.

Addressing these gaps is essential for advancing knowledge and informing evidence-based policies and practices for sustainable waste management in the W&R sector, particularly in the SA context.

7.10. Areas for Future Projects

Future research in sustainable waste management within the W&R sector could focus on the following areas:

Technological innovations and consumer behaviours toward sustainable products warrant further exploration. By employing the stratified simple random sampling technique, a sample of 300 small, medium, and large wholesalers and retailers in South Africa could be drawn from the W&RSETA database. Key areas of investigation could include optimising supply chains through artificial intelligence for inventory waste management, implementing circular economy practices such as remanufacturing, and assessing the environmental impact of various supply chain models.

Additionally, evaluating the effectiveness of waste management policies, conducting international comparisons to identify best practices, and assessing the impact of collaborative efforts are critical areas for research. Addressing these topics can enhance understanding, inform policy development, and drive innovation for more sustainable practices within the W&R sector.

Furthermore, exploring the interconnectedness between environmental science, economics, public health, and policymaking could lead to more comprehensive solutions for waste management challenges. This interdisciplinary approach can uncover valuable insights and strategies to reduce environmental impact and advance sustainable practices across the sector.

7.11. Limitations of the Project

While this project makes valuable contributions to understanding waste management and sustainability in the W&R sector, several limitations must be acknowledged.

Firstly, the project's scope may be constrained by time and resource limitations, potentially limiting the depth of analysis or the breadth of data collection.

Additionally, the generalisability of findings may be limited by the specific context of the SA W&R sector, and caution should be exercised when applying the project's recommendations to other geographic regions or industry sectors.

Furthermore, the project's reliance on secondary data sources, such as literature reviews and case studies, may introduce bias or inaccuracies inherent in the original sources. The availability and quality of data may vary across different sources, potentially impacting the robustness of the project's findings.

Moreover, the project's focus on post-COVID-19 waste management challenges may overlook other important factors influencing waste generation and management in SA’s W&R sector. For example,

broader economic, social, and environmental trends may also play significant roles in shaping waste management practices.

Additionally, the project may not fully capture the perspectives and experiences of all relevant stakeholders, such as waste management service providers, government agencies, and non-profit organisations. Future research could address these limitations by employing mixed methods approaches, engaging diverse stakeholder groups, and conducting longitudinal studies to track changes in waste management practices over time.

Despite these limitations, this project provides valuable insights and recommendations for promoting sustainable waste management in the SA W&R sector, laying the groundwork for future research and policy development in this important area.

7.12. Conclusion

The project focused on sustainable waste management practices within the W&R sector, particularly in South Africa. It began with an extensive literature review that highlighted the current state of waste generation and its impacts on the environment, economy, and food security. Through interviews and exploratory studies, the research identified successful waste management strategies from developed countries and assessed their applicability to the SA context. Key challenges, including limited alternatives, financial constraints, and resistance from stakeholders, were examined alongside opportunities for improvement. The findings underscored the urgent need for proactive measures to reduce waste generation and promote sustainability within the W&R sector. Recommendations were provided for retailers, policymakers, and other stakeholders, with an emphasis on collaboration, investment in research and development, stakeholder engagement, and enhanced regulatory measures. By adopting these recommendations, SA could mitigate waste generation, improve environmental stewardship, and foster socio-economic development within the W&R sector.

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APPENDIX