Evaluating consumer behaviour related to plastic carrier bags: A Namibian case study

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Dissertation accepted in fulfilment of the requirements for the degree *Master of Science in Geography and Environmental Management* at the North-West University

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Graduation May 2024

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PREFACE AND ACKNOWLEDGMENTS

The study was initiated due to the limited information available on consumer behaviour regarding the use of plastic carrier bags in the Namibian context, especially following the introduction of the plastic carrier bag levy in the country. This research is aimed at gaining a comprehensive understanding of consumer behaviour concerning plastic carrier bags, with a specific focus on the case study of Walvis Bay. The research objectives were as follows: firstly, to evaluate consumers' awareness and perceptions of the Namibian plastic bag levy; secondly, to analyse the factors that influence consumers' behaviour related to plastic carrier bag use through the Theory of Planned Behaviour (TPB); and finally, to determine the proportion of plastic carrier bags in household plastic waste. These findings will be used to make recommendations aimed at enhancing the effectiveness of the plastic carrier bag levy.

I would like to express my sincere gratitude to all those who contributed to the completion of this dissertation. First and foremost, I thank the Almighty for His unwavering guidance and protection throughout this journey.

My deepest appreciation goes to my supervisor, Prof. Claudine Roos, for her invaluable advice and unwavering support throughout the study gave me the hope and courage to continue and complete my studies.

I am immensely thankful to the Namibia Chamber of Environment (NCE) for funding my tuition fees and to the Gobabeb Namib Research Institute for supporting the fieldwork component of my research and execution of this study. Special thanks to Dr. Gillian Maggs-Kölling and Dr Eugene Marais for their contributions have been instrumental in my academic journey.

I would like to thank the Walvis Bay municipality staff for permitting me to conduct the research in their jurisdiction. Huge thanks to Mee Nangula Amutenya and Mr David Uushona for assistance during the implementation of the project, and Mr Gustav Nyau for the tour around town and waste collection information.

I extend my gratitude to the Gobabeb staff for their support. Fieldwork would not have been possible without the hard work and dedication of Glen Kasper and Romario Bees, who endured challenging conditions to assist with data collection.

Lastly, I thank my family in Walvis Bay for accommodating me during the data collection phase, and BB for unending support throughout my study.

ABSTRACT

More than 160 public policies have been introduced, globally, to reduce the consumption of plastic bags, with a specific focus on plastic carrier bags. In Europe, these policies have successfully influenced consumer behaviour, while in Africa, the impact remains uncertain due to policy failures or a lack of information. It is well-established that consumer behaviour, which includes psychological and social factors, plays a crucial role in reducing plastic consumption.

This research specifically aimed to explore consumer behaviour related to the consumption of plastic carrier bags in Namibia, where people continue to purchase these bags even after the introduction of a plastic carrier bag levy. The study applied the Theory of Planned Behaviour (TPB) to understand consumer behaviour related to plastic carrier bags in Namibia, with a specific focus on Walvis Bay as a case study area. The TPB posits that the intention to perform a behaviour can be accurately predicted by one's attitude toward the behaviour, social norms, and perceived behavioural control. Intention, along with perceived behavioural control, predicts the actual behaviour of consumers regarding plastic carrier bag use. Self-reported data, collected through a TPB-based survey questionnaire, was administered at the household level. A total of 191 households from four suburbs in Walvis Bay (Kuisebmond, Narraville, Hermes and Meersig) participated in the research. Self-reported data were supplemented by observations of the proportions of plastic carrier bags in household plastic waste.

Approximately 60.4% of respondents mistakenly believed that the prices of plastic carrier bags were uniform, despite variations. Situational factors, convenience, and environmental awareness were found to significantly influence plastic carrier bag purchasing behaviour. However, neutral scores in perceived behavioural control and social norms indicated a lack of clear social expectations and confidence when making decisions about plastic bag purchases. Furthermore, the study revealed that factors such as education, age, and income level significantly influenced the constructs within the TPB and the proportion of plastic bags in household waste.

On average, households used between 7.8 and 11.3 plastic bags each week, with 47.3% of these bags being reused for waste disposal. This pattern of reusing plastic bags at home contributed to the continued purchase of such bags, suggesting that addressing the plastic bag levy should be approached from a solid waste management perspective. These findings provide valuable insights into the dynamics of plastic bag use and support the need for a comprehensive approach to address plastic waste management.

Keywords: *plastic carrier bag, plastic levy, waste management, Theory of Planned behaviour*

ABBREVIATIONS AND ACRONYMS

AECOM	Architecture, Engineering, Construction, Operations, and Management
EAC	East Africa Community
EPS	Expanded Polystyrene
ERB	Model of Environmentally Responsible Behaviour
GAIA	Global Alliance for Incinerator Alternatives
HDP	High-Density Polyethylene
LDP	Low-Density Polyethylene
MCAR	Missing Completely at Random
MEFT	Ministry of Environment Forestry and Tourism
MET	Ministry of Environment and Tourism
NCE	Namibia Chamber of Environment
NFAS-REC	Faculty of Natural and Agricultural Sciences - Research Ethics Committee
NSA	Namibia Statistic Agency
NSWMS	National Solid Waste Management Strategy
NWU	North-West University
PBC	Perceived Behavioural Control
PEB	Pro-Environmental Behaviour
PEB	Theory of Pro-Environmental Behaviour
PET	Polyethylene terephthalate
RDFs	Refuse Derived Fuels
RO	Research Objective

SPSS	Statistical Package for the Social Sciences
TPB	Theory of Planned Behaviour
TRA	Theory of Reasoned Action
UNEP	United Nations Environmental Programme
USA	United States of America
WWF	Worldwide Fund for Nature

KEY DEFINITIONS

Attitude: In the context of the theory of planned behaviour (TPB), attitude refers to behavioural belief of a person's evaluation of the degree of positive and negative magnitudes of performing a particular behaviour (Ajzen, 1991).

Awareness: In the context of the theory of planned behaviour (TPB), awareness refers to a person's understanding and knowledge of environmental issues (Li & Zhao, 2017; Muralidharan & Sheehan, 2016)

Consumer: In the context of this research, a consumer is any person who buys and or uses plastic carrier bags.

Consumer behaviour refers to the actions, decisions, and patterns exhibited by individuals or households in the purchase, use, and disposal of plastic carrier bags. It encompasses factors such as the frequency of plastic bag usage, reasons for choosing plastic bags over alternative options, awareness of environmental consequences, and willingness to adopt sustainable alternatives (Santos *et al.*, 2013).

Foamed plastic: Commonly known as Styrofoam this is rigid, lightweight expanded polystyrene (EPS) foam such as coffee cups, food trays, box packaging, and other daily life items (UNEP, 2018a:11).

Household is a group of people that live in one residential plot and have meals together. Household size refers to the number of people in the household (Namibia Statistics Agency, 2016).

Perceived behavioural control: In the context of the theory of planned behaviour (TPB), perceived behavioural control refers to a person's belief in their ability to perform a specific behaviour successfully (Ajzen, 1991, 2011)

Plastic carrier bag: These are plastic bags with or without handles purchased or given to the customer at the point of sale to carry or transport purchased goods (UNEP, 2018b), also referred to as *plastic grocery bags* or *plastic shopping bags*.

Plastic packaging consists of (1) manufacturer's plastic bags, encompassing both plastic packaging for food or beverage products and plastic packaging for non-food and non-beverage items, and (2) plastic shopping bags (Phuc & Yasuhiro, 2011:27)**.**

Regulations are rules or directives made and maintained by relevant authorities. Regulations pertaining to plastic carrier bags within this research are legal provisions, directives, or statutory requirements established by governmental authorities or relevant agencies to control, govern, or standardise various aspects of plastic carrier bag production, distribution, use, and disposal (UNEP, 2018b).

Situational variables: In the context of the theory of planned behaviour (TPB), situational variables refer to external conditions or circumstances that can influence an individual's behaviour, decisions, or actions in a particular situation (Lam & Chen, 2006)

Social norms: In the context of the theory of planned behaviour (TPB), social norms refer to a normative belief of what society deem right or wrong for an individual to perform a behaviour (Ajzen, 1991).

Suburb is a group of residential-detached houses within a certain price range and occupancy density.

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CHAPTER 1 INTRODUCTION

1.1 Background

More than 160 public policies have been introduced, globally, to reduce the consumption of plastic bags, with a specific focus on plastic carrier bags (Nielsen *et al.*, 2019a). Plastic carrier bag policies include a range of interventions - from a complete or partial ban of plastic bags; the introduction of taxes or levies where plastic bags are used; voluntary agreements; to a combination of these approaches (Hasson *et al.*, 2007; Xanthos & Walker, 2017). These varying approaches differ in terms of their progress in implementation and effectiveness. In Europe and the United Kingdom, for instance, plastic bag regulations have caused a change in consumer behaviour, causing spillover effects into other environmentally conscious behaviours (Convery *et al.*, 2007; Poortinga *et al.*, 2013). Research done in African countries, however, reports varying results. Research by Babayemi *et al.* (2019) and D'Silva (2019) have shown a decrease in plastic bag use and a resultant reduction in plastic pollution upon the introduction of plastic bag levies in Rwanda, while the findings of Behuria (2019:5) have indicated that these levies have failed in East Africa. Similarly, research conducted in South Africa has shown that the plastic carrier bag levy had little effect on achieving reduced consumption of these bags (Hasson *et al.*, 2007). Failure to achieve the outcomes of plastic bag levies is mostly ascribed to a lack of enforcement, levies not being significant / high enough to change behaviour, cultural resistance, the inconsistent application that differs across the neighbouring borders and the political economy of plastic bags, as well as poor waste-related behaviour (Behuria, 2019).

It is well-known that consumer behaviour plays an important role towards achieving a reduction in plastic consumption. It is, therefore, important to understand human behaviour as it relates to plastic carrier bag usage. The Theory of Planned Behaviour (TPB), designed to understand and predict human behaviour (Ajzen, 2012), has been used to systematically identify factors that influence pro-environmental behaviour (Hossain *et al.*, 2020; Nigbur *et al.*, 2010), which contribute to improved waste management practice. The TPB should produce useful insights into factors that influence consumer behaviour influencing the consumption of plastic bags, towards ultimately making recommendations for improved plastic bag policies.

1.2 Problem statement and rationale for the study

For many African countries, there is a lack of information on the progress of implementation and the effectiveness of plastic bag policies. In the African context, limited research has been

done on the implications of plastic carrier bag levies on consumer behaviour, especially because consumers bear the cost of plastic bags (Knoblauch *et al.*, 2018; Nielsen *et al.*, 2019). Research on consumer response to plastic bag legislation in Botswana highlights a decline in usage due to pricing rather than substantial behavioural change, emphasising the need to research on psychological factors that influence consumer behaviour towards plastic bags (Dikgang & Visser, 2012). Despite the initial success of the plastic bag levy in South Africa, it seems that the levy now has little effect on the reduction of plastic bag usage, and there is a lack of comprehensive research on how consumers have adapted to plastic bag levies and whether they lead to long-term behaviour change (Hasson *et al.*, 2007). While in Zimbabwe, the persistence of plastic bag usage despite the introduction of a levy highlights the need for research on effective communication strategies to promote environmental awareness and behaviour change among the public (Chitotombe, 2014). Namibia is among the countries where not much information is available on the implications of plastic carrier bag levies on consumer behaviour (Bezerra *et al.*, 2021).

In Namibia, improper waste disposal is a major problem combined with a lack of solid waste awareness (MEFT, 2018). Municipalities, local authorities and regional councils are responsible for providing waste collection and disposal services to their inhabitants (MEFT, 2018), however, most local authorities do not have town-specific waste management policies, relying only on the guidance provided in the Environmental Management Act 7 of 2007 (MEFT, 2007). The legislation offers directives for enforcing environmental protection laws, serving as a broad framework for developing environmental plans. It does, however, not adequately address waste management practices. Illegal waste dumping and littering, where plastic bags are often one of the main waste streams, are observed in Namibia in areas without formal waste collection and uncontrolled dumpsites (Hartman, 2019).

Some progress has, however, been noted to address the problem of plastic bag pollution in the country and to regulate the use of plastic bags. In April 2017, the regulations relating to Nature Conservation (Nature Conservation Ordinance, 1975) was amended to add Regulation 9A which states that: *"No person shall enter a game park or nature reserve with a plastic bag"* (Government Notice 85 in Government Gazette 6285) (MET, 2017:4). Furthermore, in 2018, the Namibian Ministry of Environment, Forestry and Tourism (MEFT) [previously known as the Ministry of Environment and Tourism (MET)(MEFT, 2017)] published the National Solid Waste Management Strategy (NSWMS) with the view of improving solid waste management in Namibia. The NSWMS strongly advocates the waste management hierarchy, which gives preference to waste prevention, minimisation, reuse and recycling, and highlights important principles, such as the circular economy. The strategy specifically focuses on problematic

wastes, such as plastic carrier bags, with targets to *"plan a charge on plastic bags in shops"* (MEFT, 2018: 7), *"have consultations on plastic bag charges"* (MEFT, 2018:10) and *"implement plastic bag charges"* (MEFT, 2018: 15).

In accordance with the provisions of the NSWMS, Namibia introduced an environmental levy on plastic carrier bags in August 2019 (Government Notice 226 in Government Gazette 6967) (Ministry of Finance, 2019). The levy aims to reduce plastic bag use and cause behavioural change on plastic bag users, while the generated revenue from the levy is used to improve waste management practices (Nakale, 2018). The effectiveness of the levy in achieving its intended outcomes – i.e., reducing plastic bag use and related plastic waste – has not yet been researched. Furthermore, consumers' perceptions, behaviours and awareness, and the socio-economic impacts of the Namibian plastic bag levy are unknown. Further research focused on understanding consumer behaviour, as it relates to these levies, would assist in identifying gaps and opportunities in the regulatory framework, and recommend possible amendments or supplementary actions to improve efficiency in achieving its goal.

1.3 Research aim and objectives

The overall aim of the research is to evaluate consumer behaviour related to plastic carrier bags in Namibia, by focusing specifically on Walvis Bay, with the aim of making recommendations for improving the effectiveness of the plastic bag levy.

In line with the research aims, the following research objectives are set:

1. ***Research objective 1:*** Assess consumers' awareness and perceptions about the Namibian plastic bag levy.
2. ***Research objective 2:*** Assess the factors that influence consumers' behaviour related to plastic carrier bag use through the TPB.
3. ***Research objective 3:*** Determine the proportions of plastic carrier bags in household plastic waste to supplement self-reported behaviour (in RO2).

1.4 Scope of the research

The research was conducted in the central coastal town of Walvis Bay, Namibia as a case study area. Four suburbs, namely Kuisebmond, Hermes, Narraville, and Meersig, representing different socio-economic levels, were chosen as specific survey areas for the evaluation of consumer behaviour related to plastic carrier bags.

The study focused exclusively on household behaviour and employed a household survey to gather data, excluding surveys at shops or other locations. A total of 191 households are represented in the research. The focus of the research was on consumer behaviour concerning the use of plastic carrier bags for shopping, intentionally excluding any other types of plastic bags or materials from its scope.

The study applied the Theory of Planned Behaviour (TPB) as its theoretical framework, relying on self-reported behaviour and supplementing it with observations of actual plastic bag presence in the surveyed household waste stream. The TPB relies on self-reported information related to aspects such as attitude, awareness, perceived behavioural control, social norms and situational variables. The primary objectives were to analyse consumer behaviour, identify influencing factors, and assess sustainable alternatives.

This research aimed to provide valuable insights that could inform policy and decision-making processes concerning plastic bag usage and environmental sustainability, not only in the study area but also beyond.

Data were collected between February and March 2023.

1.5 Defining key terminologies

Defining key terminologies, it is crucial to provide clear and concise explanations that establish a common understanding for the reader. An understanding of key terminologies helps to bridge the gap between the researcher's specific focus and the broader academic or disciplinary context, ensuring that the terminology aligns with the study's objectives and contributes to the scholarly discourse in the field.

1.5.1 Plastic carrier bags

Plastic carrier bags, also referred to as *plastic bags, plastic grocery bags* or *plastic shopping bags*, are typically provided to customers at the point of sale for carrying and transporting purchased goods. These items belong to the thermoplastics family and are made from Low-Density Polyethylene (LDP) or High-Density Polyethylene (HDP) polymers. The bags have varying sizes and thickness and may or may not have handles (Madara, 2016; UNEP, 2018a). These bags are known for their convenience, durability, and affordability. Plastic carrier bags have raised environmental concerns due to their adverse impact on pollution, wildlife, and the broader ecosystem, making them a central focus of this research. Throughout this study, the

terms "plastic bags", "plastic carrier bags" and "plastic shopping bags" are used interchangeably to refer to plastic carrier bags.

1.5.2 Households

The definition of household varies across disciplines and survey focus. The Namibian Statistic Agency (NSA) defines household as *a collective entity comprising one or more individuals, whether they share familial ties or are unrelated, cohabiting within the same homestead or compound* (Namibia Statistics Agency, 2016:7). Importantly, these individuals need not occupy a singular dwelling unit, indicating that they may reside in separate residential structures while still constituting a single household. Crucially, households exhibit a communal existence characterised by shared arrangements for sustenance and living, while also being accountable to a common head of household (Namibia Statistics Agency, 2016).

The multiple dwelling units in Walvis Bay are mainly backyard shacks within a residential erven, housing about half of the population (Staff report, 2017; Walvis Bay municipality, 2014). Using the above definition will assume backyard shacks are multiple dwelling units for a single household, while each backyards shack has their separate head of house and prepare their own separate meals resulting in multiple households within one erven (or plot of land). These households often share a single refuse bin, which makes it difficult to determine plastic waste composition per household. For the purposes of the observational part of this research, reference to households refers to the people living within the same residential erven and share a single municipal refuse bin for waste collection, while for the purposes of the survey questionnaire, the NSA definition is retained, which represents a single dwelling unit as the respondents were answering on behalf of their own households only.

1.5.3 Regulations

According to the Oxford Dictionary, *regulations are rules or directives made and maintained by relevant authorities*. Regulations as it pertains to plastic carrier bags within this research, are legal provisions, directives, or statutory requirements established by governmental authorities or relevant agencies to control, govern, or standardise various aspects of plastic carrier bag production, distribution, utilisation, and disposal. These regulations may include measures such as prohibitions on single-use plastic bags, specifications for bag thickness and composition, imposition of fees or taxes on plastic bag usage, mandates for recycling or environmentally responsible packaging practices, or combinations of these measures (UNEP, 2018b). Analysing regulations in the context of plastic carrier bags is vital for comprehending

the legal framework that shapes consumer behaviour. For this research, policies, bans, levies and voluntary agreements are all referred to as plastic carrier bag regulations.

1.5.4 Consumer behaviour

Consumer behaviour are mostly research for market-based purposes and is defined by Jisana (2014: 34) as *activities performed by an individual to acquire and utilise a product or service to satisfy their needs*. These activities can be influenced by cultural, social, personal, and psychological factors. For this research, consumer behaviour refers to the actions, decisions, and patterns exhibited by individuals or households in the purchase, use, and disposal of plastic carrier bags. It encompasses factors such as the frequency of plastic bag usage, reasons for choosing plastic bags over alternative options, awareness of environmental consequences, and willingness to adopt sustainable alternatives (Santos *et al*., 2013). The Theory of Planned Behaviour (TPB) will be applied to evaluate consumer behaviour related to plastic carrier bags. Analysing consumer behaviour in this context aims to understand the motivations and behaviours of households regarding plastic carrier bag use and to identify potential drivers for adopting eco-friendly practices in this regard.

1.6 Assumptions and limitations

The study was carried out within Walvis Bay Municipality area, focusing exclusively on consumer behaviour at the household level in residential area, with no investigation in supermarkets or other crowded places. The consumer behaviour at household level might be different from those in commercial or industrial area as they were not part of the study.

It was assumed that households would be willing to participate in the survey and provide accurate, truthful information regarding their plastic carrier bag usage behaviour. While the proportion of plastic carrier bags found in the plastic waste stream weekly was assumed to be the number of plastic bags purchased that week per household.

Due to limited studies utilising the TBP measuring scale for plastic carrier bag behaviour in Namibia and southern Africa, a measuring scale was developed, drawing from European and Asian studies of which consumer behaviour could be different. Socio-economic strata were employed as a proxy for income levels, as research has shown that these two factors convey similar information.

The selected households were considered a representative sample of the entire population in the coastal town, allowing for generalisable findings for the Walvis Bay area, but caution must

be exercised when extrapolating them to a national level. This limitation is due to short sampling time, differences in shopping habit influenced by locality, and potential seasonal variations.

1.7 Potential contribution of the research

Household surveys of plastic carrier bag use behaviour are sparse in literature (Li & Wang, 2021) especially in an African context. This research may assist in understanding the effectiveness of the plastic bag levy in changing consumer behaviour related to the use of plastic carrier bags. Conducting surveys at different income levels provide an insight into perceptions and effects of plastic bag levy at varying income levels (Hasson *et al*., 2007). Determining the fraction of plastic bag waste provides crucial information on the effectiveness of the plastic bag levy and future plastic waste management especially with national plastic bag ban on the card. The information may be compared to other plastic bag levies in Africa and the rest of the world to identify gaps for the policy adjustment.

Filling in the knowledge gaps about the above-mentioned components makes this study significant in both short-term and long-term management of plastic waste in Namibia.

Plastic carrier bag consumption can be better addressed if factors influencing the use and purchasing by consumers are clearly understood. This might also contribute to the innovation of possible alternatives that are area-specific and informed awareness campaigns.

Lastly, this study bridges the gap in self-reported and actual behaviour while revealing the different behaviour of plastic bag reuse at households or influential factors that affect the continues purchasing of plastic carrier bags.

1.8 Dissertation structure and outline

The dissertation is structured into five chapters. Chapter 1 provides an overview of the background, aim, research objectives, research problem, significance, and study limitations. In Chapter 2, a literature review is conducted, focusing on plastic bag regulation, associated behaviours, and the utilisation of the Theory of Planned Behaviour (TPB) to understand and predict behaviours related to plastic bag usage. Chapter 3 outlines the research methodology, including a comprehensive research design, the research tools employed for data collection, and the techniques used for data analysis. Chapter 4 presents the results obtained from the research and initiates a discussion around them. Finally, Chapter 5 concludes the dissertation and offers recommendations based on the findings.

1.9 Conclusion

The introduction chapter provide an overview of the research project and what the research aims to achieve. The following chapter will present the literature review on the plastic bags regulations and the use of TPB to predict plastic bags use behaviour.

CHAPTER 2 LITERATURE REVIEW

2.1 Introduction

The negative impact of plastic pollution on the environment prompt political debates and policy intervention while scholars investigate set regulations to reduce plastic bag consumption, understand consumers' behaviour in the purchasing of plastic bag and plastic waste generation around the world (Convery *et al.*, 2007; Nielsen *et al.*, 2019a; Phuc & Yasuhiro, 2011). However, there is limited information on the effectiveness of plastic regulation in changing consumer behaviour and empirical data on plastic bag proportions and composition in household waste streams in Southern Africa (Bezerra *et al.*, 2021), especially in the Namibian context.

This chapter examines existing literature on consumer-related behaviours related to plastic bags, focusing on the Theory of Planned Behaviour (TPB) and its application to plastic bag use behaviour. As far as possible, literature was sought focusing on plastic carrier bags. However, where such literature did not exist in the public domain, similar literature on plastic waste was referred to.

The literature review gives an overview of plastic bag regulation and different behaviour observed, followed by the TPB discussion and application in predicting behaviour that influences the use of plastic bags.

The literature reviewed mostly consisted of peer-reviewed academic publications and legislation (including regulations). These sources were accessed via Google Scholar, Research Gate and the NWU Library repository, in addition to official government websites. Newspaper and web pages were also considered to provide background information on the plastic bag context in Africa due to the lack of published papers, in some instances. The phrases used to search for literature included: "plastic bag", "plastic carrier bag", "plastic grocery bag", "plastic shopping bag", "consumer behaviour", "plastic bag regulation", "Theory of Planned Behaviour" and "household plastic waste" as individual phrases and in combinations.

2.2 The global plastic waste problem

Plastic, a once-praised material during the ~1950s, has become the world's greatest environmental problem, found in every corner of the world (Nielsen *et al.*, 2019b). This proliferation of plastics is mainly due to low production costs, as well as its lightweight and

durable properties and diverse application potential (Rios *et al.*, 2007). Packaging is the main market for plastic accounting for 116 Mt of the 388 Mt of plastic produced in 2015 (UNEP, 2018c). An increase in plastic packaging led to a global shift from reusable to single-use plastic packaging, increasing municipal waste by more than 10% in developed countries. At a global scale, 6300 Mt of plastic waste have been generated by 2015 of which 4977 Mt accumulated at the landfill or in the environment. It is estimated that 12 000 Mt of plastic waste would have accumulated in landfills and the environment by 2050 (Geyer *et al.*, 2017). The excessive use and accumulation of plastic waste in the environment led to the development of ambitious and effective internationally binding instruments, the UN Plastic Treaty to end plastic pollution. The instrument highlights the need to prioritise reuse and policy measure to overcome barriers to scaling reuse (Ellen MacArthur Foundation, 2023; UNEP, 2022a,b).

Plastics persist in the environment because they do not biodegrade, but photodegrade into microplastics (Rios *et al.*, 2007), causing a growing concern in plastic waste management. Microplastic is too small to trace its source and difficult to remove from the environment with a reduction in inputs as the only mitigation strategy (Jambeck *et al.*, 2015).

2.2.1 Sources of plastic waste

Inadequate waste management such as open dumping and landfilling are the key contributor to plastic pollution (Nielsen *et al.*, 2019a). The practices are mainly found in Africa and Asia, which have the lowest solid waste collection efficiency (Knoblauch *et al.*, 2018) and have the world's largest landfills, followed by America and Europe respectively (UNEP, 2015). Municipal solid waste accounts for half of the macroplastic, while tyre abrasion and city dust are the main source of microplastic (UNEP, 2018c). There is the limited research and empirical data to link plastic waste on land to releases in the marine environment - instead estimates are used.

A study by Jambeck *et al.* (2015) revealed that plastic waste in the ocean is due to littering and inadequate waste disposal on land by coastal countries. In 2010, approximately 275 million metric tonnes of plastic waste were generated by 192 coastal towns, of which about 12 million metric tonnes entered the ocean through waterways, currents and wind. However, Morales-Caselles *et al. (2021)* argue that wind and currents are not efficient transport modes for plastic waste from land to open water, and that leakage hotspots are mostly rivers in urban centres experiencing poor waste management (WWF, 2021). Though widely cited, Jambeck *et al.* (2015) does not give an accurate global representation because the study failed to consider varying watershed characteristics, natural disaster inputs, losses from at-sea vessels and the export of plastic waste to other countries and contribution by landlock countries.

Additionally, the data are mostly from municipalities and does not consider illegal dumping and informal waste collection.

2.2.2 Impacts of plastic waste on the environment

The detrimental effects of plastic waste in the environment include unsightly litter, health risks, and threats to the life of domestic animals and wildlife (Behuria, 2019). Plastic waste that is not collected or illegally dumped ends up being washed into city drainage systems causing seasonal floods that destroys infrastructure and causes the outbreak of disease with potential fatalities (UNEP, 2015). The lightweight nature of plastic allows for windblown transport into the environment, detrimentally affecting landscape aesthetics. In some countries, plastic waste are referred to as the “national flower” (Staff reporter, 2003), because windblown plastics get stuck in trees, causing unsightly pollution (Wagner, 2017).

Microplastics are often mistaken for food by marine organisms leading to fatalities or accumulating in food chains and recently reported in human blood. The impacts of microplastics in blood and tissues of organisms are still largely unknown (Leslie *et al.*, 2022).

Plastic pollution contributes to climate change through production from fossil fuels, transportation, and when in landfills it traps organic waste causing methane production with an estimated increase of 15% greenhouse gases (GHG) emission of global budget (WWF, 2021:15).

2.2.3 Problematic plastics

The production of polyethylene terephthalate (PET) bottles, lids, and caps has increased over the years due to the expanding beverage industry (WWF, 2021). Sachets used for water and other food products contribute to 52% of the overall plastic waste that remains unprocessed (GAIA, 2020; Nyarko & Adu, 2016). Recycling sachets, films, and foils poses a substantial challenge due to issues such as contamination, sorting difficulties, and extensive use of additives (GAIA, 2020; Shen & Worrell, 2014). In marine environments, macro plastic waste, including plastic bags and take-away items, dominates the presence, alongside fishing gear (Morales-Caselles *et al.*, 2021).

Plastic carrier bags have the highest consumption as a packaging material (Nielsen *et al.*, 2019b). The lightweight and balloon shape of plastic bags causes their unintentional transfer by wind and water into the environment from waste bins, dumping sites or landfills (Clapp & Swanston, 2009; Knoblauch *et al.*, 2018). Plastic bags litter in the environment is generally

blamed on poor waste management especially in Africa (Bezerra *et al.*, 2021; Chitotombe, 2014).

Packaging is the largest market for plastic with materials designed for single use (Geyer *et al.*, 2017). A study by Phuc & Yasuhiro (2011) at household level found that plastic packaging and containers account for 95% of plastic waste, of which 46% were plastic bags. Essonanawe *et al.*, (2014) echo the same sentiment of packaging plastic contributing to high plastic waste but could not indicate the proportion of each plastic type.

Plastic carrier bags, also referred to as *plastic shopping* bags or *plastic bags* or *plastic grocery bags*, are plastic bags with or without handles purchased or given to the customers at point of sale to carry goods. These bags belong to the thermoplastics family and are made from low density polyethylene (LDP) or high density polyethylene (HDP) polymers (UNEP, 2018b).

Plastic carrier bags are considered problematic because they are designed for single-use with an average use of 12 minutes (The World Count, 2023) and reused once or twice (Cho, 2020), are difficult to recycle or not recyclable, and has significant environmental impacts as litter and with low recovery rate that exceeds revenues (Wagner, 2017). In response to these concerns, South Africa has revised regulations governing plastic carrier bags. The amendments now include mandatory national specifications, stipulating a minimum thickness of 24 micron, a requirement for 50% post-consumer recycled content and submission plastic carrier bags life cycle information by the manufacturer. This amendment is aims to enhance the environmental friendliness and reusability of plastic bags (Department of Environment Forestry and Fisheries, 2021; Rapson *et al.*, 2021).

This research specifically focuses on plastic carrier bags, and the remainder of the literature review will, therefore, focus on this type of plastic bag.

2.3 Regulation of plastic carrier bag usage

More than 192 countries around the world have adopted various approaches to regulating single-use plastics, of which 127 countries focus on plastic bag production, use and distribution (UNEP, 2018b). In the Global South, the impact related to poor waste management was the motivation for regulating plastic bags, as opposed to the situation in the Global North where public pressure and critical media coverage informed the regulation (Knoblauch *et al.*, 2018). Following a South to North emergence pattern, and without a conventional norm at the international level governing the adoption of plastic bag regulations, led to each country setting regulations at local and regional levels, based on country-specific environmental and health concerns (Clapp & Swanston, 2009). Although regulations differ between countries, their main

goal is to reduce consumption or eliminate plastic bag use, while indirectly changing consumer behaviours, minimising plastic waste and generating revenues for waste management (Clapp & Swanston, 2009; Nahman & Godfrey, 2010). The variation in the range and scope of plastic bag regulations makes it difficult to assess the effectiveness at a global scale and identify which specific regulation may be the best to reduce plastic bag use at global or even sub regional levels (UNEP, 2018a). However, the United Nation member states are currently developing a Global Plastic Treaty, the first global international legally binding agreement aimed at ending plastic pollution by addressing the full plastic carrier bags lifecycle (Ellen MacArthur Foundation, 2023; UNEP, 2022a).

Plastic bag regulation are divided into three major categories (a) reduction of production and use, (b) improvement of waste systems, and (c) implementation of supporting measures (Turpie *et al.*, 2019). Many implemented regulations are more focused on the reduction of production and use, through implementing supporting measures, with minimal enforcement, research and education (Bezerra *et al.*, 2021; Nielsen *et al.*, 2019b). Reduction of production and use, which is mostly implemented through legislation, include bans, levies/taxes and a combination of both, as well as voluntary agreements.

Knoblauch *et al.* (2018) states that bans include the complete stop of sales, usage, importation, and production of plastic bags. The ban regulates consumer behaviour by eliminating the plastic bag option, while levies modify the behaviour by thinking through their choices after having to pay for an item (Wagner, 2017).

Levies, taxes or other fees or charges may be paid by stores and manufacturers for production, importation and distribution of plastic bags. Levies and taxes are paid to the government, while charges remain with the retail store (Poortinga *et al.*, 2013). The value of the levy is country-specific, and may be affected by plastic bag design (Dikgang *et al.*, 2012) and day-specific charges (such as on Saturdays in Malaysia) (Richards & Zen, 2012). Partial bans and levies are a complete stop of usage or production and importation of certain plastic bag types, based on specific design and allowing the production, sale, and importation of preferred plastic bags (Hasson *et al.*, 2007; Xanthos & Walker, 2017). Transgressors of set regulations are faced with monetary penalties (D'Silva, 2019; Hasson *et al.*, 2007; Watts, 2018).

Voluntary agreements were mainly triggered by environmental impacts and lobbied by environmental companies such as beach cleanups in coastal towns or request for retailers to stop giving out plastic bags for free (Leuschner, 2019). Additionally, retail stores offer incentives to customers who bring their own reusable bags. The retail store, Target, for

instance reported a 58% increase in the use of reusable bags (Pisani, 2010) when customers were incentivised with a future purchase reward. Some stores have implemented plastic bags return schemes (SPAR, 2021) (i.e., for every 10 plastic bags you return you get one reusable bag), while others use alternative bags made from recycled materials (Das, 2021). It is however, reported that most of the returned plastic bags are not recycled as there is no recycling facility for plastic bags but taken to landfill or incinerated (abc7 Chicago, 2023).

2.3.1 Regulation of plastic carrier bags in the developed world

Developed countries are the world's largest producers, consumers, and exporters of plastic waste. In the United States of America (USA), 103 billion plastic bags with low recyclability were consumed in 2014. By 2017, more than 271 non-state plastic carrier bag regulations were adopted of which 94% are bans with or without levies on paper bags and 6% levy fee on plastic and paper bags (Wagner, 2017). In California, plastic bag bans increased the use of reusable bags by 40%, and the use of paper bags by 16% (Kish, 2018). The rejection of plastic bag regulation is mainly due to low public interest, perceived convenience related to plastic bag usage, and because of economic reasons (Clapp & Swanston, 2009; Li & Zhao, 2017). In contrast, coastal towns and areas where plastic waste impacts are evident, anti-plastic movement initiatives are accepted with very little to no rejection (Kish, 2018; Li & Zhao, 2017; Wagner, 2017)

Regulations in Europe are consistently implemented and monitored and have been successful in reducing plastic bag usage. The Irish plastic bag tax, which aimed at reducing plastic litter and negative landscape effects, led to a 90% reduction in plastic bag usage and a decrease in the presence of plastic bags in rural landscapes by 2005. The regulation, however, had the unintended consequence of increasing the use of plastic carrier bags for the household disposal of waste (as a bin liner), which ended up at landfills (Convery *et al.*, 2007). According to research conducted by Thomas *et al.*, (2016) in Wales, a significant increase in the use of reusable shopping bags was observed upon the implementation of plastic bag regulations in comparison to England, where there were no regulations on plastic bags at the time. However, six months after the introduction of the five pence levy in England, plastic bag usage and reusable bag usage were no different from Wales and Scotland, where plastic bag regulations were introduced four years earlier (Thomas *et al.*, 2019). This shows plastic bag regulations' consistent effects across UK countries and policy spillover, requiring short turn-around times to be effective (Convery *et al.*, 2007; Thomas *et al.*, 2019).

2.3.2 Regulation of plastic carrier bags in the developing world

Plastic bag regulations in developing countries typically include complete or partial bans on plastic bags, taxes or levies on plastic bags or a combination of these approaches with varying effectiveness (Bezerra *et al.*, 2021). The effectiveness of developing countries regulations are either short-term or no progress reported (UNEP, 2018b). Nyathi and Togo (2020), and UNEP (2018b) state that the lack of effectiveness of these policies is due to poor enforcement and monitoring, resistance from the stakeholders, and lack of plastic bag alternatives. The passing of the *East Africa Community (EAC) Polythene Materials Control Bill* by the East Africa Legislative Assembly, pressure from the EAC, and persistence from Rwanda's government to take action - led to discussions in the region, but with varying implementation success (Behuria, 2019:12).

2.3.2.1 Regulation in Africa

Despite plastic bag regulations having a Global South diffusion and the African continent leading in adopting plastic bag regulations, there is limited information on the effectiveness of the regulations, and plastic pollution is still a challenge in most of Africa (Clapp & Swanston, 2009). The region experiences ineffectiveness in plastic bag regulations, even though many countries have implemented a combination of plastic bag levies, and plastic bag bans. The ineffectiveness of plastic bag regulation in Zimbabwe can be linked to - a lack of enforcement and poor communication, causing consumers to resist acceptance of the plastic bag levy (Chitotombe, 2014; Mogomotsi *et al.*, 2019). South Africa observed a short-term impact of the levy reducing plastic bag use by 80%, however, consumers got used to the relatively low, insignificant levy cost reverting back to their old shopping habits, which are characterised by high usage of plastic carrier bags (Hasson *et al.*, 2007). Xanthos and Walker (2017) suggest that the levy should be adjusted over time for consistent positive impacts.

In Botswana, the plastic bag levy revenue is seen as a profit-making scheme, instead of the intended purpose of reducing plastic carrier bag use. Challenges also included a lack of communication with consumers about the intent behind the collection of the levy (Madigele & Mogomotsi, 2017). Thomas *et al.* (2019) encourage that creating awareness gives better policy understanding, therefore, increasing regulation support and compliance. Mogomotsi *et al.* (2019) argue that the plastic levy alone is not effective in changing human behaviour as consumers continue to buy plastic bags stating the levy did not affect their consumption in any way.

Countries with plastic bag bans on importation, production, sale, and distribution that are well enforced and monitored, have reported success. Eritrea reported a reduction in loss of livestock, blocked drainage system, pollution in general and development of new markets for plastic bag alternatives, in addition to a successful shift in the use of plastic bags to alternatives (Yebiyo, 2023). Rwanda observed a long-term reduction in plastic bag consumption (D'Silva, 2019) and reduction in plastic waste in streets across the country, with Kigali purported to be the cleanest city in Africa (Turpie *et al.*, 2019). In addition, Rwanda's plastic bag regulations support initiatives that deal with recycling and the development of sustainable alternatives (Behuria, 2019).

Unfortunately, plastic bag regulations are often politicised and intersected by business power causing poor implementation or no implementations at all (Clapp & Swanston, 2009). A study conducted in East Africa Community found that the strong plastic ban implemented by Rwanda's government as part of their Economic Vision for 2020 was not intersected by business power. However, in Kenya and Uganda, where business power is well pronounced, there was obstruction in the implementation of plastic bag regulations (Behuria, 2019). Kenya, with pressure from local lobby groups and support from United Nations Environmental Programme (UNEP), successfully implemented their plastic bag regulations after four attempts. However, these regulations were unsuccessful in significantly reducing plastic pollution (Kimeu, 2023; UNEP, 2005). Uganda's internal and external influence on plastic bag regulation implementation has been delayed by well-organised business power, inconsistency in taking a firm governance stance on plastic bags, and links of politicians and regulators to plastic manufacturing companies (i.e., conflicts of interest) (Behuria, 2019).

2.3.2.2 Regulations in Namibia

In 2017, a ban on bringing plastic bags into Namibian National Parks and other nature reserves was passed in the Government Notice 85 in Government Gazette 6285 (MET, 2017). This ban only came into effect later in 2018, due to lack of implementation, monitoring and enforcement measures (The Namibian, 2018). The regulation gives exemption to some plastic bags such as – plastic bags designed for waste disposal, agriculture purposes, sampling and those that form an integral part of packaging and transparent resealable bags (MET, 2017). The success of this ban is largely unknown. The ban is also relatively poorly communicated to visitors of national parks and nature reserves, and not strictly implemented by staff members responsible for access control (if any).

In 2018, the Ministry of Environment, Forestry and Tourism (MEFT) recognised the need to improve solid waste management and developed a National Solid Waste Management

Strategy (NSWMS) (MEFT, 2018), in accordance with the Environmental Management Act No.7 of 2007 (Office of the Prime Minister, 2007). The NSWMS strongly advocates the waste management hierarchy, which gives preference to waste prevention, minimisation, reuse, and recycling, and highlights important principles, such as the circular economy. One of the five main objectives of the strategy is to "*instil a widespread culture of waste minimisation and expand recycling systems*" (MEFT, 2018:9). The strategy specifically focuses on problematic wastes, such as plastic carrier bags, with targets to *"plan a charge on plastic bags in shops"* (MEFT, 2018: 7), *"have consultations on plastic bag charges"* (MEFT, 2018:10) and *"implement plastic bag charges"* (MEFT, 2018: 15).

This objective led to the introduction of the environmental levy of N$ 0.50 on plastic for conveyance or packing of goods; stoppers, caps lids and other closure of plastics, including carrier bags or plastic shopping bags, as prescribed under the Customs and Excise Act (Act No. 20 of 1998) (Ministry of Finance, 2019). The levy aims to reduce the use of plastic bags that are impacting the environment through littering, while generated revenue will be ploughed back in waste management (Thikusho, 2019). The levy targets importers and manufactures, however it also cascades down to the consumer (Fisher Consulting, 2018). In Namibia, shops currently charge different prices for plastic carrier bags, ranging from N$0.50[1] to N$2.50, with most stores charging N$1.00 for a 24-litre plastic carrier bag. Some clothing stores and smaller shops, not belonging to larger shopping chains, continue to give plastic bags to customers for free. The effectiveness of the plastic carrier bag levy, towards reducing the consumption of plastic carrier bags in Namibia, is still largely unknown, and, thus, the focus of this research.

2.4 Plastic carrier bags and circular economy

The significance of plastic carrier bags and their environmental impact, particularly through pollution, has prompted the integration of circular economy frameworks into plastic waste management. While the definition of the circular economy is not standardized and continues to evolve, Bucknall (2020) conceptualized it as an alternative to the linear economy. In this system, resources circulate in a closed-loop without losing any material for as long as possible, simultaneously integrating economic benefits with environmental and social sustainability. Syberg (2021) emphasizes that the plastic circular economy addresses all phases of the value chain, starting from product design, production, and use to end-of-life considerations.

Despite global efforts to reduce plastic pollution and promote circular economy practices, regulations in many countries primarily focus on the production and use of plastic carrier bags

[1] N$1.00 is equivalent to R1.00 or USD0.05

(Nielsen et al., 2019). Measures such as banning non-recyclable plastic bags and restricting additives, as suggested by Hasson et al. (2007), improve recyclability and facilitate resource circulation. However, complete bans, as seen in Rwanda, replace plastic carrier bags with biodegradable alternatives, contradicting circular economy principles by allowing resources to exit the system soon after use. In contrast, the use of reusable bags aligns with the circular economy ethos, promoting the utilization of durable and long-lasting products.

Recent initiatives of the National Plastic Treaty (Ellen MacArthur Foundation, 2023) have shifted the focus to the end-of-life phase in plastic waste regulation. Extended producer responsibility (EPR) is emphasized to promote reuse, recycling, and recovery. However, this approach, successful for plastic bottles in Europe, faces challenges with plastic carrier bags, particularly in developing countries. Plastic bags often find secondary use in households as bin liners (Montoya, 2003), leading to low recycling and recovery rates due to contamination and the low monetary value for sorting and recycling (Jang et al., 2020).

Namibia serves as an illustrative case where regulations fall short in considering the entire value chain of plastic carrier bags. Factors such as printing on plastic bags, the presence of CaCO3 in some imported plastic, and the absence of suitable recycling plants render plastic carrier bag recycling impossible. Consequently, the few plastic bags that make it to cycling facilities are added to Refuse Derived Fuels (RDFs), contributing to a linear economy rather than a circular economy. Bucknall (2020) underscores that achieving a plastic circular economy requires a combination of innovative techniques, investments, and a shift in business approaches. Crucially, a major change in human behaviour toward plastic carrier bag use is highlighted as essential for the successful implementation of circular economy principles.

2.5 Consumer behaviour and plastic carrier bag usage

Many consumers continue to buy plastic carrier bags even after the implementation of policies, levies and taxes. McKechnie (1992) and Engle *et al*. (1991) defines “consumer buying behaviour” as *a decision-making process that include recognising the problem, searching for information, evaluating the alternatives, deciding to buy and post-purchasing behaviour*. These decision-making stages influence the consumer’s behaviour when purchasing plastic carrier bags.

Li and Zhao (2017) and Mogomotsi *et al.* (2019), who studied consumers’ perceptions on plastic bag levies pointed out the following reasons for the continuous buying of plastic bags:

- Plastic bags are regarded as being cheap and readily available;

- Using plastic bags is habitual (i.e., is what they are used to);
- Unavailability of convenient alternatives; and
- Plastic bags are reused for storage, as bin-liners and/or freezer bags at home.

A study by Zen *et al.* (2013) emphasised that the reuse of plastic bags by households is a positive behaviour that could be improved by awareness campaigns urging customers to bring their own reusable bags. In addition, the study revealed that most consumers forget to bring reusable bags, a behaviour that can be linked to consciousness to avoid plastic bag consumption.

Understanding factors influencing behaviour is crucial in designing an effective behavioural intervention geared toward achieving the target of the implemented plastic carrier bag levy in both long and short-term. Consumer behaviour directly impacts compliance, the actual environmental impact, unintended consequences, and economic implications of such policies. By considering consumer motivations and habits, policymakers can design more targeted and successful regulations that achieve their environmental and societal objectives while minimising negative consequences.

2.5.1 Factors influencing consumer behaviour and plastic carrier bag use.

Consumers' plastic bag buying behaviours is influenced by multiple aspects, such as personal, social, cultural and psychological factors (Santos *et al.*, 2013). Plastic bag cost, availability, convenience, and secondary use are some of the other factors influencing plastic bag usage behaviour (GAIA, 2020; Mogomotsi *et al.*, 2019:23). Chitotombe (2014) adds that alternatives are many times regarded as being expensive and that levy regulations are regarded as a shifting of plastic pollution responsibility from manufacturers to the consumer. Misinterpretation of the intent of these regulations may also cause problems with implementation. For example, the misinterpretation of the levy intention in Malaysia, where a plastic bag levy is only charged on Saturdays, caused consumers to change their shopping dates (avoiding shopping on Saturdays) rather than changing their plastic bag usage behaviour (Zen *et al.*, 2013).

Consumers also use plastic carrier bags as garbage bags to dispose of their household waste, therefore buying more plastic carrier bags instead of avoiding their purchase (Arı & Yılmaz, 2017). Habits and shopping practices influence bringing own shopping bags as people forget their shopping bags (Aruta, 2021; Chang & Chou, 2018). Rivers *et al.* (2017) argue that consumers embrace the convenience of plastic bags and indicated that consumers do not think of the environmental problems associated with plastic waste at the time of purchase.

Cashiers asking if the customer needs a plastic bag creates awareness and makes the consumer rethink their choice causing a decrease in the purchasing of plastic bags (Asmuni *et al.*, 2015; Ohtomo & Ohnuma, 2014; Shihepo, 2020). Others argue that cashiers asking if a customer needs a plastic bag may increase the use of plastic bags, because a customer may feel too embarrassed to refuse a bag (Lam & Chen, 2006)

The next sections explore the factors influencing consumer behaviour and plastic carrier bag usage in more detail.

2.5.1.1 Environmental motivation

An increase in environmental knowledge generally results in a better attitude towards the environment (Asih *et al.*, 2020). In research conducted by Aruta (2021) and Geetha (2022), respondents who distinguished/realised the environmental benefits associated with reducing plastics were more willing to reduce their plastic bag use. Research conducted in Ireland also indicated that consumers, who regarded plastic bag charges as a benefit towards reducing plastic bag litter in the environment, were more motivated to reduce their plastic bag purchasing behaviour (Poortinga *et al.*, 2013). Furthermore, Li and Zhao (2017) indicated that people living close to areas that were are polluted by plastics, or were attached to areas polluted by plastics in some way, are more likely to be motivated to keep the environment clean and avoid the purchasing of plastic bags.

2.5.1.2 Group conformity/peer pressure

The observation of sustainable environmental behaviour by humans in their surrounding has social influence causing imitation by others. For instance, the influence of neighbours' recycling behaviour on one another were observed to have a positive effect on kerbside recycling (Nigbur *et al.*, 2010). In plastic bag-related studies, people who observed others reducing their use of plastic bags were motivated to reduce their own plastic bag use because of reciprocity (Aruta, 2021). Similarly, heads of households and volunteers/leaders of social organisations, who have shown to lead by example, have positively influenced the plastic bag behaviour of their peers (Zambrano-Monserrate & Ruano, 2020; Zen *et al.*, 2013). Arı and Yılmaz (2017) have found that social pressure had a significant effect on their respondents' willingness to use cloth bags as alternatives to plastic carrier bags.

2.5.1.3 Governance initiatives

Governments have high policy power, which allows for the introduction, implementation and enforcement of set regulations throughout the plastic bags supply chain (Wagner, 2017).

Government initiatives can influence consumers' intended pro-environmental behaviour because it is mandatory and citizens must obey these requirements (Geetha, 2022; Muralidharan & Sheehan, 2016). As mentioned earlier, the passing of the on *East Africa Community (EAC) Polythene Materials Control Bill* by the East Africa Legislative Assembly, pressure from the EAC and persistence from Rwanda's government to take action, led to discussions of plastic pollution in the region (Behuria, 2019). However, inconsistent nonaligned of plastic bag regulations between neighbouring countries, together with lack of alternatives in countries with implemented regulations, has led to plastic bags smuggling in Rwanda (D'Silva, 2019). Global initiatives, including the recent United Nations plastic treaty, ensure better government responses to plastic pollution and may improve consumer compliance. The treaty, a binding document, requires countries to report progress in plastic waste management, aligning with global efforts to end pollution across the entire lifecycle. Additionally, it enhances international collaborations for technology access, capacity building, and scientific cooperation (UNEP, 2022a).

Legislation creates a nationally uniform approach to reducing plastic bag use, through mandatory requirements, which can lead to behavioural change. A study by Muralidharan and Sheehan (2016) on the USA plastic bag ordinance showed that people were bringing reusable bags to avoid the tax, but not when the tax was framed as a "fee". Tax is seen as a mandatory and lawful obligation, therefore, consumers felt forced to comply, whilst consumers did not share the same sentiment when it was being framed as a fee. The intention behind legislation need to be well communicated to increase buy-in from customers, and legislation must be enforced and monitored for effectiveness (Convery *et al.*, 2007).

2.5.1.3.1 Plastic carrier bags fiscal approaches

Environmental fiscal approaches play a pivotal role in promoting sustainable practices by leveraging economic tools to incentivize responsible behaviour and reduce the usage of plastic carrier bags. However, these approaches come with inherent strengths and weaknesses. On one hand, economic measures generate revenue that can be directed towards addressing environmental challenges, as highlighted by MEFT (2018). Unfortunately, this revenue is often collected alongside general government funds and diverted to unrelated expenditures, as seen in the case of the South Africa plastic bag levy.

Taxes and charges imposed on environmentally harmful goods have been shown to induce behavioural changes, encouraging the adoption of eco-friendly alternatives while also triggering a spillover effect (Poortinga *et al.*, 2013; Thomas *et al.*, 2016). Conversely, Hasson

et al. (2007), suggests that such measures may only lead to short-term behavioural shifts with subsequent bounce-back effects.

Moreover, determining the appropriate tax or levy rates presents a challenge, as setting rates too high can result in unintended consequences such as black-market activities (Dsilva, 2019) or businesses exploiting environmental charges due to regulatory loopholes (Madigele & Mogomotsi, 2017). The complexities in implementing market-based instruments and the lack of effective communication have contributed to resistance from businesses, which view these measures as additional operational burdens (Behuria, 2019).

Furthermore, while environmental charges may encourage the adoption of alternative solutions, there's a risk that consumers may switch to other single-use options not covered by the levy, like paper bags, thereby undermining the intended environmental benefits (Convery *et al*., 2007).

Addressing these fiscal challenges, as emphasized by UNEP (2018, 2020), requires implementing social safeguards such as targeted subsidies or rebates to mitigate the regressive impact of environmental taxes. Additionally, regularly monitoring the effectiveness of environmental fiscal measures and adjusting tax rates in response to changing economic conditions or technological advancements can enhance the efficiency of these approaches. Finally, collaboration with international partners is essential to tackle challenges related to globalization and leakage.

2.5.1.3.2 Levies and taxes

Levies and taxes are market-based instruments that internalise the external cost of pollution. The purpose is to influence consumer's decision to buy a plastic bag, or to drive appropriate behavioural change to avoid plastic bags use, through a charge (Muralidharan & Sheehan, 2016; Poortinga *et al*., 2013). However, in the African context, the relatively low levy cost and lack of awareness of customers have diminished the purpose of the levy (Hasson *et al*., 2007; Mogomotsi *et al*., 2019; Rivers *et al*., 2017). Li and Zhao (2017) emphasise that consideration should be given to economic conditions that might affect access to alternative packaging materials.

2.6 Understanding consumer behaviour and plastic carrier bag usage

Consumer behaviour in relation to plastic carrier bag usage has been explored from diverse angles and with varying theoretical approaches in different studies. Poortinga *et al.* (2013) and Thomas *et al.* (2019) focused primarily on attitudes, while Hasson *et al.* (2007) employed

economic theory to comprehend consumer choices. Given the complexity of this issue, which combines consumer behaviour with environmental concerns, necessitates a multi-faceted approach. Consequently, various theories and frameworks have been developed to offer a more holistic understanding of consumer behaviour in relation to environmental issues.

2.6.1 Frameworks towards understanding human/consumer behaviour.

Frameworks for understanding human and consumer behaviour provide structured approaches to analyse, explain, and predict why people act the way they do in various contexts. These frameworks draw from multiple disciplines, including psychology, sociology, economics, and marketing. The sections below provide a brief introduction to some of the key frameworks used in understanding consumer behaviour related to the use of plastics.

2.6.1.1 Theory of Pro-Environmental Behaviour

The Theory of Pro-Environmental Behaviour (PEB) explains eco-friendly actions. It involves personal factors like attitudes and values, cognitive aspects such as knowledge, emotions like concern, social influences, behavioural factors like self-efficacy, and external factors. These influence intentions, which, in turn, predict pro-environmental behaviour, including recycling, conserving energy, and sustainable choices. PEB helps understand and promote environmentally friendly actions (Kurisu, 2015:47; Larson *et al.*, 2015).

Limitations of the Theory of Pro-Environmental Behaviour (PEB) include its simplification of complex behaviours, measurement challenges, limited focus on factors, and the inability to consistently predict actual behaviour. It also overlooks cultural differences, habit formation, and the need for structural change in promoting environmental sustainability (Larson *et al.*, 2015; Udall *et al.*, 2021).

2.6.1.2 Model of Environmentally Responsible Behaviour (ERB)

The Model of Environmentally Responsible Behaviour (ERB) posits that responsible environmental behaviour is a complex issue involving the interaction of multiple variables. The intention to act is shaped by personality factors such as attitudes, locus of control, and a sense of personal responsibility, as well as environmental knowledge (encompassing action skills, knowledge of action strategies, and awareness of environmental issues). However, situational factors such as economic constraints, social pressures, and the availability of different action choices can either positively or negatively influence behaviour. Given that the model is developed from meta-analysis, the model could not provide measured interaction amongst the identified variables and their interconnection (Akintunde, 2017; Hines *et al.*, 1987).

2.6.1.3 Theory of Reasoned Action (TRA)

The Theory of Reasoned Action (TRA) offers valuable insights into human behaviour by emphasising the role of attitudes and subjective norms in predicting behavioural intentions. It provides a structured approach that allows for the development of targeted interventions and persuasive strategies across various domains such as public health, marketing, and education (Fisher *et al.*, 1995). However, TRA has limitations as it assumes individuals are entirely rational decision-makers and focuses primarily on predicting intentions rather than actual behaviour (Hale *et al.*, 2002). This gap between intention and action can limit its accuracy in some cases.

To address these limitations, the Theory of Planned Behaviour (TPB) extends TRA by including perceived behavioural control, accounting for additional factors that influence behaviour beyond attitudes and norms, thus providing a more comprehensive understanding of human behaviour (Ajzen, 1991; Madden *et al.*, 1992).

2.6.1.4 Theory of Planned Behaviour (TPB)

The Theory of Planned Behaviour (TPB), designed to understand and predict human behaviour (Ajzen, 1991), has been extensively used in waste management and waste behaviour context. Researchers have used the TPB to systematically identify factors that influence pro-environmental behaviour (Hossain *et al.*, 2020), kerb-side recycling programmes (Nigbur *et al.*, 2010), waste management behaviour (Harper *et al.*, 2022; Roos *et al.*, 2021), intentions and attitudes to reduce and use plastic bags (Arı & Yılmaz, 2017; Aruta, 2021; Lam & Chen, 2006), and the effect of taxes and levies on plastic bag usage (Muralidharan & Sheehan, 2016).

This research employed TPB because of its comprehensive approach to behaviour analysis, which goes beyond single constructs like attitude. Environmental issues are complex and demand a multidirectional understanding. TPB provides valuable insights into how societal norms, external and internal factors, and psychological emotions collectively influence behaviour execution (Ajzen, 2011). These three primary constructs enable the exploration of related variables to improve our understanding of behaviour on plastic carrier bags purchase and use.

2.7 Applying the Theory of Planned Behaviour (TPB) in understanding plastic carrier bag behaviour

TPB is designed to predict psychosocial determinants and explain human behaviour and behavioural choices. According to Ajzen (1991), human behaviour are primarily defined by intention, which is a motivational factor to perform a behaviour. TPB is designed to predict social human behaviour depending on the intention (motivation factor) to perform a behaviour, which is influenced by: attitude (positive or negative evaluation of own psychological emotions), subjective norms (social pressure from significant people) and perceived behavioural control (resource availability to perform a behaviour) (Ajzen, 1991).

Although TPB is widely used in understanding and predicting human behaviour, it has some limitations. One key limitation is that it may not adequately account for external factors that can influence behaviour, such as environmental constraints or societal norms. Additionally, TPB assumes that individuals are rational decision-makers who systematically evaluate the advantages and disadvantages of their actions, which might not hold true, especially when emotions and impulsivity are significant influencers (Ajzen, 2011; Madden *et al.*, 1992).

Research performed in the 2000s has amended and extended TPB to include social norms and actual/observed behaviour (Nigbur *et al.*, 2010), demographic factors (age, gender, etc.) (Aruta, 2021), convenience and environmental concerns (Sun *et al.*, 2017) to explore waste-related behaviour. Government initiatives and group conformity were also used to understand consumer avoidance of plastic bags (Geetha, 2022). Research on the bag-use model, which is a hybrid between responsible behaviour model and extended TPB, found that situational variables had a significant effect on the actual behaviour of bringing own shopping bag (Lam & Chen, 2006). Figure 2-1 shows a diagrammatic representation of TPB components included in this research.

The elements of the TPB framework are unpacked and discussed in the sub-sections below.

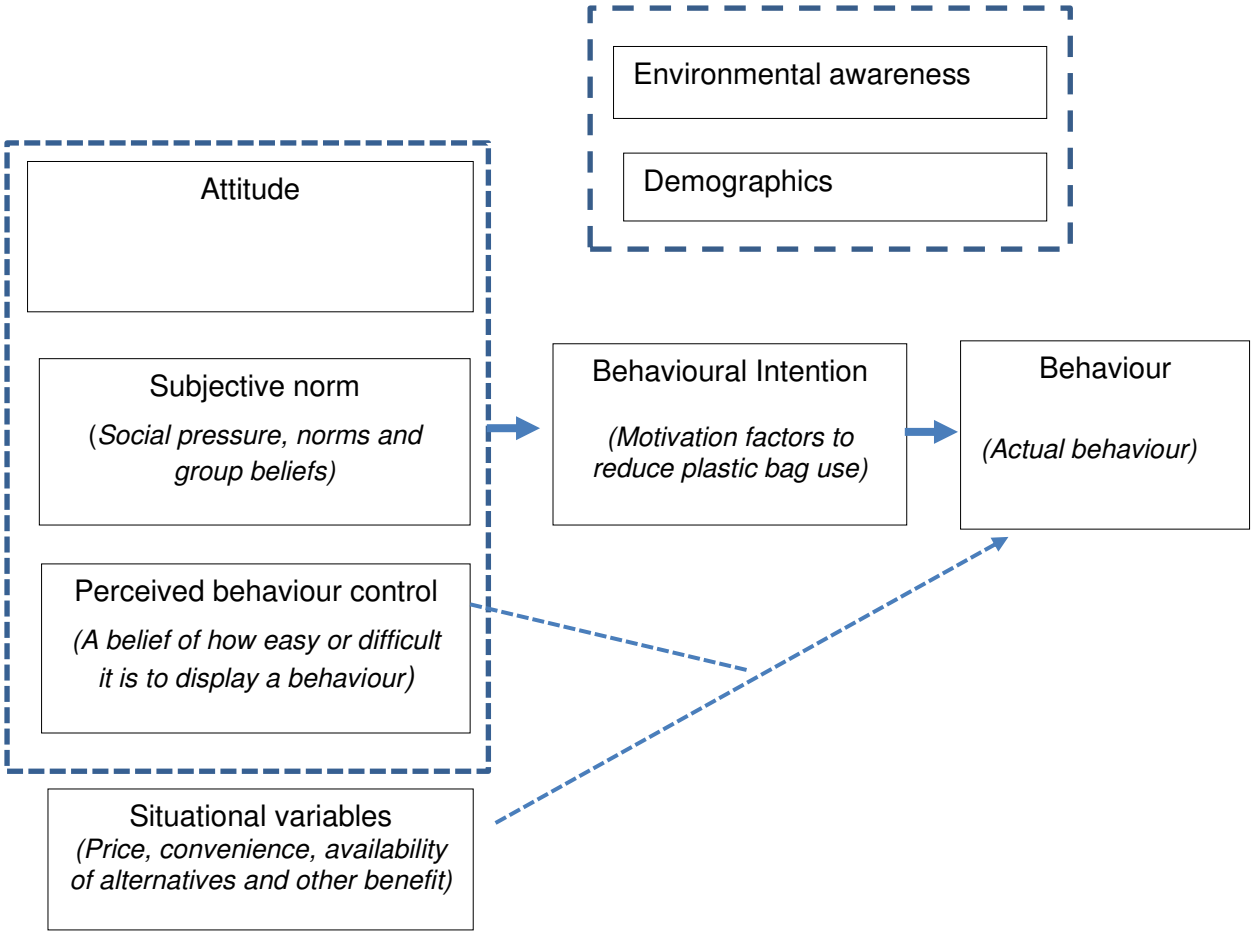

Figure 2-1: Theory of Planned Behaviour framework for this research (adapted from: Ajzen, 1991; Lam & Chen, 2006; Sun *et al.*, 2017; Van *et al.*, 2021)

2.7.1 Attitude

Attitude is a behavioural belief of a person's evaluation of the degree of positive and negative magnitudes of performing a particular behaviour (Ajzen, 1991). According to research by Aruta (2021), attitude is a weak predictor of intention to reduce plastic use in interdependent cultures, but stronger in independent cultures due to difference in personal preference expression. Again, attitude was a weak predictor of behaviour towards the use of reusable bags during plastic bag bans in research by Isbanner (2021), and Ohtomo and Ohnuma (2014). However other studies observed attitude to strongly predict recycling behaviour (Nigbur *et al.*, 2010) and reduction in plastic bag use (Arı & Yılmaz, 2017).

2.7.2 Social norms

A social norm is a normative belief of what society deems right or wrong for an individual to perform a behaviour (Ajzen, 1991). Social norms can either be an injunctive norm (perception of what other people agree or disagree with a certain behaviour) or a descriptive norm (the performance of a certain behaviour by people important to an individual). Consumers' perceptions of plastic bag social norms is a strong predictor of plastic bag avoidance behaviour (Borg *et al.*, 2020). For instance, if the norm is to use plastic bags, most consumers will opt for plastic bags. Conversely, if the norm promotes the use of alternatives, most consumers will choose those alternatives. Individuals influenced by social pressure are likely to express the intention to reduce their use of plastic bags. (Arı & Yılmaz, 2017; Aruta, 2021).

2.7.3 Perceived behavioural control (PBC)

Perceived behavioural control (PBC) is a person's belief in their ability to perform a specific behaviour successfully. A higher level of perceived behavioural control generally corresponds to a greater likelihood of engaging in the behaviour, while lower perceived control may hinder or discourage the action (Ajzen, 1991, 2012). PBC is influenced by the internal factors such as awareness and motivation or external factors such as availability of resources, environmental constrains, societal support and availability of alternatives. Furthermore, actual behaviour can be determined directly from perceived controlled behaviour even if the behavioural intention is positive (Nigbur *et al.*, 2010). If a person feels they are unable to perform a certain task (i.e., not able to stop using plastic bags because no alternatives are available), poor control over their circumstances may overrule the positive intention to act.

2.7.4 Situational variables

Situational factors are external conditions or circumstances that can influence an individual's behaviour, decisions, or actions in a particular situation. These factors can include economic constraints, social pressure and availability of options that can weaken or strengthen the ability and desire to perform a behaviour (Hines *et al.*, 1987). Situational variables are conditions related to the inconvenience and embarrassment arising from the goods a customer buys (Lam & Chen, 2006). For example, a customer that came with only two reusable bags for shopping and bought more goods than the bag can accommodate may buy plastic bags to avoid embarrassment of carrying loose items. A study by Lam and Chen, (2006) showed that situational variables can make attitude, environmental concern and perceived control behaviour weak to predict the actual behaviour. Situational variables may also include the availability or unavailability of alternatives, price and convenience.

2.7.4.1 Convenience

Convenience can be understood as the ease or accessibility of performing a behaviour relative to the effort required. Convenience, in the context of this research, refers to ease, practicality, availability, price and benefits plastic carrier bags offer to consumers to carrying and transporting purchased items (Sun *et al.*, 2017). Plastic bags are lightweight, durable, relatively inexpensive, and readily available, making them simple and practical for shoppers to carry their goods. A study by Madigele *et al. (*2017) found that consumers with high education, and a high level of environmental awareness are willing to pay for plastic bags to avoid the inconvenience of carrying reusable bags around. Lack of strong/durable alternatives led to the doubling of plastic bags to carry goods that would otherwise fit in just one plastic (Wang & Li, 2021).

2.7.4.2 Pricing and access to alternatives

Price influences decisions through its impact on affordability, while access to alternatives provides individuals with choices that can align with their preferences and needs, therefore having a direct impact on human behaviour. The intent behind charging a levy for plastic carrier bags is that a charge on plastic bags would deter consumers from buying plastic bags (Convery *et al.*, 2007). Because the cost of plastic carrier bags is relatively low (especially when compared to alternatives), consumers are willing to bear the cost and continue purchasing plastic carrier bags. Research has shown that high prices cause high decrease in plastic bag use and significant increase in the use of uncharged plastics bags (Madigele & Mogomotsi, 2017; Wang & Li, 2021).

2.7.5 Environmental awareness

Environmental awareness and pro-environmental behaviour are used interchangeably in the literature, although slightly different in meaning. Environmental awareness refers to a person's understanding of environmental issues, while pro-environmental behaviour are actions taken by an individuals to protect and preserve the environment based on awareness (Santos *et al.*, 2013). Environmental awareness of consumers may improve by providing evidence on the impacts of plastic bags on the environment, which can influence regulatory compliance or positive environmental behaviour (Li & Zhao, 2017). However, provision of information alone is insufficient to cause change in behaviour, although it is important in shaping attitude. Behaviour is influenced by the type of information the consumer receives through public awareness campaigns or personal experience (Li & Zhao, 2017). Muralidharan and Sheehan (2016) found that environmental concerns about plastic bag litter are a strong predictor of

attitude, social norms and perceived behavioural control regarding plastic bag regulation. For example, people living closer to the beach or those who have seen the impact of plastic bags on the ocean are more likely to have positive attitudes toward plastic regulations (Kish, 2018; Wagner, 2017).

2.7.6 Demographics

Demographics provide crucial information about study populations to understand the composition and make meaningful comparisons and generalisation. Demographics allows for exploration of the relationships and interaction between groups to identify patterns, trends and disparities that may affect analysis. It also provides comprehensive information on socioeconomics that influence behaviour, policy development and evaluation (Arı & Yılmaz, 2017; Aruta, 2021; Borg *et al.*, 2020; Lam & Chen, 2006; Zambrano-Monserrate & Ruano, 2020).

2.7.6.1 Gender

Societal norms and expectations often dictate how individuals should behave based on their gender, leading to the formation of distinct gender roles. These roles are reinforced through socialisation, starting from a young age, and can impact career choices, communication styles, consumer behaviour, and even health-related decisions. Gender also intersects with other factors like culture, race, and socioeconomic status, adding complexity to the relationship between gender and environmental behaviour (Vicente-Molina *et al.*, 2018).

Gender was found to be a significant control variable affecting behavioural intention towards reducing the use of plastic carrier bags (Sun *et al.*, 2017). Research has also indicated that males are more likely to use plastic bags than females as they do not carry reusable bags, while females generally have high intention to reduce plastic bags use with or without influence of others (Borg *et al.*, 2020; He,2012; Zambrano-Monserrate & Ruano, 2020). While men's motivation to reduce the use of plastic carrier bags is usually low, it increases when the behaviour is normative or when they observe important people performing a behaviour (Aruta, 2021).

2.7.6.2 Age

Age significantly impacts behaviour, from developmental stages to cognitive abilities, socialisation, consumer choices and generational differences. A study by Li and Wang (2021) found that age has a significant positive effect on plastic bag usage behaviour. Older people are generally more environmentally conscious and reportedly reuse their plastic carrier bags

more often. Research also indicates that older people are generally more price sensitive and would be more inclined to reduce plastic carrier bag usage if a levy is imposed (Wang & Li, 2021). Older people feel social pressure more keenly as compared to young adults, therefore, they are more likely to display behaviour that is deemed positive by society and support regulation (Arı & Yılmaz, 2017). Older people use reusable bags and old plastic bags more frequently than younger people, and also use less plastic bags compared to younger consumers (Borg *et al.*, 2020; Wang & Li, 2021).

2.7.6.3 Level of education

According to Hines *et al.* (1987) education is important for the development of environmentally responsible and active citizens as it impacts behaviour through knowledge and awareness, fostering critical thinking, enhancing communication and influencing information uptake. Most studies found a positive increase in environmental awareness with an increase in the level of education (Arı & Yılmaz, 2017; Li & Zhao, 2017; Madigele *et al.*, 2017).

2.7.6.4 Household size

Household size exerts a multifaceted influence on behaviour. It shapes consumption patterns, impacting the types and quantities of goods and services acquired, which in turn influence spending behaviour(Karaaslan *et al.*, 2022). Additionally, household size can influence social dynamics and interpersonal behaviour, affecting communication and responsibilities. Research have shown that plastic bag use increases with increase in family size in urban areas and decrease with household size in rural area (Zambrano-Monserrate & Ruano, 2020; Ogwueleka, 2013).

2.7.6.5 Income

Linked to education, income shapes consumer behaviour by determining purchasing power and spending habits, while highlighting the role of socioeconomic factors in shaping individual choices and broader societal trends (Márquez *et al.*, 2008). People with low income put in more effort to reduce plastic bag use compared to those with high income especially in areas where plastic bag levies have been charged (Arı & Yılmaz, 2017; Lam & Chen, 2006; Zambrano-Monserrate & Ruano, 2020).

2.8 Self-reported versus observed behaviour

The majority of the studies on consumer behaviour regarding plastic bags and other environmental related behaviour assess self-reported behaviour (Madigele *et al.*, 2017;

Muralidharan & Sheehan, 2016; Sun *et al.*, 2017; Thomas *et al.*, 2016). However, it has been found that self-reported behaviour is affected by beliefs, attitude and perception linked to preferred behaviour instead of what is actually practiced (Chao & Lam, 2011; Huffman *et al.*, 2014; Lam & Chen, 2006). Although the two behaviours are correlated, Huffman *et al.* (2014) concluded that correlation could only explain 8% of the variation. Additionally, social pressure causes people to report favourable behaviour, whilst they do not in actual fact practice this behaviour. Chao and Lam (2011) found an overestimate of responsible environmental behaviour, cautioning on interpretation made solely from self-reported behaviour. Most studies investigated plastic bag consumption through self-reported behaviour and observed behaviour in retail stores (Zen *et al.*, 2013) and there is limited information on the amount of plastic bags disposed of by consumers at home. Self-reported behaviour gives a subjective interpretation of reality. It is, therefore, advised that self-reported behaviour should be supplemented by observations of actual behaviour, where possible, to provide a more objective view of reality.

2.9 Chapter summary

Regulating plastic production, use and disposal has been upheld as an effective means to reduce plastic waste. The introduction of plastic bag levies has failed to reduce plastic bag consumption and plastic pollution remains a global concern. Researchers are exploring the psychological processes involved to understand consumer behaviour regarding plastic bags, which is clearly a complex issue. In this chapter, the impacts of the levy on consumers have been discussed to characterise the different behaviour. The Theory of Planned Behaviour and its different variables are discussed in the context of plastic bag use behaviour. The application of TPB by others is mostly on self-reported behaviour and observation behaviour from supermarkets, with limited research on both self-reported and observed behaviour at household level. TPB will guide the research methods and questionnaire design for this research.

Chapter 3 presents the methodology followed, based on the TPB and lessons learned from the literature reviewed.

CHAPTER 3. METHODOLOGY

3.1 Introduction

This chapter describes the research methodology employed for evaluating consumer behaviour regarding plastic carrier bags in Namibia, using Walvis Bay as a case study area. The chapter outlines the research design approach, criteria applied in the selection of the case study site and suburbs within the case study area, as well as methods for data collection and analysis aligned with the research objectives. Lastly, the chapter provides an overview of ethical considerations and outlines methodological assumptions and limitations.

3.2 Research design

Creswell (2014:15) defines research design as *procedures on inquiry within the research approach that gives directionality to the research study*. Research design has three main approaches: (a) qualitative approach (narrative and phenomenological research), (b) quantitative approach (experiment research and survey research) and (c) mixed-method approach (a combination of qualitative and quantitative). The qualitative research approach views the reality of the world as ever-changing multiple constructs and interpretations over time that cannot be deduced from variables but rather as interpretation (interpretivism paradigm) therefore subjective (Marshall, 1996). In contrast, the quantitative research approach views the reality of the world as a measurable phenomenon with data being analysed statistically (positivism paradigm) and therefore objective (Sharan, 2002). Mixed method approaches neutralises the weakness and bias of an individual approach, while providing a comprehensive analysis of the research problem (Creswell, 2014:43).

The research followed an exploratory mixed methods approach with convergent parallel collection of qualitative and quantitative data. A qualitative approach through survey questionnaires with close and open-ended questions was employed to gain an understanding of consumer behaviour related to plastic bags. The quantitative component of the research was through observations and quantification of plastic bag composition in household waste. The survey was centred around the Theory of Planned Behaviour (TPB) through self-reported behaviour of mainly psychosocial factor questions. However, there are often discrepancies between self- reported and actual practiced behaviour (Chao & Lam, 2011; Huffman *et al.*, 2014; Lam & Chen, 2006). Therefore, surveys were supported by observational data.

Table 3-1 provides an outline of the data collection methods employed as these relate to the three research objectives (defined in Section 1.3 of this dissertation).

Table 3-1: Research design

Research objective	Data collection	Justification
RO1: Assess consumers' awareness and perceptions about the Namibian plastic bag levy.	A **household survey** was conducted through use of a structured survey questionnaire based on the TPB.	Questionnaire-based surveys are effective in collecting adequate information on attitude, behaviour demographics and opinions for empirical research (Lu, 2021). TPB is a theoretical framework for factors that influence a wide range of individual behaviour (Ajzen, 2011).
RO2: Assess the factors that influence consumers' behaviour related to plastic carrier bag use through the TPB.		
RO3: Determine the proportions of plastic carrier bags in household plastic waste to supplement self-reported behaviour (in RO2).	**Observations:** Quantification and characterisation of plastic bags in household waste.	Due to reported discrepancies between self-reported behaviour and actual behaviour, surveys were supplemented by observations (quantification and characterisation) of plastic waste present in household waste (Chao & Lam, 2011; Huffman *et al.*, 2014; Lam & Chen, 2006).

3.3 Case study

To evaluate consumer behaviour related to plastic carrier bags in Namibia, Walvis Bay was selected as a case study area. Section 3.3.1 provides the justification for selection of the case study area, while Section 3.3.2 gives a description of the case study area, and Section 3.3.3 discusses the areas of Walvis Bay included in the research.

3.3.1 Justification for selection of the case study area

According to Creswell (2014:42), a case study provides for an intensive study of a situation or site bounded by time and activity to obtain detailed information through varying data collection procedures. Plastic waste management is a cross cutting problem within environmental, social and governance contexts, which would benefit through intensive research at a case study level. Walvis Bay was chosen as a case study area to evaluate consumer behaviour related to plastic carrier bags in Namibia.

Walvis Bay was chosen as a case study area based on the following reasons:

(a) Plastic waste pollution is a known problem in Walvis Bay, with plastic waste being blown into the environment by prevailing coastal winds (Leuschner, 2019). This problem may also cause serious adverse problems to the marine environment. According to Xanthos and Walker (2017), the accumulation of marine debris could be related to incorrect waste disposal on land.

(b) The town is near Ramsar site, wetlands and protected areas such as the Dorob National Park and Namib Naukluft National Park. Understanding and managing pollution from plastic carrier bags in such areas is of conservation and aesthetic importance.

(c) Walvis Bay has high tourism and recreational activity, which is Namibia's third most important sector. Walvis Bay is a harbour town where tourists are docked into Namibia, providing a gateway to numerous tourist destinations including the Namib Sand Sea World Heritage Site.

(d) Walvis Bay is amongst the first towns in Namibia to implement plastic bag charges before the national plastic bag levy was enforced.

(e) The Municipality of Walvis Bay has expressed interest in plastic bag regulations at local and national level.

(f) Lastly, from a convenience perspective, Walvis Bay is in relatively close proximity to the research institute where the researcher is based.

3.3.2 Description of the case study area

Walvis Bay is a central coastal harbour town in the Erongo region of Namibia and covers 1124 km^2, including 60 km of coast line (MEFT, 2008). The town has rural and urban jurisdictions, but this study focused on the urban jurisdiction under the authority of the Municipality of Walvis Bay. Walvis Bay is located between the Atlantic Ocean on the west and Namib Desert on the east. The town's climate is influenced by the Benguela Current causing 80% humidity, a minimum of 20 mm of rain per year, an average temperature of 22˚C and an average wind speed of 4.5 to 8 kilometre per hour (Walvis Bay municipality, s.a.). Improperly disposed plastic bags may, therefore, travel long distances into the ocean and national parks.

Walvis Bay has a population of 35 828 people (NSA, 2011) and 14 535 households. The town is divided into seven residential categories also known as suburbs or townships[2]. For this study, the term *suburb* refers to a neighborhood of detached residential formal houses within a certain income bracket. Walvis Bay's seven suburbs are: Kuisebmond and Narraville (low- to middle income), Walvis Bay central (also referred to as Hermes) (middle- to high income), and Meersig, Dolphin Beach and Langstrand (high-income).

3.3.3 Selection of areas within Walvis Bay

According to Márquez *et al*. (2008), socio-economic status is a significant factor that correlates with behavioural characteristics and consumption patterns. Hasson *et al.* (2007) suggest that studies on plastic carrier bags should cover diverse income groups to make provision for income level as a socio-demographic variable that may influence the consumption of plastic carrier bags. This is especially important when researching the effectiveness of fiscal instruments, such as levies and taxes (i.e., plastic bag levy). Walvis Bay provided an area with well-defined suburbs based on property price and expected level of income. To ensure a representative sample, four of the seven suburbs, namely Kuisebmond, Narraville (low- to middle income), Hermes (middle- to high income) and Meersig (high income), were chosen for the study (see Figure 3-1). These four suburbs have the highest number of households out of the seven suburbs of Walvis Bay (see Table 3-2).

It is worth noting that while Narraville and Kuisebmond are both classified as low to middle-income areas according to the Walvis Bay Municipality's 2014 data, there are notable distinctions between them. Narraville exhibits fewer backyard shacks, and its streets and residential plots tend to be more spacious compared to Kuisebmond. Additionally, in Kuisebmond, nearly every house sampled featured backyard shacks, and the family income range typically fell between N$1000 and N$6000 (Staff report, 2017; Walvis Bay Municipality, 2014). Therefore, for the purposes of this study, Kuisebmond was categorised as a low-income area, while Narraville was categorised as low to middle-income, reflecting the nuanced differences in their socio-economic characteristics.

[2] Statistics provided by the Municipality of Walvis Bay

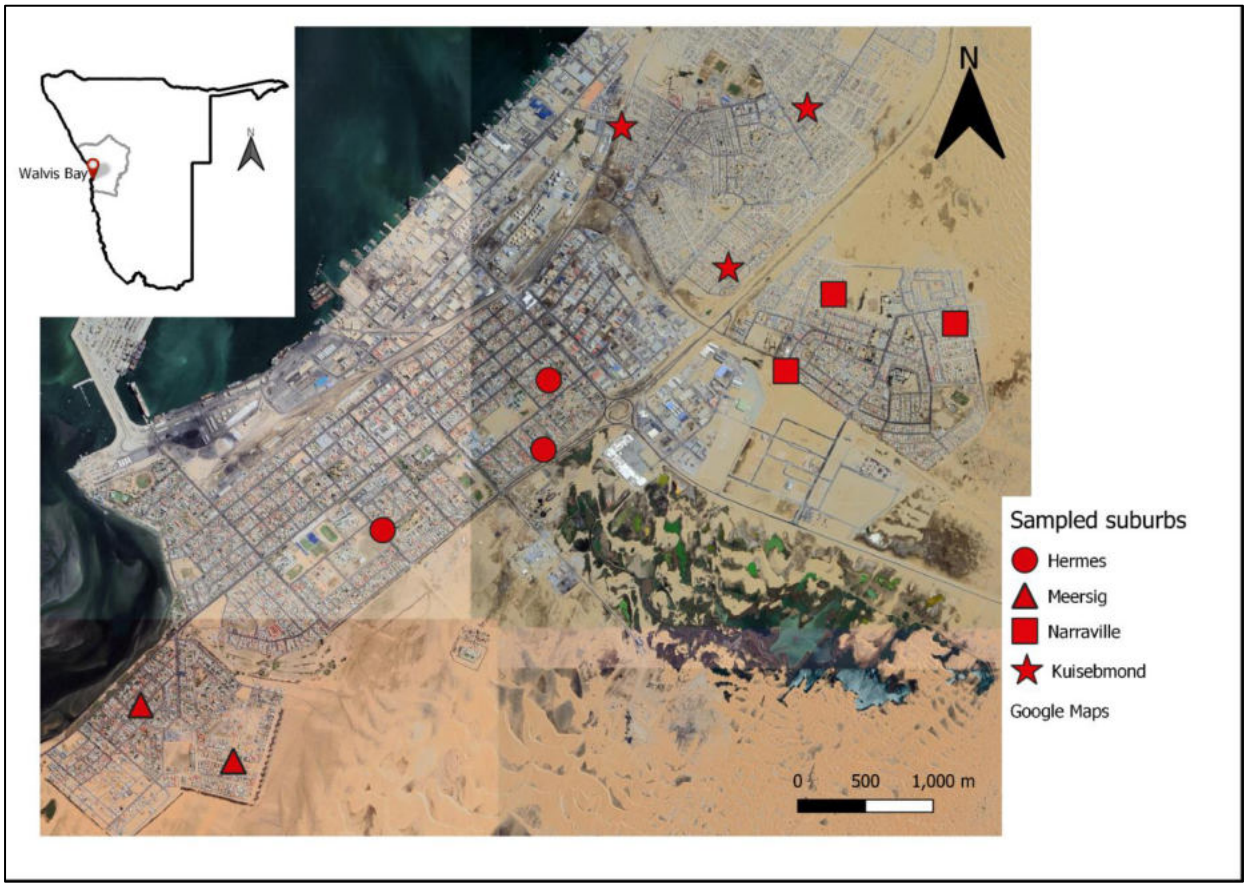

Figure 3-1: Map of Walvis Bay displaying the suburbs of Walvis Bay included in the research.

3.4 Data collection

The data for this study were collected between February and March 2023 over a period of six weeks, by convenient sampling method. Survey questionnaires were administered in one week, while plastic waste observations and sampling were done in four consecutive weeks. The data collected by means of observations (i.e., characterisation and quantification of plastic bags in household waste) followed the municipality waste collection schedule. Consideration of the starting point for the scheduled daily waste removal was a priority as this allowed for waste to be collected and sampled on the day of collection (Anders, 2008).

The following subsections explains the data collection by means of household surveys (Section 3.4.1 and sub-sections) and plastic waste observations (Section 3.4.2 and sub-sections).

3.4.1 Household surveys

Surveys conducted at household level are an important tool to measure characteristics of human population and behaviour that are essential for economic and social policy decisions (Grosh and Glewwe, 2000). Demographic information provided at household level is more accurate than using census data. Furthermore, household surveys are good for representativeness that can be extrapolated to population level. It provides for direct evaluation of practices and behaviour, while measuring variables in their normal state (Clark & Steel, 2007). Household surveys also provide sufficient information for the statistical interpretation of the meaning and significance of different variables.

For the purposes of this research, a structured survey questionnaire with closed and open-ended questions, focusing on consumer behaviour related to the consumption of plastic carrier bags, was used to collect data.

3.4.1.1 Developing the survey questionnaire

Due to the absence of similar studies in Namibia, the questions and statements included in the survey questionnaire were based on international peer-reviewed publications focusing on plastic and/or plastic bag and/or waste management behaviour by Arı and Yılmaz (2017); Chao and Lam (2011); Lam and Chen (2006); Poortinga *et al.* (2013); Sun *et al.* (2017) and Van *et al.* (2021). Theory of Planned Behaviour (TPB) formed the basis for the questions included in the questionnaire, considering variables such as: Attitude (A), environmental awareness (EA) regarding plastic bags, situational variables/factors (SF), convenience (C), perceived behaviour control (PBC), intention to buy plastic bags (I) and actual behaviours (B). The survey questionnaire was drafted in English and is appended as **Annexure A**.

Section A of the survey questionnaire collected basic socio-demographic information, such as gender, age, total number of people in the household, and highest qualifications of the head of the household. Section B collected information about the purchase and use of plastic carrier bags. Finally, Section C provided statements of plastic carrier bag consumption based on the TPB. Responses to the questions were measured by means of a Likert- or ordinal scale rating, where respondents had to indicate their level of agreement or disagreement to each statement (where 1 = Strongly agree; 2 = Agree; 3 = Neutral; 4 = Disagree; and 5 = Strongly disagree).

3.4.1.2 Piloting the survey questionnaire

A pilot survey is a crucial part of the research process and questionnaire development (Roopa & Rani, 2012). The questionnaire was piloted on a sample of ten students from the Gobabeb

- Namib Research Institute to determine if the wording, language, order of the questions and presentation influenced the participants response. Suggestions on rephrasing statements were considered and incorporated before data collection.

3.4.1.3 Determining the sample size

The study followed a multi-stratified sampling approach, based on socio-economic difference and waste collection date and time. According to Hasson *et al.* (2007), consideration should be given to covering a broad spectrum of society across disparate groups of different income levels, to provide an insight into perceptions and effects of plastic bag levies. The stratification was based on residential structure, specifically suburban areas, which reflects the socio-economic profile of different income groups within Walvis Bay as recommended by the SWAT-Tool (European Commission, 2004). Determining an adequate, representative sample size in survey research is important for adequate data collection (Al-Sabaihi, 2003).

The sample size was determined using a stratified random sampling formula as described by Al-Sabaihi (2003) to estimate sample size and suburb proportion with 5% precision and 95% confidence level due to absence of standard deviation or variance information from the suburbs, using the following formula:

$$n = \frac{\sum_{i=1}^{L} \frac{N^2 i\ pi(1-pi)}{wi}}{\frac{N^2 e^2}{Z^2} + \sum_{i=1}^{L} Ni\ pi\ (1-pi)}$$

Where: *Z* is the inverse of the standard normal cumulative distribution that correspond to the level of confidence; *N* is the town population size; P_i is the subpopulation proportion for the stratum/ suburbs; *e* is the precision level; wi is the weight of the strata (suburbs to be sampled). To calculate the sample size for each suburb within the town $n_1 = wi * n$.

The calculated sample size per suburb is indicated in Table 3-2. The targeted sample size was a total of 375 households.

Table 3-2: Calculated sample size based on residential erven per suburb.

Suburb	Number of residential erven per suburb	Calculated sample size (nr of households)
Kuisebmond (low-income)	6982	180
Narraville (low to middle-income)	3006	76

Suburb	Number of residential erven per suburb	Calculated sample size (nr of households)
Hermes (middle-income)	2449	54
Meersig (high-income)	1238	63
Total	**10 669**	**375**

3.4.1.4 Selection of households for inclusion in the survey

The household selection process was influenced by the waste collection route, presence of occupants at the household, and willingness of households to participate in the survey. Each suburb was surveyed on its designated waste collection day. Selection of streets for sampling was determined by considering the waste collection schedule set by the municipality and the accessibility of streets during waste collection. This approach facilitated a meaningful comparison between self-reported and observed plastic use behaviours. Priority was given to streets with waste collection scheduled between 7:00 AM and 11:00 AM, allowing for waste composition analysis to be carried out on the same day as conducting the survey questionnaire.

3.4.1.5 Distribution of the survey questionnaire

Questionnaires were distributed face-to-face by a team of three trained research assistants over a period of five consecutive days, with one day allocated for each suburb. However, an exception was made for Kuisebmond, which required two days for sampling due to its higher population and two-day waste collection schedule.

The approach involved initiating the survey from one end of each street and approaching all households where individuals could be observed being present at the house. In cases where doorbells were available, they were rung to gain access. A convenient sampling method was employed to select the most accessible households, taking into consideration the presence of residents at home, while excluding areas predominantly consisting of businesses and flats. Household members present during the survey had to willingly participate in the research and agree to partake in plastic waste collection and sorting as part of the research.

The questionnaires were administered through face-to-face interviews. During these interviews, participants had the option to complete the questionnaire on their own if they felt comfortable doing so. In cases where a participant had difficulty understanding a question, the researcher provided explanations. Some household members preferred to have the researcher read out the questions and assist in completing the questionnaire. In the areas of

Kuisebmond and Narraville, all questionnaires were completed in the presence of the researcher. However, in Hermes and Meersig, where many households had housekeepers present who could not complete the questionnaire, a drop and collect method was employed to enhance participation. This method involved leaving the questionnaire with the participant, collecting it a week later. To accommodate the linguistic diversity in Walvis Bay, where Afrikaans, English, Khoekhoegowab and Oshiwambo are the prominent spoken languages, assistant researchers were proficient in these languages and could translate the questionnaire to participants as needed.

3.4.1.6 Obtaining informed consent

Permission was obtained from the Walvis Bay Municipality to conduct the survey within its jurisdiction. The permission, together with an ethics approval letter (see Section 3.6 below) served as an official authorisation to approach households for participation in the survey. In accordance with ethical guidelines, only household members who were 18 years or older were eligible to take part in the survey. For each eligible participant, a designated section on the questionnaire was provided to indicate their consent to participate. This section required the participant's signature, signifying their agreement to voluntarily (and without compensation/remuneration) participate in the survey.

3.4.2 Household plastic waste observations

The volume of plastic waste generated serves as a valuable indicator for assessing plastic consumption (UNEP, 2018c). Therefore, determining the proportion of plastic bag waste yields crucial insights into the actual practices/behaviour related to plastic bag consumption. Data regarding waste generation and the composition of plastic waste are instrumental in evaluating and comparing plastic waste at the household level, contributing to a better understanding of human behaviour (Márquez *et al.*, 2008). It also supplements self-reported behaviour collected through the survey questionnaire.

According to Maskey & Singh (2017), collecting waste from the source and hand sorting is the most accurate method of waste quantification. The proportion of plastic carrier bags in household plastic waste was determined as outlined in the sub-sections below.

3.4.2.1 Waste sample collection from households

The collection of waste from households adhered to the Municipality's established waste collection schedule, ensuring that approximately one week's worth of waste was collected from households prior to weekly collection (Essonanawe *et al.*, 2014). Waste sampling was

done while conducting the survey questionnaire, as well as four consecutive weeks afterwards, to provide for potential variations in waste generation throughout the month (Anders, 2008). Waste collection was carried out using a standard waste collection truck.

During the week of the questionnaire survey (week 1 of the research), households were provided with black refuse bags, and were requested to dispose of any plastic waste that they generate (and would normally dispose of) in these bags. However, the black refuse bags were not filled with plastic waste during week 2 of the research (first week of waste collection). Households indicated that they did not possess plastic waste despite their refuse bins being full of plastic waste. Mbande (2003) suggests that household knowledge of waste measurement can influence the results, as they are more likely to provide cleaner waste.

Given the limited data obtained in the first week, for the subsequent weeks (research weeks 2 to 4), both black bags and plastic waste retrieved from waste bins were collected. All bags were accurately labelled with the street name and house number. These bags were then transported to the landfill where they underwent sorting, weighing, recording, and disposal. Any recoverable recyclables, such as bulk clear plastic and plastic bottles (PET and HDP), were transported to the recycling facility.

3.4.2.2 Weighing and sorting

The collected households plastic waste was classified into categories and subcategories adopted from Essonanawe *et al.* (2014) and Phuc and Yasuhiro (2011). The main categories consisted of plastic packaging, plastic containers, plastic bottles, plastic films, plastic foams, plastic ropes, tubes and nets, plastic containers, and synthetic hair braids. Plastic packaging was sub-divided into the following sub-categories: plastic shopping bags, clear plastic bags, Ziplock/sealable bags, packaging bags of fresh fruits and vegetables, packaging bags of dry food, packaging bags of frozen food, non-food packaging, unspecified packaging, sachets and bulk packaging.

Different plastics and plastic bag types were manually sorted, counted, weighed, and recorded. Since plastic is a lightweight material, three calibrated electronic balance scales of 10 to 40g, 1 to 5000g and 0.01 – 2000g were used to account for lighter plastic. The weight of non-compacted plastic bags does not show the true bag representation of plastic waste quantity and volume. Counting individual plastic bag types was favoured because plastic bags are lightweight. In addition, the plastic bag levy introduced charges per bag without taking weight of the bag into consideration. Furthermore, a review by Anders (2008) pointed out that lighter material such as paper and plastic waste can be contaminated with food, moisture, and

dirt, and should be cleaned (where possible) to avoid weight bias. Therefore, plastic bags and bottles that had content were emptied before weighing.

The number and weight of all categories and sub-categories of plastic and plastic bag waste were recorded individually per household from where the waste was collected. These values were then combined per suburb.

3.5 Data analysis

Section 3.5.1 provides a description of the analysis of survey questionnaire data, while Section 3.5.2 describes the analysis of data from household plastic waste observations and quantification.

3.5.1 Analysis of the survey questionnaire data

Excell was used for descriptive statistics and charts for initial analysis of data obtained from survey questionnaires. The data were analysed using SPSS-22 software. Cronbach's alpha test was run to test the scale reliability and evaluate the internal consistency of Likert scale questions.

Kolmogorov-Smirnov was used to test for normality since the data consisted of more than 100 responses. This test is used to assess whether a sample comes from a population with a specific distribution. In questionnaire data analysis, it might be used to check whether responses to a questionnaire item follow a particular distribution, such as normal distribution. If the responses significantly deviate from the expected distribution, it could indicate issues with the data or suggest the need for non-parametric analyses (Berger & Zhou, 2005). All the variables were statistically significant; therefore, the data are not normally distributed even after log transformation resulting in the use of non-parametric tests.

A non-parametric Spearman correlation was conducted to assess significance and direction of relationships between TPB constructs and demographic variables. It assesses whether there is a monotonic relationship between the variables, meaning that as one variable increases, the other tends to either increase or decrease consistently (Schmid & Schmidt, 2007). Correlation was also conducted to determine the variability between reported and observed plastic bag use behaviour.

Multiple regression was conducted to determine the predictor variables of behavioural intention and the actual behaviour. According to Halinski and Feldt (1970) multiple regression is employed to understand the relationship between one dependent variable and two or more

independent variables. It helps in predicting the value of the dependent variable based on the values of the independent variables. In questionnaire data analysis, multiple regression can reveal which combination of independent variables has the most impact on the dependent variable. For this study the dependent variable were behavior and intention while situational factor, attituded, social norms, perceived behavioral control, environmental awareness and demographics were the independent variables.

Kruskal-Wallis was run to test for any significant differentiating waste generation and socio-demographic information. Unlike parametric tests like ANOVA which assume normality and homogeneity of variances, the Kruskal-Walli's test is a non-parametric alternative used to determine whether there are statistically significant differences between three or more independent groups when the dependent variable is ordinal or continuous. It's often used when the assumptions of ANOVA are violated or when dealing with small sample sizes (Breslow, 1970; McKight & Najab, 2009; Ostetagova *et al*., 2014).

3.5.1.1 Dealing with missing data/fields

Missing values are common in survey studies (Allison, 1995) except for online questionnaires that enforce completion of required fields. This study had 1.7% missing values in the survey questionnaire. These resulted from dropouts, refusals, and uncorrectable errors. Deleting cases with missing data are a standard practice, but it can reduce analytical power and introduce bias, especially in small samples (Patrician, 2002). In this study, listwise deletion would have resulted in 25% data loss. Therefore, the researcher opted for pairwise deletion, assuming data missing completely at random (MCAR), verified through Little's MCAR test (χ=1085.285; df = 1015; p-value = 0.62) (SPSS, 2011).

MCAR test is not directly used for analysing questionnaire data, but rather for assessing the nature of missing data. It helps determine whether the missingness of data in a questionnaire is completely random or if there's a pattern to it. If data are missing completely at random, it implies that the missingness is unrelated to both observed and unobserved data, which simplifies the analysis. If data are not missing completely at random, it suggests that there may be underlying patterns or reasons for the missing data that need to be addressed in the analysis.

3.5.2 Analysis of household plastic waste

Since the data were not normally distributed and the sample size was not equal, the Kruskal-Wallis' test was used to test for significant differences in plastic waste composition and

observed plastic carrier bags proportion amongst suburbs and demographics. A non-parametric correlation test was conducted to test the correlation between plastic waste composition and demographics.

3.6 Ethical considerations

Research involving humans as subjects is guided through ethical principles and as such the research proposal was submitted to North-West University (NWU) Faculty of Natural and Agricultural Sciences - Research Ethics Committee (NFAS-REC), to evaluate methodology risks. The research was considered to fall within the minimal risk category, and ethical clearance was granted (NWU-01314-22-A9).

From an ethical perspective, consumers participation in the survey was voluntary and participants were informed that they could withdraw from the study at any stage if they felt uncomfortable. Participants were assured that their answers are anonymous and would be kept confidential with no trace back to them. Participants had to provide informed consent (see Section 3.4.1.6) to participate in the study. Additionally, only household members of 18 years and above could participate in the survey. Minors and incapacitated adults were purposefully excluded as research participants.

3.7 Methodological assumptions and limitations

The sections below outline the methodological assumptions and limitations of this research. The delineated research scope (Section 1.4) should be considering when reading these assumptions and limitations.

The data collection timeframe was limited, with a small workforce, which necessitated conducting the survey over the course of a week, with three assistant researchers spending one day per suburb except for Kuisebmond which was sampled for two days due to population size.

A total of 195 of the 375 targeted household (52%) responded to the survey, with the lowest response rate in Meersig (19.1%). In high-income households, even when employing a drop and collect method, household members were unwilling to participate, resulting in an underrepresentation of the high-income consumers. Consequently, the collected data are skewed towards low to medium income suburbs with higher response rates (50 – 61.8%).

The study assumed that the number of household members remained constant during the plastic waste collection period since households did not label the refuse bags with the number of occupants.

The findings related to the first two research objectives (RO1 and RO2) relied on self-reported information. It is known that self-reported behaviour may differ from actual behaviour. Therefore, self-reported data were supplemented by the quantification of plastic bags in household waste. This was done by giving households a waste refuse bag and requesting them to dispose of all plastic waste in the bag.

During the initial week of sampling, some households did not return refuse bags, indicating a lack of plastic waste and when they did return it, the refuse bags were primarily filled with bottles and cleaner plastic waste, with few or no plastic carrier bags. Plastic waste picked from refuse bins was, therefore, included in the collection.

In some instances, household members verbally agreed to participate in the survey but were hesitant to sign a consent form, or in the drop and collect method, they agreed to plastic waste collection, but failed to return the questionnaire. These households were considered survey participants despite not completing the survey questionnaire.

In Kuisebmond, where 50% of Walvis Bay's population resides, the proportion of plastic shopping bags in household plastic waste was influenced by backyard shacks, which also function as households. Backyard shacks on a single residential erf shared a single refuse bin, and neighbours without refuse bins sometimes disposed of their waste in others' bins.

Across all suburbs, women were more willing to participate in the survey, resulting in a higher representation of females. Participants were not asked to disclose their income, as this was considered sensitive information; instead, the town suburb was used as a proxy for income level.

The study's results provide insights into consumer bag usage behaviour but cannot be extrapolated to the national level due to limitations related to sample size, differences in shopping habits, and potential seasonal variations.

Lastly, the limitations related to the statistical analysis methods, mentioned in Section 3.5 of this dissertation, should be taken into consideration when reading the findings of this research.

3.8 Chapter summary

The methodological chapter provides a comprehensive overview of how data were collected to accomplish the research objectives. A mixed-method research design was employed to gain a deeper understanding of consumer behaviour regarding plastic carrier bags. Four suburbs in Walvis Bay, representing different income levels, were included in the study. Self-reported behaviour was assessed through face-to-face distribution of structured survey questionnaires (based on the TPB) to households to identify factors influencing plastic carrier bag behaviour. Additionally, self-reported data were supplemented by observations and quantification of plastic carrier bags within the waste stream. Chapter 4 will present the results and discussions based on the data collected, as outlined in the methodology described in Chapter 3.

CHAPTER 4. RESULTS AND DISCUSSION

4.1 Introduction

Chapter 4 reports on the findings obtained from the data analysis to evaluate consumer behaviour related to plastic carrier bags in Walvis Bay, Namibia.

Participation by research respondents is outlined in Section 4.2. Section 4.3 provides the socio-demographic information of research participants, while Section 4.4 presents results and a discussion of consumer's awareness of the Namibian plastic bag levy (i.e., price of plastic bags) (RO1). Section 4.5 reports on the second research objective, which aimed to assess the factors that influence consumers' behaviour (decisions or choices) when opting to use plastic carrier bags, using the Theory of Planned Behaviour (TPB) (RO2). Finally, Section 4.6 presents the results and discussions on the plastic proportion in household plastic waste (RO3).

4.2 Participation in the research (response rate)

The calculated total sample population was 375 households (see Table 3-2), however only 195 households participated in the research, which is about half (52%) of the targeted households (Table 4-1).

The lowest response rate was in Meersig (high-income suburb). This was mainly due to unwillingness of households to participate in the research or respondents being away for work and only minors were present at home. Even though the drop and collect method was employed, the response rate was still low (19.1%) in this area. Kuisebmond and Narraville had the highest response rates of 60.5% and 61.8%, respectively, while Hermes had a response rate of 50% (Table 4-1).

Although the researchers aimed to do waste observations and quantification at each of the households completing the survey questionnaire, this was not possible in all instances. The households participating in the plastic waste quantification study were fewer than the number of households completing the survey in the cases of Kuisebmond and Narraville. However, in limited instances, some of the households that did not complete the survey or did not provide informed consent, agreed to participate in the plastic waste quantification process. A total number of 484 plastic waste samples (refuse bags with plastics) were collected from the three suburbs, as indicated in Table 4-1.

Due to various reasons, not all households had four consecutive weeks of waste collection. These reasons included the withdrawal of some households from the study, difficulties in locating certain households (attributed to discrepancies between recorded erven numbers and actual house numbers), households forgetting to put out their waste or refuse bins, and instances where the municipality's truck had emptied the bins before the scheduled collection.

Table 4-1: Participation in the survey questionnaire and waste observation and quantification study

Suburb	Calculated sample size (Section 3.4.1.3)	Survey questionnaire		Waste observation and quantification		
		Households participating in the survey	Response rate	Households sampled for plastic waste	Waste sampled without completing the survey questionnaire	Total nr of plastic waste samples collected
Kuisebmond (low income)	180	109	60.5%	75	1	244
Narraville (low to middle income)	76	47	61.8%	40	2	115
Hermes[3] (middle income)	54	27	50.0%	27	7	85
Meersig (high income)	63	12	19.1%	12	2	40
Total	**375**	**195**	**Mean: 52%**	**154**	**12**	**484**

4.3 Socio-demographic information of research participants

Table 4-2 outlines the socio-demographic information of survey participants, which included gender, education, age range and household size.

[3] *Not all surveyed households were sampled. Drop and collect questionnaires participants agreed for waste to be sampled but did not complete the questionnaire resulting in an equal number of surveyed and sampled.*

Table 4-2: Socio-demographic information of survey participants expressed in percentage (n = 191 participants)

Variables	Suburb				Overall representation
	Kuisebmond	Narraville	Hermes	Meersig	
Gender					
Female	69%	60%	52%	75%	64.9%
Male	31%	38%	44%	25%	34.0%
(blank)	0	2%	4%	0	1.1%
Education					
No education	10%	13%	0	0	9%
Primary School	4%	9%	0	0	4%
Secondary School	56%	32%	24%	25%	44%
Tertiary	19%	32%	40%	67%	28%
Adult education	11%	15%	4%	8%	11%
(blank)	0	0	32%	0	4%
Age range					
18-29	36%	23%	28%	0	29%
30-39	25%	15%	16%	50%	23%
40-49	22%	15%	20%	25%	20%
50-59	12%	26%	20%	0	16%
60-69	2%	9%	8%	17%	5%
70 and above	2%	13%	4%	8%	5%
(blank)	1%	0	4%	0	1%
Number of members of the household					
1	2%	0	0	0	1%
2-3	10%	30%	32%	50%	20%
4-5	26%	30%	20%	25%	26%
6-7	27%	21%	16%	17%	24%
8-9	13%	13%	16%	8%	13%
10	5%	4%	0	0	4%
>10	17%	0	12%	0	11%
(blank)	0	2%	4%	0	1%

The population in Walvis Bay consists of almost equal number of males and females, with males representing 54% and females by 46% of the population, respectively (NSA, 2011). In this study, however, the respondents consisted of 64.9% females and 34% males (with 1.1% of the respondents not indicating their gender) (Table 4-2). Females were generally more willing to participate in the research than males. Male participants would often read the survey questions and then asked a female household member to complete the questionnaire. Some indicating that it is the female who does the shopping and that they would, therefore, be in a better position to complete the questionnaire. These findings were similar to those of Mogomotsi *et al.* (2019) who found that females were more willing to participate in their research and were therefore more represented than males in their study of plastic bag usage in Botswana.

Some 87% of the respondents indicated that they had received education, with most participants having secondary education (44%), tertiary education (28%) or adult education (11%) (Table 4-2). There was a distinction between the level of education in the low-, middle- and high-income suburbs, with the highest percentage of respondents with no education in the low- to middle income areas of Kuisebmond (10%) and Narraville (13%) and the highest percentage of respondents with tertiary education in the middle- to high-income areas of Hermes (40%) and Meersig (67%) (Table 4-2).

Approximately 72% of the respondent population were between the ages of 18 and 49, with 29% being between 18 and 29 years of age, 23% between 30 and 39, and 20% being between 40 to 49 (Table 4-2). This reflects the Walvis Bay urban population structure in terms of age (NSA, 2011).

Most households (26%) have four to five occupants, followed by six to seven (24%) and two to three (20%). The highest household size (ten occupants and more) was observed in Kuisebmond 22% and Hermes 10%. The high number of occupants in Kuisebmond is due to multiple backyard shacks that are found within individual residential erven. The least number of occupants (two to three occupants) was observed in Meersig (50%).

There were not statistically significant ($p > 0.05$) differences observed between age, education, gender of respondents from different suburbs in Walvis Bay.

Demographic information was used in the analysis of TPB constructs and the plastic bags proportion in the household plastic waste.

4.4 Results related to RO1: Assessing consumers' awareness and perceptions about the Namibian plastic bag levy

To determine the awareness and perceptions of the participants regarding the plastic bag levy in Namibia, Section B of the questionnaire posed three questions:

- Grocery stores charge the same price for plastic shopping bags. (Yes/No)
- How much do you pay for a plastic bag in a food store? (Indicate in N$)
- What amount are you willing to pay for a plastic shopping bag at any food store (in N$)?

  a) 0.50 b) 1.00 c)2.00 d) 2.50 e)3.00 f) 3.50

4.4.1 Price of plastic carrier bags at different grocery stores

The first question related to the awareness of the plastic carrier bag levy required respondents answer to whether *different grocery stores charge the same price for plastic shopping bags*. The plastic carrier bag price question was asked to gauge the respondents' awareness of price at different grocery stores. Figure 4-1 provides an overview of the respondents' responses to the question related to the pricing of plastic carrier bags at different grocery stores.

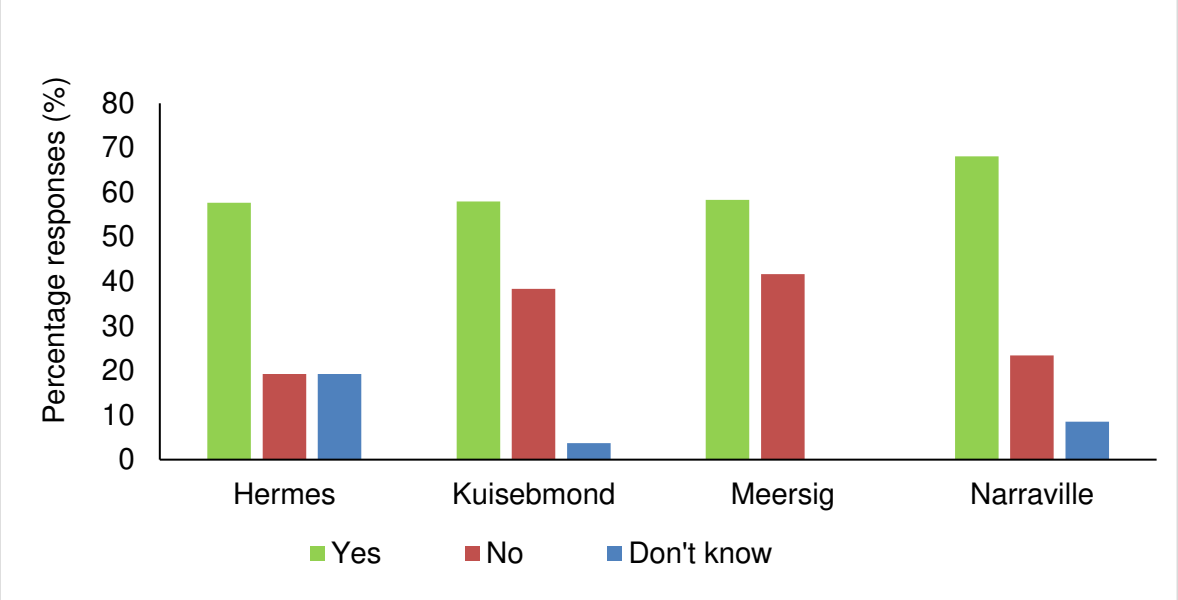

Figure 4-1: Responses per suburb related to the question of whether different grocery stores charge the same price for plastic carrier bags.

Overall, 60.4% of respondents agreed that different stores charge the same price for plastic carrier bags, while 32.3% disagreed and 6.8% were unsure. Results of a different pilot study conducted in Walvis Bay 2020, indicated that 84.8% of respondents were aware of the plastic bag levy, but that only 45% were aware of the levy's intention[4].

The high percentage of respondents (60.4%) indicating that plastic carrier bags are priced the same, may result from most major retail food stores in Walvis Bay charging N$1.00 for a 24-litre plastic carrier bag, even though the levy is only N$0.50. Meersig (42%) and Kuisebmond (38%) have the highest number of consumers reporting different prices of plastic carrier bags at different stores, possibly due to variations in plastic carrier bag pricing among big and small retail food stores that operate in these areas. In some cases, small plastic bags used for separating cosmetics and food within a larger carrier bag are provided for free.

About 6.8% of respondents expressed uncertainty about the pricing of plastic carrier bags at different stores, with Hermes (19.2%) and Narraville (8.5%) having a relatively high number of respondents who indicated that they were unsure. This uncertainty was evident during the survey, as household members completing the questionnaire often asked their housemates about the prices at their preferred food stores, but even the housemates could not provide answers. In contrast, all respondents in Meersig were aware of the plastic carrier bag price (i.e., 0 respondents indicating that they were uncertain). Hasson *et al*. (2007) found that middle to low-income consumer were price sensitive during the levy introduction however, acclimatisation resulted in a turn-over and low-price elasticity.

The unannounced price increase of the plastic bag levy in February 2021 saw large retail stores raising the price of a plastic bags from N$0.50 to N$1.00, covering both the levy cost and production expenses but without public notice[5]. Although the levy adjustment may be positive from a deterrent perspective, if not communicated, the adjustment may not change purchasing behaviour of plastic carrier bags, since consumers may be unaware of the price increase (especially if they do not ask about the price of a bag before purchasing it). An adjusted plastic carrier bag levy that is well communicated, will keep consumers aware of the charges, and may increase plastic bag avoidance behaviour amongst consumers (Convery *et al*., 2007; Dikgang & Visser, 2012; Mogomotsi *et al*., 2019). Furthermore, plastic bags have historically been perceived as free to consumers, despite their cost being incorporated into the overall price of goods (Hasson *et al.,* 2007). The increase in prices beyond the levy cost, purportedly to cover production expenses, often leads to a lack of transparency regarding

[4] Unpublished study
[5] Interview with one of the big retail store managers regarding plastic carrier bag prices.

whether the initial charges included in the goods' prices to cover plastic costs are removed or not. This ambiguity can lead to consumer scepticism regarding the purpose of the levy, thereby undermining its effectiveness in promoting behaviour change (Chitotombe, 2014) while enriching the retailers (Madigele & Mogomotsi, 2017).

4.4.2 Plastic carrier bags prices as indicated by consumers

Respondents were asked an open-ended question regarding the current price of plastic carrier bags. The prices indicated by respondents ranged from N$0.50 to N$2.50, with some respondents providing other amounts. The indicated prices per suburb are provided in Figure 4-2.

Most respondents (62.3%) indicated that the price of a plastic carrier bags is N$1.00, while 16.3% of respondents indicated a cost of N$1.50 and 13.5% a cost of N$2.00. The remaining respondents indicated that the price was either N$0.50 (2.3%), N$1.20 (0.9%), N$2.50 (2.3%) or other lower or higher amounts (2.3%) (see Figure 4-2). Meersig (15.4%) and Hermes (4.5%) indicated other prices, which were between N$ 3.00 to N$6.00. These respondents probably included prices of paper or cloth shopping bags which are much higher in price than plastic carrier bags, but also vary depending on the food store.

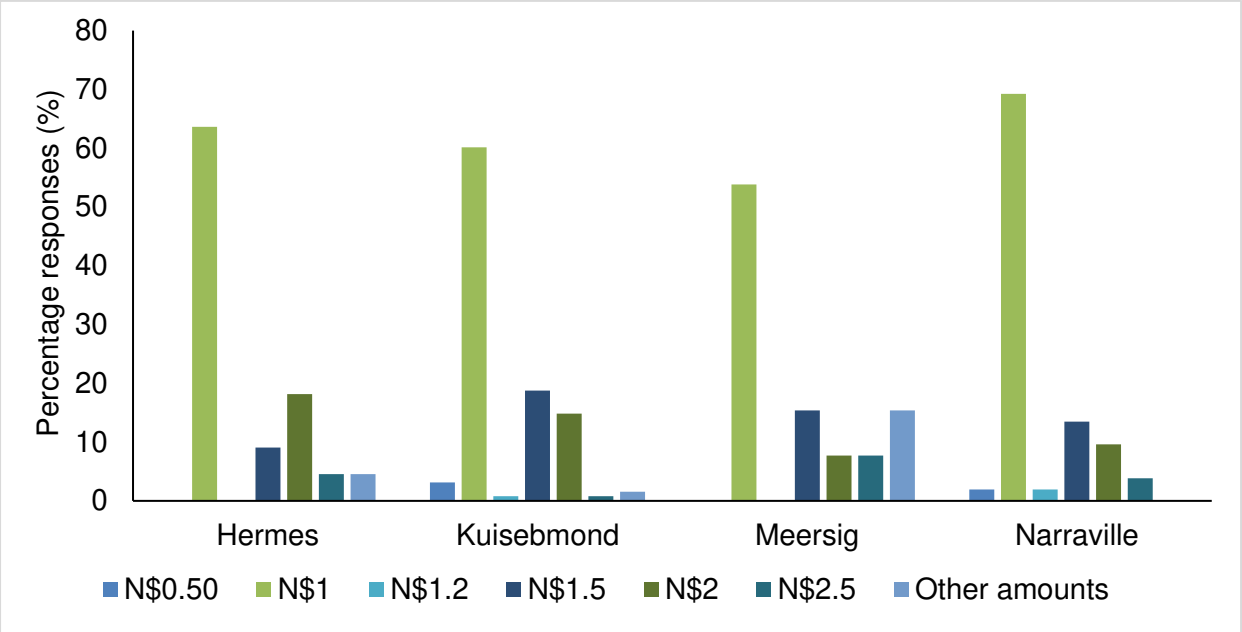

Figure 4-2: Responses per suburb related to the question of the price of plastic carrier bags.

Although the price of a plastic carrier bag is generally around N$1.00 at most stores, some stores, like Shoprite, have different prices for different sizes and types of plastic carrier bags. Great price variation is observed in Narraville and Kuisebmond. This could be due to a greater number of small retail stores mainly found in these suburbs with varying plastic carrier bag sizes and prices. According to He (2012) and Madigele *et al.* (2017) variation in plastic bags could have an impact on plastic carrier bags consumption, but caution that the plastic bags cost is small in comparison to the total shopping bill which might not influence the consumers preference of plastic carrier bags.

4.4.3 Willingness of consumers to pay for plastic carrier bags

To determine the willingness of consumers to pay for plastic carrier bags, the following question was posed:

- What amount are you willing to pay for a plastic shopping bag at any food store (in N$)?
  a) 0.50 b) 1.00 c)2.00 d) 2.50 e)3.00 f) 3.50

Responses to the question is outlined in Figure 4-3 according to suburb.

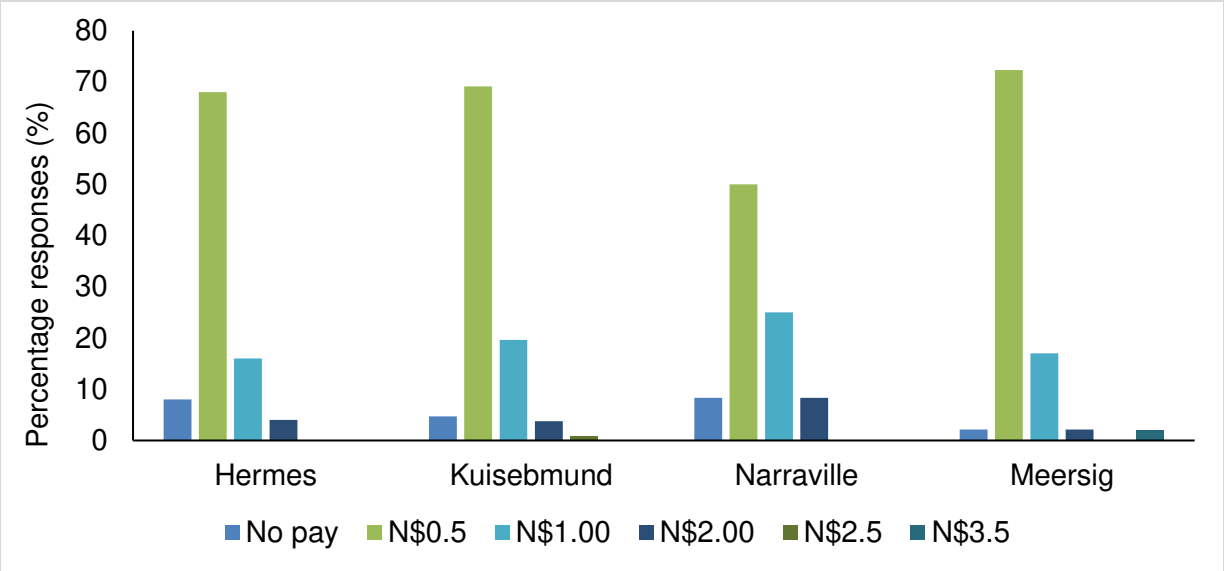

Figure 4-3: Responses per suburb related to the question of how much consumer are willing to pay for a plastic carrier bags.

Most of the households were willing to pay around N$0.50 for a plastic carrier bag. There was no statistically significant difference in consumers' willingness to pay in relation to demographic variables. The data reveals that, overall, 68.2% of consumers are inclined to pay

N$0.50, while 18.8% are willing to pay N$1.00. Additionally, 4.7% of consumers express their reluctance to pay, and a further 1% are open to paying either N$2.50 or N$3.50.

For an effective plastic bags levy, the plastic carrier bag cost should be high enough such that consumers think before deciding to get a plastic bag (Convery *et al.*, 2007). This might help break the impulsive purchasing of plastic bags and the plastic bags use habits.

4.5 Results related to RO2: Assess the factors that influence consumers' behaviour related to plastic carrier bag use through the TPB

The results on the influencing factors of consumers purchasing plastic bags were obtained through the analysis of structured closed-ended questions (See Section C in Annexure A). The results are presented in the sub-sections below, with Section 4.5.1 (Table 4-3) providing the descriptive statistics of the level of agreement to the statements posed. Section 4.5.2 provides the reliability test results, Section 4.5.3 the regression analysis and Section 4.5.4 outlines the Spearman correlation test of the TPB variables.

4.5.1 TPB variables descriptive statistics

Respondents were required to express their level of agreement on an ordinal scale of 1 (strongly disagree) to 5 (strongly agree) with various statements related to plastic carrier bag usage. The statements were based on the different constructs of the Theory of Planned Behaviour (TPB) and focused on: attitude (A), situational factors (SF), convenience (C), perceived behavioural control (PBC), social norms (SN), environmental awareness (EA), intention (I), and actual behaviour practice (B), as outlined in Section C of Annexure A.

Table 4-3 presents the percentage of responses for each statement along with the mean, variable mean, and standard deviation for each TPB variables. It is important to note that all 191 responses were collectively considered for the descriptive statistics, without being divided by suburbs, to ensure enough data points for analysis. In the context of this survey (as presented in Table 4-3), SD stands for "strongly disagree," D for "disagree," N for "neutral," A for "agree," and SA for "strongly agree."

The statements strikethroughs in Table 4-3 are deleted from the reliability test and are not included in any further analysis. The removed items were those that were lowering the Cronbach's Alpha value (for reliability) meaning they were not strongly correlated with the other items within the same construct. Removing these statements improved the reliability test and internal correlation and consistency (Isbanner, 2021).

Table 4-3: Descriptive statistics, indicating the level of agreement of respondents (in % respondents) to TPB statements, where SD = strongly agree, D = disagree, N = neutral, A = agree and SD = strongly disagree (n = 195 participants)

TPB questions	SD	D	N	A	SA	Mean	Variable mean*	Std deviation
Attitude (A)								
A1_I support the levy on plastic shopping bags	8.9	23.0	13.1	29.8	23.0	3.36	3.71	7.81
~~A2_I take advantage of shopping to buy Plastic shopping bags~~	16.2	39.3	15.2	22.5	6.8	2.64		
A3_It is my responsibility to lower the volume of plastic waste I generate	0.5	4.7	12.0	46.1	36.1	4.13		
A4_Paying for plastic shopping bags at grocery stores helps reduce plastic waste in the environment	3.7	15.2	19.9	34.0	26.7	3.65		
Situational factor (SF)								
SF5_Sometimes I forget my reusable bags at home when going shopping	2.1	8.9	14.1	48.2	26.2	3.88	3.64	0.71
SF6_Sometimes I buy too many things requiring me to ask for plastic shopping bags	1.0	8.9	12.6	47.6	29.3	3.96		
SF7_Cashiers do not tell me the price of plastic shopping bags	12.6	28.3	14.7	26.7	16.8	3.07		
SF8_I buy more plastics to double bag heavy goods	3.7	16.8	10.5	41.9	23.0	3.67		
Convenience (C)								
C9_I prefer products such as food and cosmetics to be packed separately from each other	2.1	5.2	8.4	34.6	48.2	4.23	4.12	0.67

TPB questions	SD	D	N	A	SA	Mean	Variable mean*	Std deviation
C10_Plastic bags are readily available in-store when I need them	1.0	4.7	12.0	50.8	29.8	4.05		
C11_Plastic shopping bags are convenient to use	2.1	6.3	11.5	41.4	37.2	4.07		
~~C12_I do not use plastic shopping bags because I have to pay for them~~	12.6	37.7	22.0	14.7	12.6	2.77		
Perceived behaviour Control (PBC)								
PBC13_Is easy for me to bring a reusable bag when going shopping	4.7	12.6	21.5	39.8	20.9	3.60	3.20	0.74
PBC14_I buy plastic shopping bags because the alternatives are not as good as plastic shopping bags	5.2	20.4	31.9	32.5	8.4	3.19		
PBC15_There are no alternatives to plastic shopping bags in store	11.0	35.6	22.0	22.0	6.8	2.77		
~~PBC16_I choose to buy reusable bags regardless of the price in order to reduce my use for plastic shopping bags~~	4.7	17.3	22.0	39.3	16.2	3.45		
Social Norms (SN)								
SN17_My family would prefer I should not buy plastic shopping bags	7.3	29.8	19.9	29.3	11.5	3.08	3.14	0.79
SN18_Important people in my close environment would support me if I tried to avoid using plastic shopping bags when shopping.	5.8	26.7	22.5	35.6	9.4	3.16		

TPB questions	SD	D	N	A	SA	Mean	Variable mean*	Std deviation
SN19_People whose opinions I value try to use fewer plastic shopping bags when shopping	3.7	22.5	31.4	33.5	7.9	3.20		
~~SN20_People in my street do not carry their grocery in plastic bags. They are always using reusable bags~~.	20.9	33.5	19.9	17.8	5.8	2.64		
Environmental Awareness (EA)								
EA21_Plastic shopping bags damage the beauty of the country	4.2	10.5	19.4	40.8	25.1	3.72	3.73	0.73
EA22_The impacts of plastic shopping bags motivate me to bring my own reusable bag when I go shopping	3.7	13.1	18.3	37.2	26.7	3.71		
EA23_Plastic bag levy aims to reduce the buying of plastic shopping bags	3.7	16.2	12.6	30.4	36.1	3.80		
EA24_Buying plastic shopping bags increases plastic waste at the landfill and in the ocean	4.7	12.6	15.7	42.9	23.0	3.68		
Intention (I)								
I25_I intend to use plastic shopping bags at home	2.1	5.8	7.3	48.2	35.1	4.10	3.64	1.04
I26_I intend to tell others to stop or reduce buying plastic shopping bags	3.7	22.5	28.8	31.9	11.0	3.46		
I27_I do not intend to buy plastic shopping bags when shopping	5.2	24.6	21.5	30.9	16.2	3.29		
I28_I am willing to reduce my use of plastic shopping bags	1.0	14.1	15.7	45.5	22.0	3.74		

TPB questions	SD	D	N	A	SA	Mean	Variable mean*	Std deviation
Behaviour (B)								
B29_I reuse my plastic shopping bags at home	0.5	2.1	6.3	51.3	38.7	4.27	3.53	0.76
B30_I actively advocate with my friends and family that we all use fewer plastic bags	4.2	17.8	22.0	42.9	13.1	3.43		
B31_I refuse to buy plastic shopping bags	8.9	28.8	19.4	20.9	21.5	3.17		
B32_In the last 4 weeks, I took my own reusable shopping bags for shopping	7.3	29.8	14.1	28.8	19.9	3.24		

**The higher the variable mean (score out of 5), the higher the level of agreement with the statements within the TPB construct.*

The sub-sections below discuss TPB variables descriptive statistic displayed in Table 4-3.

4.5.1.1 Attitude

Attitude in this context refers to an individual's evaluation of the degree of positivity or negativity associated with the purchase and use of plastic carrier bags. On average, respondents displayed a positive attitude with a mean score of 3.64 (Table 4-3). Approximately 53% of respondents reported that they support the levy (A1). Most respondents (82.2%) agreed and strongly agreed that it is their responsibility to lower plastic waste generation (A3), while 60.7% agreed that paying for plastic carrier bags reduces plastic waste in the environment (A4) (Table 4-3).

He (2012) explained that positive attitude is positively correlated with the reduction of plastic bag use. However, the attitude might change based on the inconvenience caused by avoiding the use of plastic bags (see Section 4.5.1.3 which discusses convenience). Concerted efforts should be made to improve citizens' attitude towards plastic waste reduction to achieve the goal of reduced usage of plastic carrier bags (He, 2012).

4.5.1.2 Situational factors

In the context of this research, situational factors refer to the external circumstances or conditions that can influence an individual's choices and actions regarding the use of plastic carrier bags, with an average score of 3.64 (see Table 4-3). Most of the households included in this research agreed or strongly agreed that they purchase plastic bags due to situational factors such as forgetting to bring their own reusable bag (SF5) (74.4%), buying more goods than planned (SF6) (76.9%), and doubling plastic bags to carry heavy goods (SF8) (64.9%) (Table 4-3). The findings are similar to those of Musa *et al.* (2013) in Manchester, where more plastic bags were bought because consumers forgot their reusable bags.

Furthermore, 43.5% of households either agreed or strongly agreed, that they buy plastic carrier bags because cashiers do not tell them the price (SF7). In contrast, 40.9% disagreed (see Table 4-3). This discrepancy may arise from cashiers only asking if the consumer needs a plastic carrier bag, but not necessarily disclosing the price of the plastic bag. Ohtomo and Ohnuma (2014) and Shihepo (2020) found that cashiers asking consumers if they need a plastic bag at the point of sale as being effective towards reducing unintentional purchasing of plastic bags. Adding the price to the question (*i.e., Do you need a plastic bag? The price is N$ 2.00*) might reduce the purchase and use of plastic carrier bags even more, since the consumer will be made aware of the cost.

Situational factors were statistically significant with age (p= 0.002) and household size (p= 0.04). Older people (50 – 70 years old) disagreed that situational factors influence their purchasing and use of plastic carrier bags, while young people (18 to 29) agreed and strongly agreed that they purchase plastic carrier bags due to situational factors. Similarly, Arı and Yılmaz (2017) observed that older people would frequently bring their own reusable bags when shopping.

To address situational factors effectively, strategies such as advertising reminders, promoting planned shopping, and offering incentives or rewards to encourage the use of reusable bags should be implemented (Musa *et al.,* 2013).

4.5.1.3 Convenience

Convenience refers to the ease, comfort, and practicality associated with using plastic bags, and in this research scored an average of 4.12 (Table 4-3). Consumers agreed or strongly agreed that they purchase plastic bags due to convenience reasons such as: preference of separating cosmetics and food (C9) (82.8%), plastic bags being readily available in-store when needed (C10) (80.6%) and because plastic bags are convenient to use (C11) (78.6%). Musa

et al. (2013) noted a similar pattern, with 19% of individuals avoiding mixing fresh food with other groceries.

Consumers behaviour in relation to plastic carrier bags is influenced by convenience. If plastic bags are seen as more convenient for certain tasks or purposes as listed above, individuals may be more likely to choose them over alternative options, even if they are aware of the environmental consequences (He, 2012). It is, therefore, important to consider the convenience of alternative options, such as reusable cotton bags or paper bags.

4.5.1.4 Perceived behavioural control (PBC)

Perceived behavioural control (PBC) refers to an individual's perception of their ability to perform a specific behaviour, which in the context of this research particularly refers to the purchasing and use of plastic carrier bags. PBC scored an overall mean score of 3.20 (Table 4-3), which indicated that the respondents were mostly neutral towards the PBC statements. It could be that consumers neither feel strongly about these statements nor strongly convinced of their control over and ability to make sustainable choices regarding plastic bags purchasing and use.

Their behaviour is likely influenced by a combination of various factors, and they may not feel a strong sense of control of their ability to use plastic carrier bags. This neutrality could indicate that external and internal factors influencing their decisions are balanced, and their choices may be more situation-dependent or context-specific (Arı and Yılmaz, 2017).

Respondents mostly agreed or strongly agreed that is easy for them to bring their own reusable bags when going shopping (PBC13) (60.7%) (Table 4-3). The response on this statement contradicts the findings where 74.4% of respondents indicated that they purchased plastic carrier bags because they forget to bring reusable bags (SF5) when they go shopping (See Section 4.5.1.2 on situational factors). This could also be a reason for the neutrality towards the PBC statements.

Consumer opinions on the purchase and use of plastic carrier bags vary. One of the reasons could be that they perceive plastic bags as being more effective (or “alternatives not being as good as plastic bags”) (PBC14). Approximately 41% of respondents agreed or strongly agreed with this sentiment, while 31.9% of respondents remained neutral (Table 4-3).

Availability of alternatives to plastic carrier bags in shops may also play a role towards PBC. Only 46.6% of respondents acknowledged the presence of alternatives in shops, with 22.0% expressing neutrality (PBC15). In Namibia, most large shopping chains, such as Shoprite,

Pick n Pay, Woermann Brock and Spar, have alternatives to plastic carrier bags. However, many of the smaller stores or spaza shops generally do not provide alternatives to plastic bags.

Moreover, during the survey, some consumers voiced concerns about the drawbacks of alternative options, including their higher cost, susceptibility to breakage, and limitations in carrying wet or frozen items (especially in the case of paper bags). These findings align with a study in Botswana by Mogomotsi *et al.* (2019), where consumers continued to purchase plastic bags due to factors such as availability, cost-effectiveness in comparison to reusable bags, habitual behaviour, and perceived convenience compared to alternatives.

4.5.1.5 Social norms

In this research, social norms refer to the shared expectations, behaviours, and beliefs within a given society or group regarding the use of plastic carrier bags. Based on the findings of this research, the Walvis Bay community exhibits a mostly neutral social norm concerning plastic carrier bag purchasing and usage, with a mean score of 3.14 (Table 4-3). About 40.8% of respondents agreed or strongly agreed that their family preferred that they should not buy plastic bags (SN17), while 37% disagreed or strongly disagreed to this statement. Approximately 45% of participants agreed or strongly agreed that important people in their lives would support them in reducing plastic bag use (SN18), with 32.5% disagreeing or strongly disagreeing (Table 4-3). Lastly, about 45% of respondents thought that people whose opinions they value try to use fewer plastic bags (SN19), while 31.4% were neutral about their opinions (Table 4-3).

A neutral social norm signifies the absence of clear societal expectations or prevailing social pressures (de Groot *et al.*, 2013) regarding the use of plastic carrier bags. This means that individuals within the Walvis Bay community do not experience strong societal influences either encouraging or discouraging the use of plastic bags. Consequently, consumers feel free to make their choices without significant external influence, and this neutrality can lead to a lack of clear guidance on whether to use or avoid plastic bags, making behaviour more reliant on personal preferences and individual awareness. This is different from the relatively strong societal norms influencing sustainable behaviour and the avoidance of plastic carrier bag usage in developing countries, such as Germany and Sweden, for example (Jansson *et al.*, 2017; Moser, 2015).

4.5.1.6 Environmental awareness

Environmental awareness, which refers to the extent to which individuals are aware and informed about the environmental impact of their choices when using or disposing plastic carrier bags, has an overall average score of 3.73 (Table 4-3). Of those surveyed, 65.9% agreed or strongly agreed that plastic carrier bags have a negative influence on the country's natural beauty (EA21), and 63.9% of participants acknowledged that the environmental impact of plastic bags would motivate them to bring their own reusable bags when shopping (EA22) (Table 4-3). Additionally, 66.5% of consumers agreed or strongly agreed that a levy on plastic bags aims to reduce the purchasing of plastic bags, (EA23) while 65.9% concurred that purchasing plastic bags contributes to increased plastic waste in landfills (EA24) (Table 4-3).

While the data on environmental awareness reflects heightened environmental consciousness, it also reveals a complex interplay between awareness, consumer action and behaviour. Notably, these same consumers indicated that they continue to purchase plastic carrier bags for convenience (See Section 4.5.1.3) and due to situational factors (See Section 4.5.1.2). Convenience and situational factors exert a strong influence on choices, which could overshadow consumers environmental awareness and environmental consciousness. The challenge in aligning consumer behaviour with environmental awareness is acknowledged by Kollmuss and Agyeman (2002)

The difference in response to environmental awareness and situational factors and convenience highlights the importance of bridging the gap between awareness and action to effect meaningful change (Kollmuss & Agyeman, 2002). There is a need to not only enhance environmental education and awareness, but also to address the convenience and situational factors that drive plastic bag usage. Strategies should focus on making sustainable alternatives more convenient and readily available, thereby mitigating the barriers that convenience and situational factors may pose (Hines *et al.*, 1987).

4.5.1.7 Intention

Intentions are generally associated with a higher likelihood of taking the intended action (Ajzen, 1991). In this research, the self-reported intention to use and purchase plastic carrier bags had an average score of 3.64. Approximately 68% of participants indicated (agreed or strongly agreed) that they are willing to reduce the use of plastic shopping bags (I28) (Table 4-3). Most participants (83.3%) agreed or strongly agreed that they intend to reuse the plastic carrier bags that they purchased at home (I25) (Table 4-3). This was also supported by a respondent who mentioned that they stopped buying plastic carrier bags, but when they ran

out of their accumulated “stockpile” of plastic shopping bags to use around the house, they realised that they needed to buy some.

Only 42.9% of respondents agreed or strongly agreed that they intend to tell others to reduce plastic bag use (I26), while 26% of respondents disagreed and 28.8% were neutral (Table 4-3). This finding is in line with the neutral social norms (see Section 4.5.1.5) where there is no clear expectation from others on the use or purchasing of plastic carrier bags. According to Borg *et al.* (2020) opinions and advocacy of others may affect consumers plastic bags avoidance behaviour. If social norms are positive, it will increase the advocacy of reducing plastic carrier bag use amongst consumers.

Furthermore, approximately 47% of respondents agreed or strongly agreed that they did not intend to buy plastic carrier bags when shopping (I27) (Table 4-3). Therefore, implying that they may unintendedly or unintentionally purchase plastic shopping bags. This could be due to situational factors, convenience or simply because it is a habit. Mogomotsi *et al.* (2019) found that consumers purchase plastic bags due to inconvenience of alternatives, low cost, availability and because they are used to using plastic. Given that the price of plastic carrier bags includes levy and production costs, plastic bags should be treated the same as other goods in the retail store. Instead of plastic shopping bags being easily accessible, they should be placed on the shelf like any other good, so that consumers consciously acquire and purchase these bags. Easy access could be contributing to unintentional purchase of plastic carrier bags.

4.5.1.8 Behaviour

Behaviour, in the context of this research, is the self-reported behaviour of participants regarding their avoidance of plastic carrier bags and use of alternatives (i.e., own reusable shopping bag). Overall, behaviour scored an average of 3.53. Only approximately 42% of respondents agreed or strongly agreed that they avoid (refuse) buying plastic bags (B31), while about 49% agreed or strongly agreed that they took their own reusable bags for shopping in the past 4 weeks (B32). Almost 90% of respondents agreed or strongly agreed that they reuse plastic carrier bags at home (B29) (Table 4-3). The self-reported reuse of plastic bags (B29) is in line with the intention statement (I25) (See Section 4.5.1.7).

Approximately 56% of participants agreed or strongly agreed that they actively advocate with friends and families to use fewer plastic bags (B30). This does not exactly correspond with the 42.9% agreeing or strongly agreeing that they intend to tell others to stop or reduce buying

shopping bags (See I26 as discussed in Section 4.5.1.7), which shows a difference in intention versus reported behaviour/practice.

4.5.2 Reliability test results

The reliability test, assessed using Cronbach's alpha, evaluates the internal consistency of a set of items in a questionnaire. It helps determine how reliably the statements measure the same variable or concept. High internal consistency indicates that the statements work well together, providing consistent and accurate measurements (Martin & Douglas, 1997). Cronbach alpha (α) values of 0.7 or higher indicate acceptable internal consistency.

Table 4-4 provides the results of the reliability test. The Cronbach alpha value of the overall variables was 0.754 (see Table 4-4), which is within the accepted value of ≥0.7. However, the Cronbach's alpha values of the individual variables (as shown in Table 4-4), were unacceptable (below 0.5), poor (≥ 0.50) and questionable (≥ 0.60). The variation in the Cronbach value could be linked to the indirect influence of external factors such as demographics affecting the internal consistency of variable items (Ursachi *et al.*, 2015).

A low Cronbach alpha in a data set signifies that the statements within a variable or questionnaire do not consistently measure the same underlying construct that affects the internal consistency of the data (Tavakol & Dennick, 2011). Taber (2018) suggests that deleting questions that are contributing to low Cronbach alpha values improves the internal consistency resulting in improve alpha values indicating that the remaining questions measure the construct better. Although this is a common practice it contributes to the loss of information that the deleted question intended to capture.

Table 4-4: Reliability test for TPB constructs

Variables	Cronbach's Alpha (α) before deleting question(s)	Questions deleted	Number of items remaining	Cronbach's Alpha (α) after deleting question(s)
Attitude	0.439	A2	3	0.500
Situational factors	0.504	-	4	0.504
Convenience	0.112	C12	3	0.553
Perceived Behavioural Control	0.398	PBC16	3	0.403
Social Norms	0.492	SN20	3	0.544

Variables	Cronbach's Alpha (α) before deleting question(s)	Questions deleted	Number of items remaining	Cronbach's Alpha (α) after deleting question(s)
Environmental Awareness	0.539	-	4	0.539
Intention	0.636	-	4	0.636
Behaviour	0.619	-	4	0.619
Overall variable	**0.70**	4	28	**0.754**

The discrepancy between the overall value and the combined values of the variables could be attributed to the interplay between the variables and the specific items used to measure them. While each variable individually may have had varying levels of consistency (reflected in their individual Cronbach values), when combined, they interacted in a manner that affected the overall reliability differently than simply adding up their individual reliabilities would suggest.

4.5.3 Regression analysis

Regression analysis is a statistical method used in data analysis to investigate and model the relationship between a dependent variable and one or more independent variables. The main goal of regression analysis is to understand how changes in one or more independent variables (also known as predictors) are associated with changes in a dependent variable (Muralidharan & Sheehan, 2016; Noufal *et al.*, 2020). For this study, multiple regression analyses were conducted to determine the significant effect of independent variables in predicting the intention and behaviour to use plastic bags. The sub-sections below elaborate on the results of the regression analyses.

4.5.3.1 Predictors of behavioural intention to purchase plastic carrier bags

The model fit summary of the multiple linear regression analysis for predictors of intention at a 95% confidence interval indicates a good model fit of $F(11,166) = 5.655$, $P < 0.001$, Adj $R^2 = 0.224$ and $R^2 = 0.273$. The analysis indicates that situational factors, environmental awareness, and convenience are the predictors of the intention to purchasing and use plastic carrier bag (as shown in Table 4-5).

The coefficient in Table 4-5 assessed the direction and predictive power of independent variables on intention to purchase and use plastic carrier bags.

Table 4-5: Coefficient of independent variables as predictors of intention to purchase and use plastic carrier bags.

Model	Unstandardised Coefficients		Standardised Coefficients	T	Sig.
	B	Std. Error	Beta		
(Constant)	0.191	0.898	…..	0.213	0.832
Situational factors	-0.270	0.115	-0.179	-2.343	0.020
Environmental awareness	0.633	0.115	0.427	5.482	0.000
Convenience	0.374	0.118	0.238	3.161	0.002

The results (see Table 4-5) revealed that environmental awareness is the strongest predictor of intention which can cause a change in behavioural intention of purchasing and using plastic carrier bags, while situational factors have a negative significant predicting power. The same findings were observed in a Taiwanese study were situational variables had a negative association, depowering attitude as a predictor of plastic buying behaviour (Lam & Chen, 2006).

If situational factors/variables are not considered during the implementation of the levy, the purchasing of plastic bags will continue. According to Ajzen (2011), behaviour is influenced by the situations surrounding the consumer that encourages certain behaviour without preconceived intention to perform this behaviour. Hines *et al.* (1987) also highlighted that situational factors can either strengthen or counteract the behaviour. If consumers forget their reusable bags (74.4%; See Table 4-3) or buy more goods than what can fit in their reusable bags (76.9%, See Table 4-3) they will purchase plastic bags even if they are environmentally aware of the impacts of plastic carrier bags or did not have the intention to buy plastic bags. However, if the wish to act/change behaviour is stemmed from the deep-seated desire to reduce plastic bag use, with additional personal benefits such as rewards for not using plastic bags, consumers may more likely plan ahead to avoid shopping situational factors.

The sub-sections below discuss the results of this research in context of existing literature.

4.5.3.1.1 Convenience as a predictor of intention

Approximately 81% of the respondents agreed that plastic bags are readily available in store when they need them (see Table 4-3). Additionally, convenience has a significant weak positive correlation (r = 0.185) with intention (see Table 4-7). While completing the

questionnaire, some respondents voiced that they would rather buy plastic bags instead of walking around carrying reusable shopping bags. Similar findings were observed in Botswana were consumers indicated that alternatives are not as convenient as plastic carrier bags (Mogomotsi *et al.*, 2019). A study by Sun *et al.* (2017) found that convenience is a strong influencer of plastic bags use intention. Further emphasising the point, obtaining plastic bags with ease could lead to consumers purchasing more plastic bags, as discussed in Section 4.5.1.7.

Even if the consumer has a positive attitude, but the convenience is compromised by the situation factors surrounding the shopping practice, they will opt to buy plastic bags, since convenience and situational factors are stronger predictors of intent and behaviour than other predictors, such as attitude (See Table 4-7).

4.5.3.1.2 Attitude and social norms as a predictor of intention

For this research, attitude and social norms were not considered as strong positive predictors of intention. This contradicts findings by Arı and Yılmaz (2017) on consumers attitude toward the use of cloth bags. In their study, positive attitudes and social norms were identified as the strongest predictors towards intention to reduce plastic bag usage.

It is reported that attitude is a weak predictor of pro-environmental behaviour (Aruta, 2021; Isbanner, 2021), but attitude can influence other TPB variables, which has an impact on behavioural change. Huffman *et al.* (2014) echoed that the relationship between behaviour and attitude depends on key motivating factors.

In this research, there was a statistically significant correlation (see Table 4-7) between attitude with situational factors ($r = 0.234$), and between attitudes and social norm ($r = 0.145$), both of which can predict behavioural intention or behaviour. Therefore, it could be assumed that attitude is indirectly mediating intention through other factors on plastic bag use intention or behaviour (Ohtomo & Ohnuma, 2014).

Although social norms are generally reported as being a strong predictor of intention (Fekadu & Kraft, 2002), it could not predict the bag use behavioural intention for this research. This could be due to the neutral average score of the construct as a whole, which signifies the absence of clear societal expectations (see Section 4.5.1.5). According to Aruta (2021), nations with interdependent cultures show social norm to be a strong predictor of behaviour, due to greater interpersonal harmony, adherence to norms and sensitivity to social expectation. However, social norms have a significant moderate positive correlation with intention, therefore, could be regarded as a latent predictor.

4.5.3.2 Behaviour as a dependent variable

The model fit summary of the multiple linear regression analysis of behaviour at a 95% confidence interval shows a good model fit - with F (12, 165) = 11.359, $P < 0.001$, Adj R^2 = 0.413 and R^2 =0.452. The analysis indicates that environmental awareness, PCB, social norms, education, and intention are the predictors of plastic bag purchasing and use behaviour (Table 4-6).

Table 4-6: Coefficient of independent variables as predictors of behaviour to purchase and use plastic carrier bags.

Model	Unstandardised Coefficients		Standardised Coefficients	T	Sig.
	B	Std. Error	Beta		
(Constant)	-0.361	0.566		-0.637	0.525
Environmental Awareness	0.270	0.079	0.252	3.417	0.001
PBC	0.211	0.065	0.203	3.250	0.001
Social norms	0.281	0.068	0.281	4.151	0.000
Education	0.091	0.044	0.123	2.048	0.042
Intention	0.189	0.049	0.261	3.871	0.000

4.5.3.2.1 Environmental awareness as a predictor of behaviour

Environmental awareness, which is the knowledge and understanding of environmental problems associated with plastic carrier bags, is the major predictor of both behavioural intention and actual behaviour. Environmental awareness has a weak and moderate positive significant correlation with education (r = 0.224), and social norms (r = 0.422) (see Table 4-7) which are both predictors of actual behaviour. This could mean that social norms are a latent variable influencing intention through environmental awareness given that social norms do not predict behaviour directly, but rather through intention (Ajzen, 2011). A study on consumers attitude on the use of plastic and cloths bags found that environmental awareness is a positive latent construct affecting intention (Arı & Yılmaz, 2017). Research, therefore, suggests that plastic levies should be accompanied by educational and awareness campaigns to optimally cause a change in plastic bags use behaviour (Convery *et al.,* 2007; Zen *et al.*, 2013). Hines *et al.* (1987) highlight that environmental awareness focused on knowledge of environmental

issues should be accompanied by skill on how to act on the issues to yield positive and consistent behaviour.

4.5.3.2.2 Perceived behavioural control as a predictor of behaviour.

The TPB postulates that perceived behavioural control (PBC), which refers to the ease or difficulty associated with certain behaviour, is a predictor of behavioural intention and actual behaviour. This justifies addressing the ease and difficulty associated with consumer behaviour in relation to plastic carrier bags for effective plastic bags levies (Ajzen, 1991). A higher level of PBC generally corresponds to a greater likelihood of engaging in the behaviour, while lower PBC may hinder or discourage the action (Ajzen, 1991, 2012).

In this study PBC, THAT in part includes convenience and situational factors was the main factor predicting behaviour. Madden *et al.* (1992) explained that PCB provides a direct prediction of behaviour to reflect the consumer's control to perform a behaviour, which includes lack of volitional control, and perception accuracy. For this study, the purchasing and use of plastic bags by consumers happen without the consumers volitional control, and it also validate that the consumers perception of the ease and difficulty of performing behaviours are accurate. Even though PBC is a predictor, it has a neutral score which signifies neither strong nor weak perception making PBC to predict behaviour depending on specific shopping situation.

4.5.3.2.3 Social norms as a predictor of behaviour

The influence of social norms is greater if the behaviour has a collective benefit, is ambiguous or new, and when the consequences are known. Research by Borg *et al.* (2020) conducted in Australia, showed that social norms were the strongest predictor of plastic avoidance behaviour. Further emphasising that, addressing sustainable use of plastic carrier bags through social norm messaging might yield effective collective plastic bags avoidance behaviour. Given that social norm scored neutral average score indicating the absence of clear societal expectation (see Section 4.5.1.5), care should be taken in interpreting social norms as a predictor of behaviour. Additionally, the TPB postulate that social norm do not directly predict behaviour but do so through intention (Ajzen, 1991), which was not the case for this study (see Table 4-5).

4.5.3.2.4 Education as a predictor of behaviour

In this research, level of education (demographic variable) was a weak predictor of behaviour (see Table 4-6) and TPB determinant of information to be only from consumer's behavioural,

normative and control beliefs. However, it provides consumer's education and broad life values, which can influence both intention and behavioural indirectly through the TPB's more proximal determinants (Ajzen, 2011). Education has a weak positive correlation (r = 0.249) with behaviour and environmental awareness (r = 0.244) (see Table 4-7). There was also a significant difference between behaviour and education (H (4) = 16.325, p = 0.003) with consumers with no education being neutral on performing the behaviour while the remaining level of education agree to performing the behaviour. This could be influenced by the environmental awareness as there was a significant difference in consumer awareness in relation to education (H (3) = 22.336, p= 0.001) where awareness increases with education level with high uncertainty observed in people without education and primary education. According to Madigele *et al*. (2017) and Mogomotsi *et al.* (2019) environmental awareness increases with education level and income level.

4.5.3.2.5 Intention as a predictor of behaviour

The findings of this research are similar to what Muralidharan and Sheehan (2016) found, where intention to bring reusable bags was the strongest predictor of actual behaviour. According to Ajzen (1991), the stronger the intention to engage in a behaviour, the higher the chances of performing the actual behaviour if is under volitional control. For this study, intention is a strong predictor of behaviour (see Table 4-6) and has a strong significant corelation (r = 0.605) with behaviour in the purchasing and use of plastic carrier bag behaviour (see Table 4-7). This means that every one unit increase in intentions result in a 60% increase in the behaviour. Although intention is the main predictor of plastic carrier bags purchasing and usage behaviour, intention is predicted by situational factors and convenience, which can result in behaviour being performed unintentionally or without volitional control, which acts as a substitute for actual control and can aid in forecasting the plastic carrier bag purchasing and use behaviour. Therefore, it is essential to address the potential disconnect between intentions and actual behaviour caused by convenience or situational factors by making sustainable choices more convenient.

4.5.4 Spearman correlations of TPB constructs and demographic variables.

Correlation analysis is a statistical technique used to investigate the relationship between two or more variables. It aims to determine whether there is a statistical association or connection between these variables and to what extent they vary together (Hauke & Kossowski, 2011). When applied in the context of the Theory of Planned Behaviour (TPB), correlation analysis helps researchers assess how TPB constructs relate to each other. Furthermore, when

integrated with demographic variables like age, gender, income, or education, correlation analysis provides insights into how individual characteristics influence TPB variables.

Spearman's rank correlation measures the strength and direction of association between two ranked variables. Spearman correlation generally revealed low to moderate significant positive correlation between TPB variables marked with * and ** in Table 4-7. However, there was a weak negative significant correlation between PCB and gender (r = -0.146). This means that for every one unit increase in PBC causes a decrease of 14.6% in the gender ability to reduce their use and purchasing of plastic carrier bags. Intention had a weak to moderate positive significant correlation coefficient with convenience (C), perceived behavioural control (PCB), social norm (SN) and environmental awareness (EA). While behaviour had significant correlations with education, PBC, SN and EA and intention (I). This means that an increase in one variable results in an increase in either intention or behaviour.

Table 4-7: Correlation coefficients between the TPB constructs and demographics.

Variables	Suburb	Gender	Age	Household size	Education	Attitude	SF	C	PBC	SN	EA	I
Suburb	_											
Gender	-0.012											
Age	0.170*	0.03										
Household size	-0.166*	-0.132	-0.259**									
Education	0.012	0	-0.02	-0.086								
Attitude	-0.008	-0.12	0.018	**0.152***	0.094							
Situational factors (SF)	-0.065	0.089	-0.035	**0.164***	-0.008	**0.234****						
Convenience (C)	0.027	0.061	-0.06	0.061	0.098	0.1	**0.242****					
Perceived Behaviour Control (PBC)	-0.046	**-0.146***	0.069	-0.01	0.135	**0.204****	0.123	0.125				
Social norm (SN)	-0.015	-0.024	0.127	-0.025	0.14	**0.145***	0.08	0.006	**0.399****			
Environmental awareness (EA)	-0.057	-0.086	0.041	-0.043	**0.244****	-0.021	0.061	-0.036	0.014	**0.422****		
Intention (I)	-0.036	-0.028	0.039	-0.06	0.12	-0.018	0.001	**0.185***	**0.233****	**0.433****	**0.547****	
Behaviour (B)	0.03	0.001	0.031	0.001	**0.249****	-0.031	0.028	0.106	**0.361****	**0.550****	**0.478****	**0.605****

Correlation is significant at the 0.05 level. ** Correlation is significant at the 0.01 level

4.6 Results related to RO3: Proportion of plastic carrier bags in household plastic waste.

This section provides the results obtained from the household waste characterisation (as outlined in Annexure B), specifically focusing on the proportion of plastic bags within household waste. This was done to supplement self-reported behaviour collected during household surveys, as explained in Section 3.4.2 of this dissertation.

These results are systematically presented in the following subsections: Section 4.6.1 provides the results and discussion on the composition of household plastic waste, Section 4.6.2 presents findings regarding the proportion of plastic packaging subcategories within household waste, Section 4.6.3 explores the quantity of plastic carrier bags observed in household waste, and Section 4.6.4 investigates plastic carrier bag usage in households, both as reported (refer to section B in Annexure A) and as observed (as detailed in Annexure B). Finally, in Section 4.6.5, the observed and reported plastic bag usage behaviour are compared.

4.6.1 Household plastic waste composition

A total of 2457.13 kg of waste was sorted from 484 samples collected from 136 households, of which 537.65 kg (21.9%) was plastic waste. The remaining waste consisted of food waste, sand, glass bottles and garden waste. The weight-to-volume ratio of plastic bags poses a challenge for waste management. Plastic is lightweight, and when assessing waste by weight, which is a standard measure, it may not accurately reflect the extent of plastic waste compared to other materials. This discrepancy arises because plastic typically occupies a significant volume, yet its weight is relatively low (Phuc & Yasuhiro, 2011).

Figure 4-4, below, provides the proportions of plastic waste categories by weight in percentages. Plastic bottles and plastic packaging (which includes plastic carrier bags) were the most generated plastic waste types, accounting for 236.56 kg (44%) and 204.31 kg (38%) of the household plastic waste, respectively. Plastic containers (i.e., butter tubs, yogurt tubs and other containers) contributed to 44.62 kg (or 8.3%), while films and foams jointly contributed to 6.2% of plastic waste. Synthetic hair braids (2.8%) and ropes, tubes and nets (0.7%) were the lowest contributors to total plastic waste (weight) (Figure 4-4). The high contribution of plastic bottles (44%) was mostly due to their presence in the black bags that were provided to the households to separate plastic waste from other waste streams, while the other plastic waste types were mostly retrieved from black bags that were destined for disposal (i.e. these waste were not separated by the households from other waste streams and ended up being disposed of as part of the mixed waste stream instead).

These results are almost similar to the findings of Phuc and Yasuhiro (2011) with plastic bottles, packaging and bags accounting for 73.09% of plastic waste from households in Vietnam. These types of plastic waste are the least recovered materials for recycling due to low values compared to polyethylene terephthalate (PET) and high-density polyethylene (HDPE) plastic material, and because of contamination by other waste types, such as food waste (GAIA, 2020; WWF, 2021).

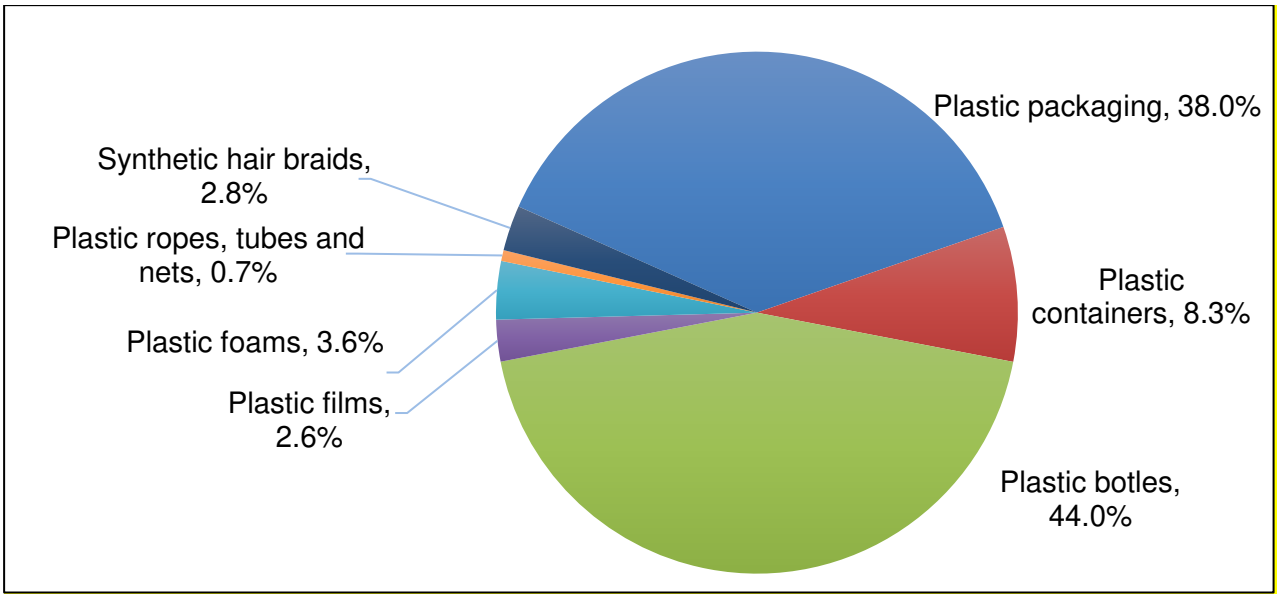

Figure 4-4: Plastic waste categories as a proportion of plastic waste (by weight in percentages)

Table 4-8 provides the Kruskal-Wallis test results between the different types of plastic waste found in the household waste and three variables, namely – suburbs, sampling weeks (week of the month), and household size.

Table 4-8: Statistician test (significance at $p<0.05$) for plastic subcategories at household size, sampling weeks and suburb level

Variables	Plastic packaging	Containers	Bottles	Films	Foams	Ropes, tubes and nets	Synthetic Braids
Suburbs	0.001	0.002	0.471	0.460	0.001	0.171	0.000
Weeks	0.001	0.193	0.004	0.034	0.002	0.184	0.315
Household size	0.001	0.632	0.189	0.008	0.014	0.030	0.008

The distribution of plastic waste categories across suburbs was insignificant for bottles, plastic films, and ropes, tubes and nets ($p>0.05$), while plastic packaging (which includes plastic carrier bags), plastic containers, foams, and synthetic hair braids were significantly different based on their suburbs of origin ($p<0.05$) (see Table 4-8).

A significant difference in plastic packaging waste (which includes plastic carrier bags) was observed across the different suburbs (see Table 4-8, $p<0.05$), with plastic packaging waste showing a decrease as income levels increases. Kuisebmond (low-income area) had the highest average weight of plastic packaging waste (0.4808 kg). This was significantly higher than the amount of plastic packaging in the high-income area, Meersig (0.3111 kg; $p = 0.005$), the middle-income area, Hermes (0.3651kg; $p= 0.015$), and the low-to-middle-income area, Narraville (0.3786 kg; $p=0.020$). The findings contradicts field observations in Botswana by Bolaane and Ali (2004), where plastic packaging waste increased with an increase in income level. The high number of packaging waste in Kuisebmond could be due to waste in the bin being a combination of waste from multiple backyard shacks (as explained earlier), each being an individual household, but sharing one waste bin. It could also be due to larger household size of the lower-income households, in general. Additionally, households in Meersig had high environmental awareness of the impact of plastic waste to the environment, while households in Kuisebmond had the lowest awareness levels (see Section 4.5.1.6), which could lead to plastic packaging avoidance. Gill *et al.* (2020) found that consumers who have a high awareness of the impact of plastic pollution tend to avoid plastic packaging and tend to support plastic reducing policies.

The statistical analysis also shows that there was a significant difference in plastic packaging waste between the different sampling weeks (see Table 4-8), with week three (third week of February) having the least average plastic packaging waste. This is not necessarily because of the type of waste generated during this week, but rather due to factors related to sampling. Week three (of February) was the first week of sampling and most of the collected refuse bags had plastic bottles without plastic carrier bags. During the other three weeks (week four of February, and week one and two of March), plastic waste was collected and picked from the household bins that were destined for disposal. Plastic packaging was also significant across different household sizes (See Table 4-8). The plastic packaging increased with an increase in household size, which is to be expected (i.e., amount of shopping groceries may increase according to household size). Households with two to three individuals had little plastic packaging waste (average of 0.3353kg) and households with ten or more individuals had the most plastic packaging waste (average of 0.5763 kg).

4.6.1.1 Proportions of plastic packaging subcategories

In this research, plastic packaging is represented by a collection of different plastic bags used for packaging of different goods as presented in Figure 4-5. The different types of plastic bags include: (a) plastic carrier bags which consumers receive or purchase at point of sale to carry their goods home; (b) clear plastic bags, also known as ice packaging bags, are transparent low-density polyethylene (LDP 4) plastic bags available in various sizes; (c) Ziplock or sealable bags, which are clear plastic bags and has a zip/sealing closure; (d) manufactured plastic packaging which form an integral part of goods packaging (such as; packaging bags for fresh fruits and vegetable, packaging bags for dry food such as rice and pasta including sachets, packaging bags for frozen foods such as meat and mixed vegetables, non-food packaging such as washing powder bags, and unspecified packaging bags of which the contents or goods cannot be readily identified.)

Plastic carrier bags accounted for 67.32 kg (or 32.9%) of the total 204.31 kg of plastic packaging waste. This accounts to 12.52% of the total amount of plastic waste retrieved from households. This was followed by clear plastics at 34.90 kg (or 17.1%) and unspecified and bulk packaging at 32.57 kg (or 15.8%) (Figure 4-5). According to Convery *et al.* (2007) in their research conducted in Ireland, plastic carrier bags accounted for about 5% of municipal waste. In this research, plastic carrier bags contributed to 2.74% of the total amount of waste collected, and 12.52% towards the total amount of plastics waste assessed (Figure 4-5).

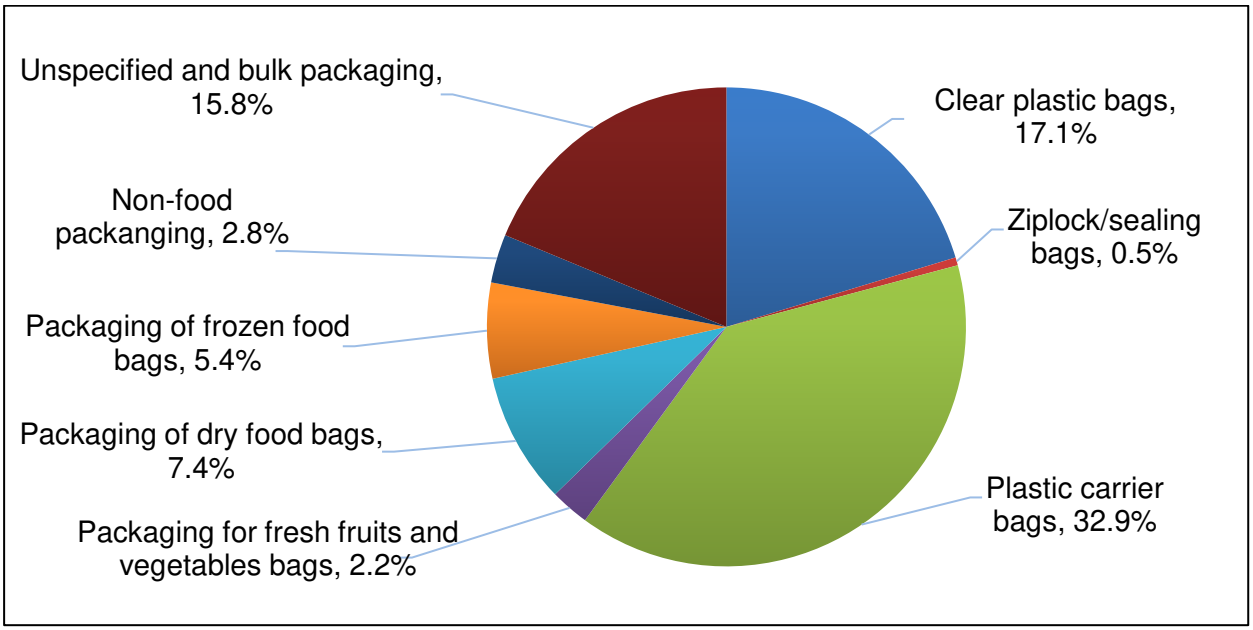

Figure 4-5: Plastic packaging subcategories as a proportion of plastic packaging waste (by weight in percentages)

Table 4-9 provides the Kruskal-Walli's test results between the different types of plastic packaging waste found in the household waste and three variables, namely – suburbs, sampling weeks (week of the month), and household size.

Table 4-9: Statistical test (significant at p<0.05) for plastic packing subcategories at household size, weekly, and suburb level

Variables	Plastic carrier bags	Clear plastic bags	Ziplock bags	Manufactured Plastic packaging					
				Fruits and veg	Dry food	Frozen food	Non-food	Un-specified	Bulk
Suburbs	0.001	0.001	0.005	0.000	0.001	0.008	0.942	0.122	0.033
Weeks	0.054	0.005	0.769	0.010	0.099	0.001	0.040	0.450	0.006
Household size	0.001	0.001	0.068	0.158	0.005	0.104	0.640	0.093	0.074

Differences in plastic carrier bags and clear plastic bag weights were statistically significant between household size and suburb (see Table 4-9).

Similar to the total plastic packaging material weights (discussed in Section 4.6.1 above), the average amount of observed plastic carrier bags was high in Kuisebmond (average of 0.165kg) and low in Meersig (average of 0.086 kg). Meersig was significantly different from other suburbs having the least average number of plastic carrier bags observed and contributing to most of the significance observed between suburbs (also see Figure 4-6 with plastic carrier bag count). However, there was no significant difference observed between Hermes (average of 0.109 kg) and Narraville (average of 0.125 kg), and Narraville and Kuisebmond. This could be due to suburbs lifestyles being slightly similar and have overlapping income (Walvis Bay municipality, 2014).

Additionally, and similar to the observations discussed in Section 4.6.1 above, plastic carrier bags increase with an increase in household size. There was a significant difference in average number of plastic carrier bags observed in households with two to three occupants and those with seven or more occupants. These results contradict the findings of Phuc and Yasuhiro (2011) in Vietnam, where the number of plastic carrier bags decreased with household size. In their research households with one to two members used an average six to ten plastic carrier bags, while households with more than eight members used an average of five plastic bags per week.

4.6.2 Plastic shopping bags (count) observed in household waste.

Figure 4-6 provides the average number (count) of plastic bags per household per week over the four sampling weeks (weeks three and four are the first two sampling weeks, conducted in February 2023, while weeks one and two are the last two sampling weeks, conducted in March 2023).

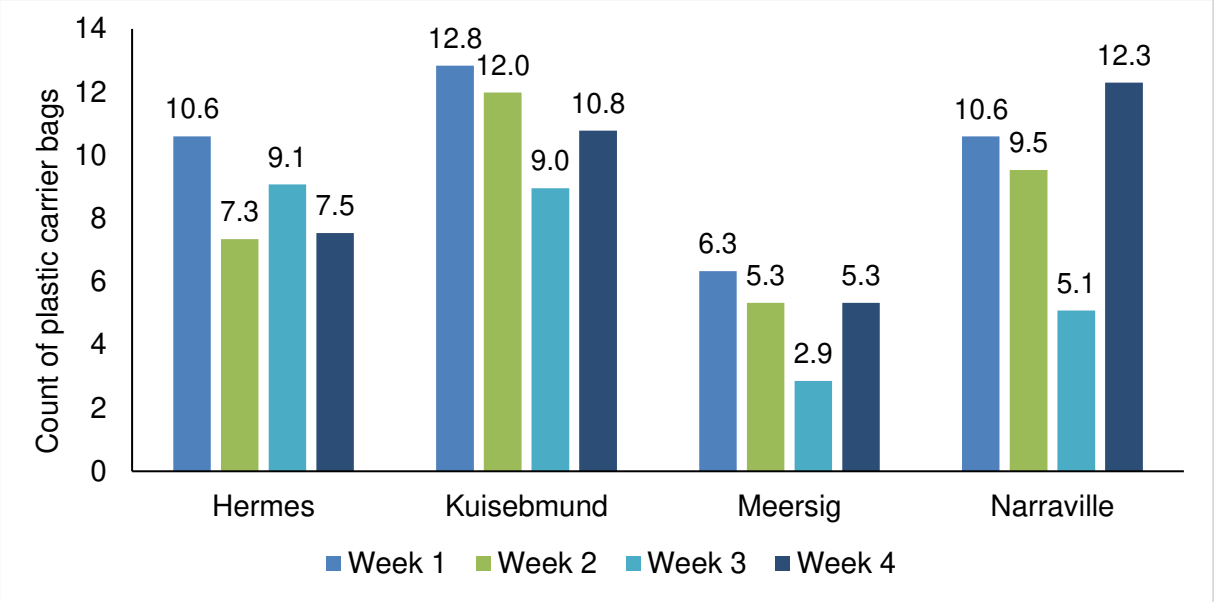

Figure 4-6: Average number (count) of plastic bags observed per household per week per suburb.

A total count of 4873 plastic carrier bags (weighing 67.32 kg) were found in the 537.65 kg of sampled plastic waste. On average, 7.8 to 11.3 plastic bags are used per household per week, with more plastic observed in first (week of March) and fourth week (of February). These differences were, however, not statistically significant (p = 0.054; Table 4 9). Similarly, Arı and Yılmaz (2017) observed that eight to nine plastic bags are taken home weekly as a result of shopping.

The low number of observed plastic bags in the third week of February (week one of the research) could be due to the sampling approach followed in the first week of the research, where households were given a black bag and asked to add all plastic waste to the black bag. These sampled plastics were the only plastics taken into consideration during this first week of the research (week 3 of February). As explained in Section 3.4.2.1, the sampling approach was adapted from the second sampling week onwards, to also include plastic waste retrieved from household waste bins.

The high-income suburb, Meersig, had the lowest average number of plastic carrier bags observed among all suburbs (see Figure 4-6) across all four weeks. Kuisebmond (low-income area) on the other hand, had the highest average amount of plastic carrier bags. This difference may be ascribed to income-level, age of inhabitants, environmental awareness, household size and/or other factors, such as lifestyle. For instance, most consumers in Meersig own cars, which may reduce their plastic bag usage as they can push trollies from the till point to their car and pack goods not requiring plastic carrier bag packaging directly into their cars. Mukucha e*t al.* (2023) mention that lifestyle factors, such as owning a vehicle, may significantly reduce reliance on plastic carrier bags to transfer groceries from point A to point B. This is an option that is not possible when boarding in a shared taxi, or when carrying groceries on foot, which are the typical means of transport in areas such as Kuisebmond.

As mentioned earlier, the number of inhabitants sharing one erven in the low-income area, Kuisebmond, may also have an impact on the number of plastic bags observed per household.

4.6.3 Plastic carrier bag reuse by households

The self-reported (Section 4.6.3.1) and observed (Section 4.6.3.2) reuse of plastic carrier bags are reported below, while Section 4.6.3.3 compares self-reported and observed behaviour.

4.6.3.1 Self-reported reuse of plastic carrier bags

As discussed in Section 4.5.1.8, 90% of respondents agreed or strongly agreed that they reuse plastic carrier bags at home (B29; Table 4-3). Although the practice of plastic bag reuse at home is recommendable, certain uses can contaminate the bags to such an extent that it cannot be reused, recycled or recovered in future. In accordance with the waste management hierarchy, plastic bag avoidance should be the primary focus with regards to changing consumer behaviour (Arı & Yılmaz, 2017). Plastic bags are currently not recycled in Namibia, but form part of Refuse Derived Fuel (RDF) to generate energy (waste-to-energy process)[6].

Figure 4-7 provides the survey responses of participants regarding their means of reusing plastic carrier bags. Respondents indicated that they used plastic carrier bags to “pick waste” (i.e., pick up animal waste or pick up garden waste when cleaning) (29.9%), to store goods (23.3%), as waste bin liners (22.1%) and as freezer bags for food (21.1%) (Figure 4-7), with 3.6% of respondents indicating that they use if for other purposes. A study in Zimbabwe indicated that plastic carrier bags are mostly reused for shopping (59.6%) (Chitotombe, 2014), and that it is

[6] Interview with manager at the recycling company, Rent-A-Drum, reported about 1% of plastic bags being part of the Refuse Derived Fuels (RDFs) .

frequently used for waste disposal (Mukucha, 2023). The same trend in reuse of plastic carrier bags as bin liners was observed in Malaysia, suggesting that the use of plastic carrier bags should be considered from the solid waste management perspective (Zen *et al*., 2013).

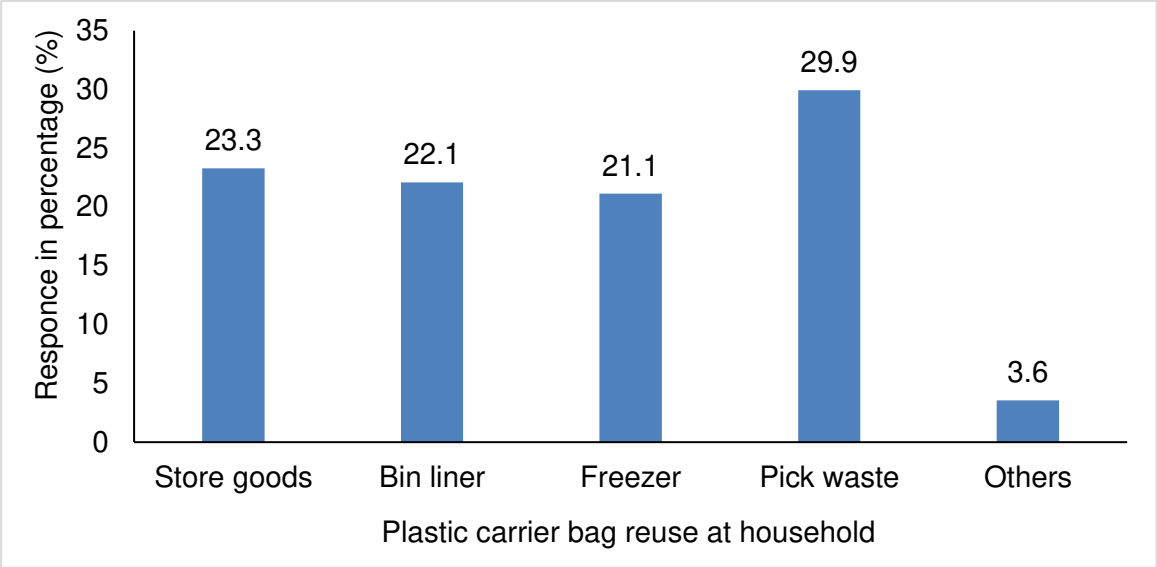

Figure 4-7: Responses related to the question of reuse of plastic bags in the household (n = 183 participants)

Section 4.6.3.2 provides an overview of the observed reuse of plastic carrier bags retrieved from household waste bins.

4.6.3.2 Observed reuse of plastic carrier bags

Out of a total count of 4873 plastic bags retrieved from household waste, it was observed that 2305 (or 47.3%) of plastic carrier bags were reused for waste disposal related activities by households. This is similar to the average of 55% of plastic carrier bags reused as bin liner in California (AECOM, 2010) and lower than the 84% of plastic carrier bags reused as waste bin bags reported by Montoya (2003) in Australia.

A total of 2568 (or 52.7%) of plastic carrier bags retrieved from household waste were disposed of without any evidence of being reused (i.e., bags were empty and not contaminated with any visible waste/residue). Some of these plastic bags were evidently wet (used for packaging of wet/frozen items), which could be the reason for it being discarded. Flimsy/thin plastic carrier bags (generally used at the open market or by informal vendors) were mostly ripped or torn, with no evidence of reuse. Thin plastic bags which are used to separate cosmetics or cleaning products from other goods, were also found to be discarded without evidence of reuse.

It was unexpected to observe the disposal of several thick (50 micron), large plastic bags from Shoprite without evident reuse. Notably, Hasson's study (Hasson *et al.*, 2007) indicated that the thickness of plastic carrier bags does not influence the perceived value of these bags, offering intriguing insights into consumer behaviour.

Small plastic bags without handles, mostly used to sell fried potato chips from takeaway shops, were also frequently found. These bags were covered by oily food residues, and it was, therefore, not surprising to see these bags being discarded. Plastic carrier bags with remnants of frozen food were also observed, and plastic carrier bags filled with waste materials (used as waste bin bags), garden waste and sand, nappies or animal faeces were frequently found.

The Walvis Bay Solid Waste and Hazardous Management regulations under the Local Authority Act (No. 23 of 1992) stipulate that domestic waste that may cause any sorts of nuisance during the collection and disposal should be put in bin liner before disposal in the bin (Walvis Bay municipality, 2011) and that garden waste and sand are not allowed in the municipality household bins. Therefore, households may have attempted to “hide” these wastes by enclosing it in plastic carrier bags before being disposed of in the bin.

4.6.3.3 Comparison of self-reported and observed consumer reuse behaviour of plastic carrier bags.

To determine if self-reported behaviour aligns to what is being practiced, observed plastic reuse behaviour (also see Section 4.6.3.2) was compared to self-reported plastic bag reuse behaviour (also see Section 4.6.3.1). The analysis was only done for the 132 households completed the questionnaire and provided access/permission for their waste to be characterised. From the survey (see B29 in Table 4-3), 90% of consumers agreed or strongly agreed that they reuse plastic bags at home. Moreover, 97.3% of respondents indicated that they reuse plastic carrier bags at home, based on responses to a “yes/no question” (see Annex A, section B). However, based on observations during a four-week period, evidence of reuse of plastic carrier bags were only observed at 69.5% of the households sampled.

This disparity could be attributed to instances of unobserved plastic carrier bag reuse not accounted for in household waste observations. For instance, individuals might reuse plastic bags for storing or packaging goods, as illustrated in Figure 4-7, or for purposes like carrying items when sharing with friends or utilising them for shopping. The prolonged presence of these plastic bags in circulation delays their appearance in the waste bin, contributing to the discrepancy between reported and observed behaviour.

Efforts to establish a correlation between self-reported and observed behaviours yielded insignificant results, suggesting a misalignment between the variables measured in the two datasets. Kormos and Gifford (2014) pointed out that the unit of analysis, whether individual or household, may influence the observed association. This is because estimating the behaviour of others within the household could pose a greater challenge compared to self-estimation. The difficulty in accurately gauging the actions of others may impact the alignment between reported and observed plastic bags use behaviour in household waste.

4.7 Chapter summary

To evaluate consumers' awareness and perceptions of the Namibian plastic bags levy (RO1), the following key findings were observed from the research:

- **Pricing uncertainty:** A significant 60.4% of respondents believed that different stores charged the same price for plastic carrier bags, contrary to the actual situation in Namibia. This suggests a notable level of uncertainty among consumers regarding the pricing of plastic bags.

- **Knowledge of bag prices:** The majority of consumers (62.3%) demonstrated accurate knowledge of the prices of plastic bags. Notably, most food shops charged N$1.00 for 24-liter plastic bags. However, variations in pricing were observed, particularly in smaller shops situated in different suburbs.

- **Willingness to pay:** Generally, consumers exhibited a willingness to pay for plastic carrier bags, with a minimal 4.7% expressing unwillingness to do so. Nevertheless, this willingness was contingent on the price point, with the following breakdown: 68.2% of respondents were willing to pay N$0.50; 18.8% were willing to pay N$1.00; and only 1% of respondents were willing to pay N$2.50 or more, indicating a sharp decline in willingness as the price of plastic carrier bags increased.

Factors influencing consumers' behaviour when choosing to use plastic carrier bags were determined using the Theory of Planned Behaviour (TPB) (RO2). The following main findings were made:

- **Situational factors and convenience:** Respondents largely agreed that situational factors, such as forgetting personal reusable bags and buying more items than planned, cashier not disclosing the plastic carrier bags price, along with the convenience of readily available plastic bags, influenced their decision to purchase plastic carrier bags.

- **Attitudes:** Participants generally exhibited positive attitudes towards the plastic bag levy, with 53% supporting it. Moreover, a significant majority (82.2%) felt a responsibility to reduce plastic bag generation, and 60.7% believed that paying for plastic bags could decrease plastic waste.

- **Perceived Behavioural Control (PBC):** While participants found plastic bags more effective (stronger/durable) and cost-efficient than alternatives, only 46.6% indicated ready availability of these alternatives.

- **Social norms:** Social norms, particularly within the Walvis Bay community, showed neutrality, with limited influence from family or valued individuals.

- **Environmental awareness:** Respondents demonstrated environmental awareness, with 65.9% recognising the negative impact of plastic bags on Namibian landscapes. Majority (63.9%) claimed that the environmental consequences of plastic bags would motivate them to use reusable bags.

- **Behavioural intentions:** The willingness to reduce plastic bag use (68%) and the intention to reuse plastic bags at home (83.3%) were prevalent. However, only 42.9% intended to advocate for reduced plastic bag use, reflecting the observed neutral social norms. Around 47% had no intention of buying plastic bags while shopping.

- **Self-reported behaviour:** Approximately 42% of respondents actively avoided purchasing plastic bags, while almost half (49%) brought their reusable bags for shopping in the past four weeks. Nearly 90% of participants reported reusing plastic bags at home.

- **Predictors of behavioural intention and actual behaviour:** Situational factors, convenience, and environmental awareness emerged as significant predictors of behavioural intention to purchase and use plastic bags. PBC, behavioural intention, social norms, and environmental awareness were identified as predictors of actual behaviour.

- **Correlations:** No significant correlations were found between suburbs and TPB constructs. However, gender exhibited a negative correlation with PCB, household size correlated positively with attitude and situational factors, and education level had positive correlations with environmental awareness and reported behaviour.

When determining the proportion of plastic bags observed in household plastic waste while validating reported behaviour (RO3), the following main findings were made:

- **Composition of household plastic waste:** Plastic waste in households primarily comprised of plastic bottles (41.1%) and plastic packaging (35.5%), with plastic carrier bags constituting 12.52% of the total plastic waste sample.

- **Plastic packaging composition:** Plastic packaging, a collection of various plastic bags used for packaging goods, is primarily composed of plastic carrier bags (32.9%) and clear plastic bags (17.1%). Notably, both bag types showed statistical significance concerning suburb and household size.

- **Quantity and distribution of plastic carrier bags:** A total of 4873 plastic carrier bags were identified in the sampled plastic waste, with Meersig contributing the least and Kuisebmond contributing the most. On average, households utilised 7.8 to 11.3 plastic bags per week.

- **Reuse of plastic carrier bags**: Of the plastic carrier bags recovered from household waste bins, 47.3% were repurposed as bin liners or used for the disposal of garden waste, food waste, and/or pet faeces. Notably, a significant proportion of plastic carrier bags were disposed of without any visible evidence of reuse.

- **Discrepancy in reported and observed reuse of plastic carrier bags:** Comparing self-reported to observed reuse of plastic carrier bags revealed a contrast. While 97.3% claimed to reuse plastic bags at home, only 69.5% of observed household samples showed evidence of reuse in their waste bins. Directly comparing observed versus self-reported reuse is challenging, given that plastic carrier bags may still be in circulation, being reused (and not disposed of) during the research period.

CHAPTER 5 CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter provides conclusions and recommendations to this research which aimed to evaluate consumer behaviour related to plastic carrier bags in Namibia, with Walvis Bay as a case study. The study applied the Theory of Planned Behaviour (TPB) to understand consumer behaviour related to plastic carrier bags. Self-reported data, collected through a TPB-based survey questionnaire, was administered at the household level. A total of 195 households from four suburbs in Walvis Bay (Kuisebmond, Narraville, Hermes and Meersig) participated in the research. Self-reported data were supplemented by observations of the proportions of plastic carrier bags in household plastic waste.

Section 5.2 present the research conclusions related to each of the three research objectives, while Section 5.3 proposes recommendations towards improving plastic carrier bag related behaviour, and to achieve a reduction in the use and disposal of plastic carrier bags, as well as areas for future research.

5.2 Conclusions

The sub-sections to Section 5.2 provide the conclusions related to the three research objectives:

1. ***Research objective 1:*** Assess consumers' awareness and perceptions about the Namibian plastic bag levy.
2. ***Research objective 2:*** Assess the factors that influence consumers' behaviour related to plastic carrier bag use through the TPB.
3. ***Research objective 3:*** Determine the proportions of plastic carrier bags in household plastic waste to supplement self-reported behaviour (in RO2).

5.2.1 Conclusions on RO1: Assess consumers' awareness and perceptions about the plastic bag levy.

Consumer awareness of plastic carrier bag charges plays a crucial role in addressing environmental and economic challenges associated with plastic pollution (Hasson *et al.*, 2007). At the time of conducting this research, the average price of commonly used 24-litre plastic carrier bag in Walvis Bay ranged from N$1.00 to N$2.50, with slight differences in price between different shops. Most of the respondents (62.3%) demonstrated an accurate knowledge of the price range of plastic bags. Nonetheless, the majority of participants (60.4%) believed that all shops charged

the same price for plastic carrier bags. Although the price of a standard 24-litre plastic carrier bag is around N$1.00, the price the bags vary slightly depending on the size of the plastic bags, the store selling the plastic bag, and the suburb. The uncertainty around price could be due to the unannounced price change from N$0.50 to N$1.00 which took effect in February 2021. According to Convery *et al.* (2007) and Dikgang *et al.* (2012) levy adjustments may raise awareness and promote the avoidance of plastic carrier bags among consumers, but without effective communication, it may not influence behaviour due to consumers being unaware of the price increase. Policy adjustments, such as increases in plastic carrier bag levies, should be aligned with communication strategies, to enhance the overall impact of measures aimed at reducing plastic carrier bag usage (Neef *et al.*, 2023).

Determining the factors that influence the willingness to pay for plastic carrier bags is crucial for understanding consumer behaviour and promoting sustainability (GAIA, 2020; Santos *et al.*, 2013). Generally, respondents exhibited a willingness to pay for plastic carrier bags, with a minimal 4.7% expressing unwillingness to do so. Low-to middle income households expressed a higher reluctance towards paying for plastic carrier bags than high-income households. The willingness to pay for plastic carrier bags was contingent on the price point, with a decrease in willingness to pay as the price of plastic carrier bags increases. The majority of respondents were willing to pay N$0.50 to N$1.00 for a plastic carrier bag. Dikgang *et al.* (2012) and Madigele *et al.* (2017) have reported similar findings and suggest that the price of plastic carrier bags should be adjusted high enough that a consumer will make conscious decision before purchasing a plastic carrier bag. Similarly, the price of alternatives, such as paper and reusable cotton bags should also be kept at a reasonable level to be more competitive with plastic carrier bags.

5.2.2 Conclusions on RO2: Assess the factors that influence consumers' behaviour related to plastic carrier bag use through the TPB.

In conclusion, the Theory of Planned Behaviour (TPB) serves as a comprehensive framework for understanding the multifaceted factors influencing consumers' behaviour in choosing to use plastic carrier bags. Examining the TPB constructs, situational factors and convenience emerged as influential elements, with respondents expressing agreement that these aspects significantly impact their decision to purchase plastic carrier bags. Notably, both situational factors and convenience proved to be strong predictors of both intention and actual behaviour, aligning with previous studies by Lam and Chen (2006) and Sun *et al.* (2017).

Age played a significant role in situational factor influence, with older consumers dissenting while younger consumers concurred on the impact of situational factors. This divergence could be attributed to generational differences in shopping planning, emphasising the situational nature of

consumer behaviour as elucidated by Ajzen (2011). Environmental awareness significantly correlated with education levels and suburbs, demonstrating a noteworthy correlation with behavioural intention and actual behaviour. The findings align with studies by Arı and Yılmaz (2017) and Madigele *et al.* (2017), advocating for the incorporation of educational and awareness campaigns alongside plastic levies.

Perceived Behavioural Control (PBC) and social norms, despite receiving average/neutral Likert-scores, emerged as significant predictors of actual behaviour. The neutral score on social norms implies a potential absence of societal pressure, yet PBC's negative correlation with gender suggests a gender-related influence on plastic bag purchasing behaviour. Intention, scoring positively, was identified as a robust predictor of behaviour, echoing findings from studies by Muralidharan and Sheehan (2016). However, it is crucial to note that intention itself is influenced by situational factors and convenience, highlighting a potential cycle of unsustainable behaviour when it comes to decisions concerning the purchasing and use of plastic carrier bags.

Surprisingly, attitude did not directly predict intention, aligning with the findings of Ohtomo and Ohnuma (2014). Instead, attitude exhibited significant correlations with behaviour, emphasising its nuanced role in shaping overall plastic carrier bag use behaviour, especially in socially interdependent cultures (Aruta, 2021). The integration of TPB constructs revealed a complex interplay of factors that collectively contribute to the decision-making process surrounding plastic carrier bag usage.

The study's broader findings provide a comprehensive understanding of the factors influencing consumers' choices regarding plastic carrier bags in Walvis Bay, Namibia. While situational factors, convenience, and environmental awareness emerged as prominent predictors, the intricate relationships between these factors underscore the need for nuanced interventions. The study supports the recommendation that plastic levies should be complemented by targeted educational and awareness campaigns, acknowledging the importance of addressing situational factors and convenience to foster sustainable consumer behaviour.

Although the TPB provides a useful framework towards exploring the factors influencing behaviour related to the purchase and use of plastic carrier bags, the limitation of the framework is that it relies on self-reported elements of behaviour. It is well-known that self-reported behaviour may be subjective and need to be supplemented by observed behaviour, where possible.

5.2.3 Conclusions on RO3: Determine the proportions of plastic carrier bags in household plastic waste to supplement self-reported behaviour.

Determining the proportion of plastic carrier bags in household waste is crucial for effective waste management, reducing plastic pollution, and informing environmental policies (Anders, 2008). During the observation of plastic waste in household settings to supplement of self-reported behaviour, several key findings emerged. The composition of household plastic waste was dominated by plastic bottles (41.1%) and plastic packaging (35.5%), with plastic carrier bags accounting for 12.52% of the total plastic waste sample. Plastic packaging, a diverse collection of plastic bags used for packaging goods, consisted mainly of plastic carrier bags (32.9%) and clear plastic bags (17.1%), both of which showed statistical significance concerning suburb and household size. These findings are conservative when compared to the research by Phuc and Yasuhiro (2011) that found plastic packaging and containers to account for 95.64% of plastic waste, with plastic carrier bags accounting for 45.72%.

The quantity and distribution of plastic carrier bags revealed that 4873 bags were identified in the sampled plastic waste, with the high-income area, Meersig, contributing the least and the low-income area, Kuisebmond, contributing the most. On average, households were found to utilised between 7.8 and 11.3 plastic bags per week.

The reuse of plastic carrier bags was a notable aspect, with 47.3% being repurposed for various purposes, such as bin liners or the disposal of garden waste, food waste, and/or pet faeces. However, a substantial proportion of plastic carrier bags were disposed of without any visible evidence of reuse. The results compare to research findings conducted in a Californian study in 2010, where 55% of plastic carrier bags were reused as bin liners (AECOM, 2010).

Discrepancies emerged between reported and observed reuse of plastic carrier bags. While 97.3% claimed to reuse plastic bags at home, only 69.5% of observed household samples showed evidence of reuse in their waste bins. This contrast underscores the challenges in directly comparing observed versus self-reported reuse, as plastic bags may still be in circulation and actively reused during the research period.

The observed differences in plastic waste composition and reuse behaviour compared to reported behaviour highlight the intricacies involved in understanding and accurately assessing household plastic waste management practices. The study's insights are crucial for effective waste management, especially in the context of reducing plastic pollution and informing environmentally sound policies. Again, the findings underscore the need for nuanced approaches to encourage

sustainable practices, considering factors such as suburb characteristics and household size that impact plastic waste behaviour.

5.3 Recommendations

Considering the results obtained from this study, the following recommendations can be proposed.

5.3.1 Recommendations to reduce the use of plastic carrier bags.

Recommendations for reducing the use of plastic carrier bags encompass a multifaceted approach aimed at promoting informed consumer choices and fostering sustainable behaviour. Firstly, adjustments/increases to the plastic carrier bags levy are recommended. The current levy of N$0.50 and production costs bring the price of a standard 24-litre plastic carrier bag in Namibia to about N$1.00. This cost is insignificant and does not sufficiently deter consumers, especially those with middle- and high-incomes, from buying plastic carrier bags. The price is also relatively low when compared to the cost of alternatives, such as paper bags and reusable cloth bags. Furthermore, any adjustments or increases to the price of plastic carrier bags should be communicated to the public, and pricing should be regulated to ensure transparency. This measure is vital for enhancing consumer awareness of the new pricing structure.

Since the use of plastic carrier bags may be based on habitual behaviour (i.e., opting for plastic carrier bags without thinking about it), it is proposed that plastic carrier bags are relocated from the point of payment (till) to store shelves to minimise impulsive purchasing and encourage more thoughtful consumer decisions.

Recognising that situational factors and convenience heavily influence consumers' reliance on plastic carrier bags, it is imperative to address these factors and make avoiding plastic bags more convenient. Awareness campaigns should extend beyond the environmental, health, and economic impacts of plastic bags to provide practical solutions for hassle-free shopping. Public awareness campaigns, disseminated through diverse channels like radio, TV, and social media, can serve as reminders for individuals to bring reusable bags while shopping, emphasising the importance of consistent use. Treating plastic pollution as a public health issue is crucial to underscore its significance.

Introducing a comprehensive rewards programme is identified as another effective strategy. Such a programme, offering tangible benefits like discounts, loyalty points, or vouchers, serves to incentivise consumers to consistently choose reusable bags over plastic carrier bags. Accompanied by a robust public awareness campaign, this initiative communicates the

advantages of sustainable behaviour, creating a stronger incentive for compliance and environmental responsibility.

Lastly, in alignment with local regulations, particularly the Walvis Bay Solid Waste and Hazardous Management regulations under the Local Authority Act (No. 23 of 1992), exploring alternatives to plastic carrier bags is recommended. This may involve introducing biodegradable bin liners for household waste or implementing a dual-bin system to separate organic waste from other refuse. By promoting sustainable waste management practices, these measures contribute to a more environmentally responsible and efficient waste disposal system, reducing reliance on plastic carrier bags and fostering a holistic approach to environmental stewardship.

5.3.2 Recommendations and areas of future research

To advance our understanding of the determinants of plastic carrier bag use and the presence of these bags in household waste, as well as to fortify the research's robustness, the following recommendations for future studies are proposed:

Diverse geographical replication: Future research endeavours should replicate the study in various towns across Namibia, encompassing a spectrum of geographical locations, including both urban and rural areas. This approach aims to furnish a more comprehensive perspective on the factors influencing plastic carrier bag use and waste composition, acknowledging regional variations and potential seasonal effects that might impact the findings.

Refinement of measurement scale: It may be worthwhile to concentrate on refining the TPB framework to bolster the validity and internal consistency of the construct variables. Beyond assessing overall reliability, adjustments to the scale/framework should be made to accurately capture the underlying factors influencing plastic carrier bag use, specifically targeting elements such as social norms and perceived behavioural control.

Expansion of TPB construct items: It is advised that future studies augment and broaden the items within the TPB constructs to comprehensively encompass all pertinent factors. This expansion will contribute to a more exhaustive understanding of the variables, especially social norms and perceived behavioural control, thereby facilitating a more robust analysis of plastic carrier bag use.

Focus on head of household participation: Future studies should strategically target the participation of the head of the household in surveys. This strategic approach can yield valuable insights into the social norms influencing plastic carrier bag use within households, recognising

the pivotal role often played by the head of the household in decision-making processes related to waste management.

Diversification of data collection methods: To elevate response rates (especially in high-income suburbs) and refine the overall data collection process, researchers should explore the utilisation of multiple data collection methods. A combination of online surveys, postal questionnaires, and in-person questionnaire administration can generate a more comprehensive dataset, ensuring a more representative sample of participants and elevating the quality of the study's findings.

Under representation of plastic carrier bags in household plastic waste: For future studies or potential repetitions of this research, it is recommended to enhance data collection and sampling methodologies related to plastic carrier bags used at the household level. To address the underrepresentation of plastic carrier bags in household plastic waste, it is advisable for researchers to directly collect plastic waste from household bins. This approach ensures a more comprehensive representation of both plastic carrier bag usage and plastic waste composition, as opposed to relying solely on clean plastic waste provided by household members, which may contain fewer plastic carrier bags due to being packed alongside other waste materials.

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ANNEXURE A: Participant consent form and survey questionnaire

Understanding plastic bag use behaviours

Gobabeb - Namib Research Institute, with support of the **Municipality of Walvis Bay** and **Namibian Chamber of Environment (NCE)** is conducting a survey to understand the behaviour regarding plastic shopping bag use from the residents of Walvis Bay. The survey will form part of a master's dissertation which will be submitted in partial fulfilment of the requirements for the MSc in Geography and Environmental Management at the North-West University. The study is entitled *"Evaluating consumer behaviours related to plastic carrier bags: A Namibian case study"* which aims to understand consumer behaviour related to the buying and use of plastic carrier bags / plastic shopping bags at household level.

By your voluntary participation, you will be assisting the Municipality to address more effectively the issue of plastic pollution which can be reduced in Walvis Bay and at national level. Your answers will be anonymous and cannot be linked to you personally. The questionnaire takes about 5- 10 minutes to complete, but you can stop at any time if discomfort is experienced. This research has obtained ethical clearance NWU_01314-22-A9 from the Faculty of Natural and Agricultural Science Ethics Committee (FNAS-REC)

If you have any questions or concerns about the research, please feel free to contact Ndapandula Shihepo at kapandushihepo@gmail.com

Participant consent

I confirm that the above information was explained to me in a language and in a manner that I understand. I further confirm that I am older than 18 years of age and hereby volunteer to take part in the study (sign)_____

Section A: Demographics

a) **Street name**_____ **ERVEN number**_____
Suburb_____

b) **Gender**: Female ☐ Male ☐ Other (specify)_____

c) **Age**: 18 -29 ☐ 30-39 ☐ 40-49 ☐ 50-59 ☐ 60-69 ☐ 70 and above ☐

d) **Total number of people living in the house**? _____

a. How many are **Adults** _____ and are **children** _____

e) **Highest education level of breadwinner:** No education ☐ Primary school ☐
Secondary school ☐ Tertiary education ☐ Adult education/Literacy ☐

Section B: Questionnaire

1. On average **how many** plastic shopping bags do you buy when you go grocery shopping?

   Fill in the blank.

   a) Big planned shopping _____

   b) Small unplanned shopping _____

2. Grocery stores charge the same price for plastic shopping bags? **YES** ☐ **NO** ☐
   2.1. How much do you pay for a plastic bag in a food store? N$_____

3. What amount are you willing to pay for a plastic shopping bag at any food store (in N$)
   a) 0.50 ☐ b) 1.00 ☐ c)2.00 d) 2.50 ☐ e)3.00 ☐ f) 3.50 ☐

4. Plastic shopping bags are reused in my house **YES** ☐ **NO** ☐

   4.1. They are reused to:
   a) Store goods ☐ b) As bin liner ☐ c) Freezer bags ☐
   d) Pick up waste ☐ e) Other (specify)_____

5. I dispose of my plastic shopping bags the weeks I bought them. **True** ☐ **False** ☐

Section C

6. Please think carefully about each statement and then indicate to what extent you agree with the statements, from strongly agree to strongly disagree. Tick in the option that applies to you.

Statements	**1 Strongly agree**	**2 Agree**	**3 Neutral**	**4 Disagree**	**5 Strongly disagree**
1. I support the levy on plastic shopping bags					
2. I take advantage of shopping to buy Plastic shopping bags					
3. It is my responsibility to lower the volume of plastic waste I generate					
4. Paying for plastic shopping bags at grocery store helps reduce plastic waste in the environment					
5. Sometimes I forget my reusable bags at home when going shopping					
6. Sometimes I buy too many things requiring me to ask for Plastic shopping bags					
7. Cashiers do not tell me the price of plastic shopping bags					
8. I buy more plastics to double heavy goods					
9. I prefer products such as food and cosmetics to be packed separate from each other					
10. Plastic bag are readily available in store when I need them					
11. Plastic shopping bags are convenient to use					
12. I do not use plastic shopping bags because I have to pay for them					
13. 13. Is easy for me to bring a reusable bag when going shopping					
14. I buy plastic shopping bags because the alternatives are not as good as plastic shopping bags					

Statements	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
15. There are no alternatives to plastic shopping bags in store					
16. I choose to buy reusable bags regardless of the price in order to reduce my use for plastic shopping bags					
17. My family would prefer I should not buy plastic shopping bags					
18. Important people in my close environment would support me if I tried to avoid using plastic shopping bags when shopping.					
19. People whose opinions I value try to use fewer plastic shopping bags when shopping					
20. People in my street do not carry their grocery in plastic bags. They are always using reusable bags.					
21. Plastic shopping bags damage the beauty of the country					
22. The impacts of plastic shopping bags motivate me to bring my own reusable bag when I go shopping					
23. Plastic bag levy aims to reduce the buying of plastic shopping bags					
24. Buying plastic shopping bags increases plastic waste at the landfill and in the ocean					
25. I intend to use the plastic shopping bags at home					
26. I intend to tell others to stop or reduce buying plastic shopping bags					
27. I do not intent to buy plastic shopping bags when shopping					

Statements	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
28. I am willing to reduce my use of plastic shopping bags					
29. I reuse my plastic shopping bags at home					
30. I actively advocate with my friends and family that we all use fewer plastic bags					
31. I refuse to buy plastic shopping bags					
32. In the last 4 weeks I took my own reusable shopping bags for shopping					

THANK YOU FOR YOU PARTICIPATION

ANNEXURE B: Household plastic waste characterisation recording sheet.

Plastic waste composition, sorted at household level

Date: _____Suburb name: _____ Street name: _____ Erven no: _____

Weight of the refuse bag (Kg)_____Number of people in the house_____ Plastic bags waste present _____ How many_____

Level II	Level III	Bucket weight	Plastic weight	Count	Comments on the nature of the plastic bags in the refuse bag
1. Plastic bags	Plastic shopping bags				
	Clear plastic bags				
	Ziplock bags				
2. Packaging	Packaging bags of fresh fruits and vegetables				
	Packaging of dry food bags				
	Packaging of frozen food bags				
	Non-food packaging				
	Unspecified packaging				
3. Plastic containers	Containers for food product				
	Containers for non-food product				

	Other containers				
4. Plastic bottles	PET bottles for beverages				
	PET bottles for food				
	Other PET bottles				
	HDPE food and drinks bottles				
	Other HDPE bottles				
	Unspecified bottles				
5. Plastic films	Clingy plastic films				
	Flat films				
	Plastic wraps				
7. Foams	Styrofoam trays				
	Other Styrofoam				
8. Sachets	Plastic only				
	Plastic and paper				
	Plastic and foil				
	Plastic paper and foil				
	Nets				

9. Plastic ropes and nets	Ropes				
	Tubes				
10. Cartons	Tetra-pack				
	Not specified				
11. Unspecified Plastic					