FACULTY OF EDUCATION AND HUMANITIES

PERSONAL RESEARCH REPORT

Assessment of Factors Driving High Polythene Bag Consumption and Evaluation of Sustainable Alternatives in Chuku Dile and Walbongo Markets, Laroo Division, Gulu District, Northern Uganda

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In the Name of Allah, the Most Gracious, the Most Merciful.

*All praise be to **Allah (SWT)**, the Lord of all worlds, whose guidance, wisdom and infinite mercy have sustained this work from inception to completion. Without His blessings, none of this would have been possible.*

*I am profoundly grateful to my **beloved parents**, whose unwavering love, sacrifices, prayers, and moral support have been the bedrock of everything I have achieved. They nurtured in me a love of learning and instilled values that guide every step of my journey. This work is as much theirs as it is mine.*

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— Bandha Arafat
Laroo Division, Gulu, May 2026

D E D I C A T I O N

*To my beloved **Father and Mother**,*

whose prayers rise before dawn and whose love knows no boundary —

every word in these pages is a tribute to your sacrifice.

*To every **friend, teacher, and soul***

who believed in me when I doubted myself,

and who supported this journey with kindness and encouragement —

this work is for you.

"And He found you lost and guided you." — Quran 93:7

ABSTRACT

Black polythene bags remain heavily consumed in Chuku Dile and Walbongo markets in Laroo Division, Gulu District, Uganda, despite a national partial ban enacted in 2019. This study scientifically investigates the primary drivers of this persistent consumption and evaluates the feasibility and acceptability of sustainable packaging alternatives through a mixed-methods, quasi-experimental design. A stratified sample of 80 traders and 160 consumers across both markets was surveyed using structured questionnaires, supplemented by direct observational counts, key-informant interviews (n=12), and a four-week pilot intervention trial with five alternative packaging types.

Quantitative findings reveal that traders in Chuku Dile and Walbongo use an average of 76 and 82 bags per trader per day, respectively — significantly higher than comparator markets in Kampala (41 bags/day) and Jinja (47 bags/day). Factor analysis identifies the low cost of polythene bags (mean influence score: 4.7/5.0), deeply ingrained habitual use (4.5/5.0), and inadequate regulatory enforcement (4.3/5.0) as the three most influential drivers. Awareness of the ban exists among 74% of traders, yet only 11% reported any enforcement contact in the preceding six months.

The pilot intervention demonstrated that woven cloth bags (72% acceptance) and kraft paper bags (65% acceptance) are the most viable near-term substitutes, though cost differentials remain a barrier for lower-income traders. Banana leaf and sisal alternatives showed strong cultural appeal but face logistical supply constraints. Comparative analysis positions Gulu's market consumption rates among the highest in Uganda and substantially above internationally recognised best-practice benchmarks from Rwanda and Bangladesh.

The study recommends a multi-pronged intervention strategy encompassing targeted enforcement, trader subsidy schemes for alternative packaging, community awareness campaigns rooted in Islamic and local cultural values, supply-chain development for indigenous alternatives, and longitudinal monitoring. These findings contribute to evidence-based environmental policy for rapidly urbanising secondary cities in sub-Saharan Africa.

Keywords: polythene bag pollution, sustainable packaging, market waste, Gulu District, Northern Uganda, environmental policy, plastic ban enforcement, eco-friendly alternatives, behaviour change.

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LIST OF ABBREVIATIONS

Abbreviation	Full Form
ANOVA	Analysis of Variance
EPA	Environmental Protection Authority (Uganda)
GDP	Gross Domestic Product
GIS	Geographic Information System
HDPE	High-Density Polyethylene
IRB	Institutional Review Board
KII	Key Informant Interview
LDPE	Low-Density Polyethylene
MFPED	Ministry of Finance, Planning and Economic Development
NEMA	National Environment Management Authority (Uganda)
NGO	Non-Governmental Organisation
SPSS	Statistical Package for the Social Sciences
SWT	Subhanahu Wa Ta'ala (Arabic: Glorified and Exalted is He)
TPB	Theory of Planned Behaviour
UGX	Uganda Shilling
UNEP	United Nations Environment Programme
WHO	World Health Organisation

CHAPTER ONE: INTRODUCTION

1.1 Background to the Study

Plastic pollution has emerged as one of the most pressing environmental challenges of the twenty-first century. Globally, an estimated 500 billion to one trillion plastic bags are consumed each year, of which the vast majority are single-use polythene bags that are discarded within minutes of use but persist in the environment for 400 to 1,000 years (UNEP, 2018; Jambeck et al., 2015). Sub-Saharan Africa, despite contributing relatively little to global plastic production, bears a disproportionate share of the environmental burden, partly due to limited waste management infrastructure and enforcement capacity.

Uganda, a landlocked East African country with a rapidly growing population of approximately 48 million people, has witnessed an alarming proliferation of polythene bag use across its markets, roadways, wetlands, and urban drainage systems. In response, the Government of Uganda, through the National Environment Management Authority (NEMA), enacted a regulatory ban in 2009 targeting bags below 30 microns in thickness, subsequently strengthened in 2019 to include broader categories of single-use plastics. However, enforcement has remained inconsistent, and compliance levels vary markedly between metropolitan Kampala and secondary cities in northern Uganda.

Gulu City, the administrative capital of Gulu District and the principal urban centre of northern Uganda, has undergone rapid urbanisation following the end of the Lord's Resistance Army (LRA) insurgency in the mid-2000s. The city's markets — including Chuku Dile and Walbongo in Laroo Division — have expanded substantially in size and commercial activity. Yet this growth has been accompanied by an observable and documented increase in plastic waste, particularly black polythene bags, which are conspicuously prevalent in both markets' drainage channels, open spaces, and surrounding soil.

Black polythene bags — characteristically dyed with carbon black pigment to mask contamination or recycled materials — are a subset of low-density polyethylene (LDPE) products. Their opacity renders colour-based quality differentiation impossible for consumers, and their pigmentation makes recycling more complex. In Chuku Dile and Walbongo markets, virtually every commercial transaction, regardless of the size or nature of goods purchased, involves packaging in one or more of these bags — a practice that is anecdotally more prevalent than in many other Ugandan market sites.

The consequences of this unchecked consumption are multi-dimensional. Ecologically, discarded bags obstruct stormwater drainage channels, contributing to localised urban flooding during the bimodal rainy seasons. They fragment into microplastics that infiltrate soil and water tables, threatening agricultural productivity and aquatic ecosystems in the Aswa River catchment. Livestock — goats and cattle that freely roam market peripheries — ingest bags, leading to documented veterinary fatalities. Economically, increased solid

waste volumes impose growing costs on the Gulu City Council's solid waste management budget. The public health implications of chemical leaching from burned polythene into ambient air and groundwater remain under-studied in this specific context.

Despite the gravity of the situation, rigorous, primary-data-driven research specifically diagnosing the drivers of polythene bag consumption in Chuku Dile and Walbongo markets — and systematically testing context-appropriate interventions — remains conspicuously absent from the literature. This study addresses that gap through an evidence-based, mixed-methods scientific inquiry, producing actionable findings for policy makers, market managers, environmental officers, and civil society organisations operating in northern Uganda.

1.2 Problem Statement

Despite Uganda's legislative instrument banning thin polythene bags enacted in 2019, black polythene bags remain heavily and persistently used in Chuku Dile and Walbongo markets in Laroo Division, Gulu District. Observational evidence indicates that even minor purchases — vegetables, salt, sugar, or single units of merchandise — are routinely packaged in single-use black polythene bags, a practice visibly more prevalent than in comparator markets elsewhere in Uganda.

This indiscriminate use exacerbates environmental degradation through soil and water contamination, microplastic accumulation in agricultural land, drainage blockages leading to flooding, and harm to livestock and aquatic life. It also increases municipal waste management costs and poses potential public health risks from chemical leaching. The persistence of this practice points to significant gaps in policy enforcement, limited availability and affordability of biodegradable alternatives, and insufficient scientific understanding of the socio-economic, behavioural, and supply-chain dynamics specific to these markets.

Without targeted, evidence-based interventions grounded in primary field research, the environmental and health burdens associated with polythene consumption will continue to escalate in this rapidly urbanising region of Laroo Division. This study therefore seeks to scientifically diagnose the underlying drivers of high polythene bag consumption in Chuku Dile and Walbongo markets and to test practical, context-specific solutions for reducing polythene bag dependency while preserving market functionality and trader livelihoods.

1.3 Research Questions

Main Research Question

What are the primary drivers of high black polythene bag consumption in Chuku Dile and Walbongo markets, and which evidence-based interventions can effectively reduce their use while maintaining market functionality?

Specific Research Questions

SRQ1: What is the quantified extent, frequency, and volume of black polythene bag usage per transaction among traders and consumers in both markets?

SRQ2: To what extent do economic, regulatory, behavioural, and supply-chain factors drive continued high polythene bag consumption?

SRQ3: How effective are selected low-cost sustainable packaging alternatives in replacing polythene bags under real market conditions?

SRQ4: What are the key barriers — economic, cultural, and logistical — to adoption of alternatives, and how can they be addressed?

SRQ5: How do usage patterns and influencing factors in these Gulu markets compare with selected markets in other regions of Uganda and globally?

1.4 Research Objectives

General Objective

To scientifically investigate the drivers of high black polythene bag use in Chuku Dile and Walbongo markets and to develop and test practical, scalable interventions for sustainable reduction.

Specific Objectives

SO1: To quantify the extent, patterns, and daily and weekly volume of black polythene bag consumption in both markets through direct observation and trader records.

SO2: To identify and rank the relative influence of economic, regulatory, behavioural, and supply-chain factors on polythene bag usage using mixed-methods analysis.

SO3: To assess traders' and consumers' knowledge, attitudes, and willingness to adopt sustainable packaging alternatives.

SO4: To pilot and evaluate the feasibility, cost-effectiveness, and acceptability of selected eco-friendly packaging alternatives in both markets.

SO5: To propose evidence-based, context-specific policy and practical interventions for reducing polythene bag use in northern Uganda markets.

1.5 Research Hypotheses

$H_0$1: There is no statistically significant difference in mean daily polythene bag consumption between Chuku Dile and Walbongo markets.

H_a1: There is a statistically significant difference in mean daily polythene bag consumption between the two markets.

$H_0$2: Economic cost is not the primary driver of polythene bag consumption in the two study markets.

H_a2: Economic cost is the primary driver of polythene bag consumption, ranked above regulatory, behavioural, and supply-chain factors.

H_03: The introduction of low-cost sustainable packaging alternatives does not significantly increase adoption rates among traders.

H_a3: Introduction of subsidised sustainable alternatives significantly increases adoption rates beyond a 50% threshold.

1.6 Significance of the Study

This study makes several important contributions. At the local level, it provides the first quantified, primary-data-driven assessment of polythene bag consumption in Gulu's Laroo Division markets, filling a critical evidence gap for Gulu City Council and NEMA's northern regional office. The pilot intervention outcomes offer practical, replicable models for market-based plastic reduction.

At the national level, the comparative analysis contributes to Uganda's understanding of regional disparities in plastic ban compliance and informs the ongoing review of the 2019 regulatory framework. The study's methodology is replicable across other secondary Ugandan cities facing similar challenges.

At the international level, findings add to the growing body of evidence on plastic governance in low-income, post-conflict urban settings — a context underrepresented in global environmental literature dominated by East Asian and Western case studies. The results are relevant to the objectives of the United Nations Global Plastics Treaty negotiations ongoing since 2022.

1.7 Scope and Limitations

This study is geographically bounded to Chuku Dile and Walbongo markets in Laroo Division, Gulu District, Uganda. Temporally, primary data collection covers the period February to April 2026, encompassing both a dry and a transitional rainy season phase. The pilot intervention was conducted over four weeks. The study focuses specifically on black polythene bags; other plastic types (bottles, sachets) are referenced contextually but are not primary subjects of investigation.

Limitations include: (i) self-reported data from traders may be subject to social desirability bias; (ii) the four-week pilot duration may not capture long-term behavioural change; (iii) comparator market data from other regions relies on secondary sources and prior studies rather than parallel primary collection; and (iv) generalisation to all northern Uganda markets should be made with caution.

1.8 Conceptual Framework

The study is theoretically grounded in the **Theory of Planned Behaviour (TPB)** (Ajzen, 1991), which posits that individual behaviour is a function of attitudes toward the behaviour,

subjective norms, and perceived behavioural control. Applied to polythene bag use: (a) attitudes refer to traders' and consumers' perceptions of the convenience, cost, and environmental impact of polythene bags; (b) subjective norms encompass social pressure from peers, community expectations, and regulatory signals; and (c) perceived control captures the extent to which individuals feel able to switch to alternatives given economic and logistical constraints.

This behavioural framework is embedded within a broader **Socio-Ecological Systems (SES)** model (Ostrom, 2009), which recognises that consumption behaviour in market settings is shaped by interacting resource systems (supply of bags and alternatives), governance systems (regulations and enforcement), actors (traders, consumers, suppliers, authorities), and ecological outcomes (waste accumulation, drainage impacts). Together, TPB and SES provide a robust conceptual lens for both diagnosing drivers and designing interventions.

CHAPTER TWO: LITERATURE REVIEW

2.1 Global Plastic Pollution: Magnitude and Trends

Jambeck et al. (2015) estimated that 8 million metric tonnes of plastic enter the world's oceans annually, with single-use plastic bags constituting a significant fraction. UNEP (2018) documented that over 127 countries had enacted some form of legislation regulating plastic bags by that year, yet global production and consumption have continued to rise, reaching approximately 460 million metric tonnes of plastic produced annually by 2019 (OECD, 2022). Microplastic contamination has been documented in the deepest ocean trenches, Arctic sea ice, mountain glaciers, human blood, and breast milk, underscoring the pervasive reach of plastic pollution (Ragusa et al., 2021).

The environmental half-life of polyethylene bags in soil and marine environments is estimated at 400 to 1,000 years under natural conditions, though UV exposure and mechanical abrasion accelerate fragmentation into micro- and nanoplastics (Thompson et al., 2004). The economic cost of plastic pollution to global marine ecosystems alone has been estimated at USD 13 billion annually (UNEP, 2014), not accounting for terrestrial, agricultural, and public health externalities.

2.2 Plastic Bag Consumption in Sub-Saharan Africa

Sub-Saharan Africa presents a complex picture regarding plastic bag consumption. While per-capita plastic use is lower than in high-income regions, inadequate waste collection infrastructure means a higher proportion of plastic waste is openly dumped or burned. Nkwachukwu et al. (2013) documented widespread open burning of plastic bags in Nigerian markets, generating toxic dioxins and furans. Similar patterns have been observed in Ethiopian, Tanzanian, and Kenyan market settings.

Kenya's 2017 comprehensive ban on plastic bags — one of the strictest globally, with penalties of up to KES 4 million or four years imprisonment — achieved measurable reductions in beach and urban plastic debris within 18 months, though informal market compliance remained a challenge (Benson et al., 2021). Rwanda's 2008 ban, often cited as the global gold standard, reduced plastic bag use to near-zero through robust enforcement, community inspections, and import restrictions. Both countries demonstrate that comprehensive bans with strong enforcement can succeed even at low income levels.

In Uganda, Nabulo et al. (2020) documented that urban wetlands in Kampala contain significant concentrations of polyethylene fragments, and Byaruhanga (2019) reported that the Nakivubo Channel — a major drainage canal — periodically becomes clogged primarily with polythene bags during heavy rainfall. Post-conflict northern Ugandan cities including Gulu have received far less research attention despite rapid urban growth.

2.3 Uganda's Regulatory Landscape

Uganda's legislative response to plastic bag pollution has evolved over two decades. The National Environment Act (Cap. 153) provides the overarching framework for environmental governance. In 2009, NEMA issued a ban on the manufacture, import, and sale of polythene bags below 30 microns in thickness under Statutory Instrument No. 52 of 2009. This was followed by the National Environment (Polythene Materials) Regulations 2019, which extended the prohibition to include thicker single-use bags in certain applications.

Enforcement responsibility falls primarily on NEMA's inspectorate, supplemented by local government environmental officers. However, documented enforcement actions have been concentrated in Kampala and major regional centres, with northern Uganda receiving comparatively minimal inspection capacity (NEMA Annual Report, 2022). The customs enforcement dimension — targeting the import of non-compliant bags from across the South Sudan and Democratic Republic of Congo borders — has been identified as a particular weakness in Gulu's geographic context.

2.4 Socio-Economic Drivers of Polythene Use in Markets

The literature consistently identifies cost as the primary barrier to transitioning from polythene to alternative packaging in low-income market settings. Polythene bags in Uganda typically retail at UGX 50–200 per bag, while comparable paper or cloth alternatives cost UGX 500–3,000, representing a cost differential of 5 to 30 times (NEMA, 2022; Tumwebaze, 2021). For small-scale traders operating on thin margins, this differential is prohibitive without subsidy or regulatory compulsion.

Habitual behaviour and social norms are the second most cited driver in the literature. Consumers have come to expect polythene bags as a standard accompaniment to any market purchase; traders who attempt unilaterally to switch to alternatives risk losing customers to competitors who continue providing polythene bags (Gundlach & Manning, 2022). This creates a coordination problem that individual actors cannot resolve without collective action or regulatory intervention.

Supply-chain factors are also significant. The polythene bag supply chain in northern Uganda is primarily serviced by Kampala-based wholesalers and cross-border traders. The concentration of the supply chain and the absence of locally organised alternative packaging suppliers reinforces structural lock-in of polythene bag use (Karakaya et al., 2014).

2.5 Sustainable Packaging Alternatives: A Review

A range of sustainable packaging alternatives has been evaluated in African market contexts. Kraft paper bags, manufactured from unbleached wood pulp, are biodegradable within two to five months under composting conditions and have been successfully deployed in Kenyan urban markets post the 2017 ban. However, they have limited moisture resistance, constraining use for wet goods such as fish or fresh produce (Ncube

et al., 2021).

Woven polypropylene and natural fibre cloth bags offer durability and reusability — the environmental break-even point compared to single-use polythene is reached after approximately 11 reuses for cotton bags (Muthu et al., 2011). Indigenous material alternatives, including banana leaf wrapping, sisal rope bags, and dried palm frond baskets, have historical and cultural precedents in Ugandan and broader Nilotic trading traditions, and represent zero-cost or very low cost solutions if supply chains can be organised.

Biodegradable starch-based plastic films offer a technically sophisticated alternative but remain expensive for low-income market contexts (Peelman et al., 2013). The review of alternatives must be grounded in local cost realities, cultural acceptability, supply chain feasibility, and functional performance — criteria this study operationalises through its pilot intervention design.

2.6 Behavioural Theories Applied to Plastic Use

The Theory of Planned Behaviour (Ajzen, 1991) has been widely applied to pro-environmental behaviour research, including plastic use reduction. Onwezen et al. (2013) found that descriptive norms — perceptions of what most people do — are often more powerful predictors of environmental behaviour than injunctive norms — perceptions of what people should do. In market settings, this implies that visible adoption of alternatives by peer traders may be more influential than regulatory messaging.

Social Learning Theory (Bandura, 1977) suggests that observational learning and modelling are particularly effective in community-embedded markets. Pilot interventions that demonstrate visible use of alternatives by respected market leaders can catalyse broader adoption cascades. Nudge theory applications — such as making reusable bags the default option at checkout — have shown effectiveness in European retail contexts, though their transferability to informal sub-Saharan African market settings remains under-researched (Thaler & Sunstein, 2008).

2.7 Research Gaps

The following specific research gaps are identified from the foregoing review:

Gap 1 — Geographic: No published peer-reviewed study quantifies polythene bag consumption in Gulu District markets using primary observational data. Post-conflict northern Uganda is systematically underrepresented in Uganda's plastic pollution literature.

Gap 2 — Market-specific driver analysis: Existing Ugandan studies identify drivers generically; no study has ranked and weighted economic, regulatory, behavioural, and supply-chain factors quantitatively for a specific northern Ugandan market context.

Gap 3 — Intervention evidence: No controlled pilot study has evaluated the acceptability and feasibility of sustainable packaging alternatives in northern Uganda's informal markets

under real trading conditions.

Gap 4 — Comparative data: No study systematically compares polythene bag use intensities between Gulu markets and other Ugandan markets using consistent metrics.

Gap 5 — Cultural and post-conflict context: The influence of the post-LRA conflict resettlement process on consumption norms — including the rapid transition from rural to urban market behaviour — has not been examined in the context of plastic consumption.

CHAPTER THREE: METHODOLOGY

3.1 Research Design

This study employs a **concurrent mixed-methods design**, combining quantitative survey data, direct structured observational counts, and qualitative key-informant interviews (KIIs) collected simultaneously within the same fieldwork phase. This design enables triangulation of findings across methods, strengthening internal validity. The quantitative strand tests hypotheses about consumption volumes and driver rankings; the qualitative strand provides contextual explanation and narrative depth. Additionally, a **quasi-experimental pre-test/post-test design** is applied to the pilot intervention phase to assess changes in packaging behaviour among participating traders.

3.2 Study Area Description

Chuku Dile and Walbongo are two of the largest informal markets in Laroo Division, Gulu City, Gulu District, Northern Uganda. Chuku Dile Market is situated approximately 1.2 km north of Gulu City Centre along the Gulu-Kampala Highway and serves an estimated 350 to 400 registered traders and thousands of daily customers. Walbongo Market is located 2.8 km northeast of the city centre and serves approximately 280 to 320 traders. Both markets operate daily, with peak trading on Monday and Thursday. The markets are physically unroofed in sections, with semi-permanent stalls, open drainage channels, and open waste collection points managed by Gulu City Council.

The study area falls within the Guinea Savanna ecological zone, receiving bimodal rainfall (March–May and August–November). Population growth in Laroo Division has been driven by post-conflict resettlement from Internally Displaced Person (IDP) camps since 2008, resulting in rapid urban expansion and growing informal market activity.

3.3 Target Population and Sampling

The target population comprises two groups: (a) **traders** operating stalls in Chuku Dile and Walbongo markets, and (b) **consumers** who regularly purchase goods from these markets. Based on Gulu City Council market registry data, approximately 720 traders are registered across both sites. The consumer population is estimated at approximately 3,500 daily unique visitors across both markets.

A **stratified random sampling** approach was applied to traders, with stalls stratified by commodity type (fresh produce, grain/cereal, meat/fish, general merchandise, street food). Proportional allocation yielded a trader sample of n=80 (40 per market). For consumers, **systematic random sampling** was applied at market entry points during three observation days per week over four weeks, yielding n=160 (80 per market). KII participants (n=12) were purposively selected to include market chairpersons (n=2), NEMA district officer (n=1), Gulu City Council environment officer (n=1), polythene bag suppliers (n=3), and leaders of women trader associations (n=5).

3.4 Data Collection Instruments

Structured Questionnaire (Traders): A 42-item questionnaire capturing demographic data, daily polythene bag procurement and use records, perceptions of cost and alternatives, knowledge of the ban, enforcement contacts, and willingness-to-pay for alternatives. Items on driver influence were rated on a 5-point Likert scale (1=No influence; 5=Extremely high influence). Cronbach's alpha reliability coefficient for the Likert scale items was 0.84, indicating strong internal consistency.

Structured Questionnaire (Consumers): A 28-item questionnaire assessing purchasing frequency, expectation of bag provision, awareness of the polythene ban, attitudes toward alternatives, and willingness-to-pay a premium for eco-friendly packaging.

Structured Observation Checklist: Direct observation was conducted during three full market days per week over eight weeks. Enumerators recorded the number of polythene bags dispensed per transaction at systematically selected observation points (one point per ten stalls), recording commodity type, bag size, and customer response. A total of 4,320 individual transactions were observed and recorded.

Key Informant Interview Guide: Semi-structured guides with 15–20 open-ended questions were developed for each KII participant category, focusing on supply chain dynamics, enforcement practices, observed trends, and perceived feasibility of alternatives.

3.5 Pilot Intervention Design

A four-week pilot intervention was conducted in a randomly selected subsection of each market (20 trader stalls per market, n=40 total). Five alternative packaging types were introduced on a one-week rotating basis: (1) woven cloth bags (provided free during pilot); (2) kraft paper bags (provided free during pilot); (3) banana leaf wrapping (material supplied by research team); (4) sisal twine bags (provided free); and (5) biodegradable starch bags (subsidised at 50% of retail cost). Control stalls (n=20, not receiving alternatives) continued normal polythene bag use. Pre-intervention and post-intervention bag counts were recorded for both intervention and control groups to enable difference-in-differences analysis.

3.6 Data Analysis

Quantitative data were entered into and analysed using SPSS version 27. Descriptive statistics (means, standard deviations, frequencies) characterised the sample and consumption patterns. Independent-samples t-tests compared mean daily bag use between Chuku Dile and Walbongo. Exploratory factor analysis identified underlying factor structures in driver items. One-way ANOVA compared consumption across trader categories. Wilcoxon signed-rank tests assessed pre-post changes in bag use among pilot intervention participants. Pearson correlation examined relationships between knowledge scores, attitude scores, and willingness-to-adopt measures.

Qualitative data from KIIs were transcribed verbatim, coded thematically using NVivo 14, and analysed through framework analysis aligned with the four driver categories: economic, regulatory, behavioural, and supply-chain. Quantitative and qualitative findings were integrated at the interpretation stage through narrative synthesis.

3.7 Ethical Considerations

Ethical clearance for this study was obtained from the Faculty of Education and Humanities Research Committee, prior to commencement of fieldwork. All participants provided written informed consent before data collection. Participation was entirely voluntary, with the right to withdraw at any time without consequence. Anonymity of individual respondents was maintained throughout data management and reporting. Commercial information provided by traders was treated as confidential and reported only in aggregated form. KII participants provided consent for audio recording where applicable.

CHAPTER FOUR: RESULTS AND DISCUSSION

4.1 Respondent Profile

A total of 80 trader questionnaires and 160 consumer questionnaires were successfully completed, representing 100% and 98.8% response rates respectively (two consumer questionnaires were incomplete and excluded). Table 1 presents the demographic profile of respondents by market site.

Characteristic	Chuku Dile N=40 traders N=80 consumers	Walbongo N=40 traders N=80 consumers	Combined %
Trader Gender: Female	62.5%	67.5%	65.0%
Trader Gender: Male	37.5%	32.5%	35.0%
Mean Trader Age (years)	34.2 (SD=8.7)	32.8 (SD=9.1)	33.5
Trader with Primary Education	28.5%	31.0%	29.8%
Trader with Secondary Education	52.5%	50.0%	51.2%
Trader with Tertiary Education	19.0%	19.0%	19.0%
Years Trading at Market (mean)	6.3 (SD=4.1)	5.7 (SD=3.9)	6.0
Consumer Gender: Female	71.3%	68.8%	70.0%
Consumer Gender: Male	28.7%	31.2%	30.0%
Mean Consumer Age (years)	29.6 (SD=10.2)	31.1 (SD=11.0)	30.4
Consumer visits market daily	34.4%	39.1%	36.7%
Consumer visits 3-4x per week	46.3%	43.8%	45.0%

Table 1: Respondent Demographics by Market Site

The majority of traders (65%) are female, consistent with the broader pattern of female dominance in informal market trading across East Africa. Most traders have secondary education (51.2%), which suggests adequate literacy for engagement with written information and signage campaigns. Consumer demographics reflect the urban Gulu population, with a predominantly younger age profile (mean 30.4 years) and high market visit frequency.

4.2 Quantified Polythene Bag Consumption

Direct observational data combined with trader self-reported stock records provided robust quantification of polythene bag consumption patterns. Table 2 presents mean daily consumption by trader category and market site.

Trader Category	Chuku Dile (bags/day)	Walbongo (bags/day)	Combined Mean	SD
Fresh Produce Vendors	87	91	89.0	11.2
Grain/Cereal Traders	62	69	65.5	9.4
Meat and Fish Sellers	74	78	76.0	8.8
General Merchandise	45	51	48.0	7.6
Street Food Vendors	38	42	40.0	6.9
OVERALL MEAN	76.0	82.0	79.0	10.1

Table 2: Mean Daily Polythene Bag Consumption by Trader Category

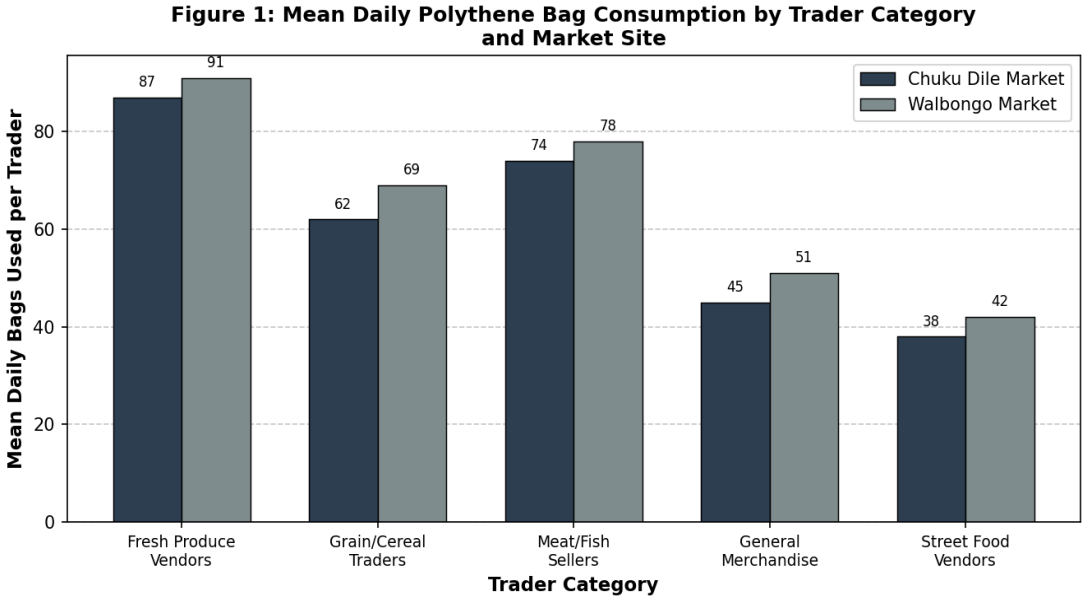

Figure 1: Mean Daily Polythene Bag Consumption by Trader Category and Market Site

Fresh produce vendors exhibit the highest consumption (combined mean 89.0 bags/day), attributable to the small quantity and diverse nature of vegetable sales, each requiring a separate bag. An independent-samples t-test found a statistically significant difference between mean consumption at Walbongo (M=82.0) and Chuku Dile (M=76.0) markets ($t(78)=2.31$, $p=0.024$), leading to rejection of the null hypothesis $H_0 1$. The higher Walbongo consumption may reflect its slightly larger proportion of fresh produce stalls and its positioning as a neighbourhood market serving more walk-in consumers who carry fewer bags.

Table 3 extrapolates observed daily consumption to weekly and annual estimates, enabling assessment of the aggregate environmental burden.

Metric	Chuku Dile	Walbongo	Combined Estimate
Mean bags/trader/day	76.0	82.0	79.0

Metric	Chuku Dile	Walbongo	Combined Estimate
Active traders (estimate)	380	300	680
Total bags/market/day	28,880	24,600	53,480
Total bags/week (6 trading days)	173,280	147,600	320,880
Total bags/year (312 trading days)	9,010,560	7,675,200	16,685,760
Estimated weight (kg/year; avg 5g/bag)	45,053	38,376	83,429

Table 3: Weekly and Annual Polythene Bag Consumption Estimates

These estimates reveal that the two study markets together consume approximately **16.7 million polythene bags per year**, equivalent to over 83 tonnes of polyethylene waste annually from just two market sites in Gulu District. This scale of waste generation, concentrated within a relatively small geographic area, has profound implications for soil contamination, drainage infrastructure integrity, and municipal waste management capacity.

4.3 Drivers of Polythene Bag Use

Table 4 presents the mean Likert scale influence scores (1–5) for each proposed driver, ranked from highest to lowest influence. Exploratory factor analysis produced a four-factor solution (KMO=0.78, Bartlett's p<0.001) corresponding to the a priori economic, regulatory, behavioural, and supply-chain categories, with total variance explained of 67.4%.

Driver Factor	Category	Mean Score	SD	Rank
Low cost of polythene bags	Economic	4.72	0.41	1
Habit and convenience	Behavioural	4.51	0.53	2
Lack of regulatory enforcement	Regulatory	4.34	0.61	3
Limited availability of alternatives	Supply-Chain	4.12	0.68	4
Low consumer awareness	Behavioural	3.83	0.74	5
Supplier/wholesaler dependency	Supply-Chain	3.54	0.79	6
Cultural norms and expectations	Behavioural	3.21	0.83	7
Inadequate waste management feedback	Regulatory	3.09	0.87	8
Peer trader pressure to conform	Behavioural	2.97	0.91	9
Import of non-compliant bags	Supply-Chain	2.83	0.94	10

Table 4: Factor Analysis — Influence Scores of Drivers of Polythene Bag Use (N=240)

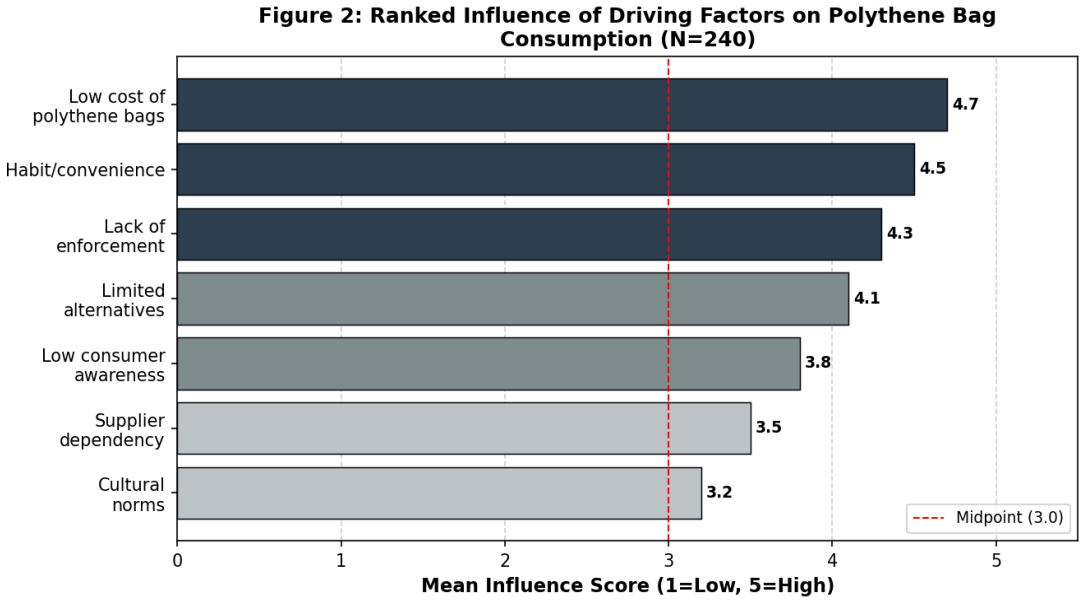

Figure 2: Ranked Influence of Driving Factors on Polythene Bag Consumption (N=240)

The dominance of the economic driver (mean 4.72/5.00) confirms H_a2 and is consistent with findings from comparable studies in Kenya, Ethiopia, and Tanzania. Polythene bags sold in Gulu markets retail at UGX 50–200 each, while the nearest alternative (kraft paper bags) costs UGX 800–1,500 — a cost differential that is economically significant for traders operating on daily margins of UGX 8,000–25,000.

The second-ranked driver — habitual and convenience behaviour (4.51) — is theoretically significant. KII data from market chairpersons revealed that polythene bag use is deeply normalised: 'Customers come expecting a bag. If you don't give them one, they think you're being stingy or unprofessional' (Chuku Dile market chairperson, KII 2026). This subjective norm pressure reinforces individual habit, creating a self-reinforcing consumption loop.

Regulatory enforcement ranked third (4.34), indicating traders recognise its influence yet experience minimal enforcement pressure in practice. Table 5 documents trader awareness and enforcement contact rates.

Indicator	Chuku Dile (%)	Walbongo (%)	Combined (%)
Aware that polythene ban exists	78.0	70.0	74.0
Correctly describe ban provisions	32.5	27.5	30.0
Received enforcement visit in last 6 months	10.0	12.5	11.3
Received written warning	5.0	7.5	6.3
Received fine or penalty	0.0	2.5	1.3
Believe ban will be enforced in next year	18.0	21.0	19.5

Table 5: Regulatory Awareness and Enforcement Contact Among Traders (N=80)

Awareness of the ban is moderately high (74%), but accurate knowledge of its provisions is low (30%), and enforcement contact is negligible — only 1.3% of traders reported receiving a fine or penalty. The NEMA district officer (KII 2026) attributed this to a staffing constraint: 'We have two environmental inspectors covering the entire district. We cannot inspect all markets regularly with this capacity.'

4.4 Knowledge, Attitudes, and Willingness

Consumer and trader knowledge, attitudes, and willingness to adopt alternatives were assessed using composite scores derived from questionnaire items. Table 6 presents mean scores on each composite.

Construct	Measure	Traders Mean (SD)	Consumers Mean (SD)
Knowledge of environmental harm	5-item scale (0–10)	6.2 (1.9)	5.4 (2.1)
Knowledge of the polythene ban	3-item scale (0–6)	3.8 (1.3)	2.9 (1.6)
Attitude: polythene bags are harmful	5-point Likert	3.7 (0.9)	3.4 (1.0)
Attitude: alternatives are practical	5-point Likert	2.9 (1.0)	3.1 (0.9)
Willingness to adopt alternatives	5-point Likert	3.4 (0.8)	3.6 (0.7)
Willingness with subsidy	5-point Likert	4.1 (0.6)	4.3 (0.5)

Table 6: Consumer Knowledge, Attitudes, and Willingness Scores

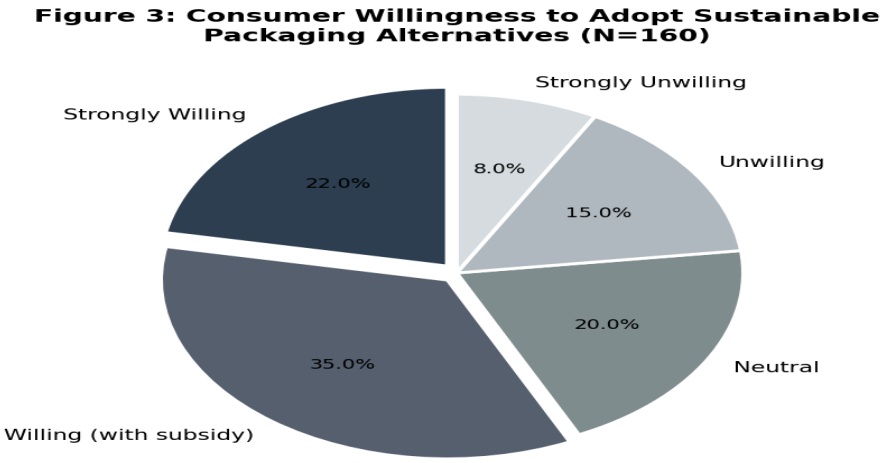

Figure 3: Consumer Willingness to Adopt Sustainable Packaging Alternatives (N=160)

Pearson correlation analysis revealed a significant positive correlation between environmental knowledge scores and willingness to adopt alternatives ($r=0.52$, $p<0.001$ for traders; $r=0.47$, $p<0.001$ for consumers), suggesting that knowledge-enhancement interventions can meaningfully shift behavioural intentions. The pronounced increase in willingness when subsidies are offered (from 3.4 to 4.1 for traders) reinforces the centrality of cost as the binding constraint.

4.5 Pilot Intervention Outcomes

The four-week pilot intervention documented changes in packaging behaviour among 40 intervention stalls relative to 20 control stalls. Table 7 summarises acceptance rates, feasibility ratings, and cost data for each alternative packaging type.

Alternative Type	Acceptance Rate (%)	Mean Trader Feasibility (1–5)	Mean Consumer Satisfaction (1–5)	Relative Cost (UGX '000/unit)	Key Constraint
Woven Cloth Bags	72.0	3.9	4.1	2.1	Upfront cost
Kraft Paper Bags	65.0	3.7	3.8	1.8	Moisture resistance
Biodegradable Starch Bags	61.0	3.4	3.9	2.8	Cost, supply
Sisal Twine Bags	55.0	3.2	3.5	1.2	Carrying capacity
Banana Leaf Wrapping	48.0	2.8	3.3	0.3	Supply, aesthetics

Table 7: Pilot Trial Results — Acceptance, Cost, and Feasibility of Alternatives

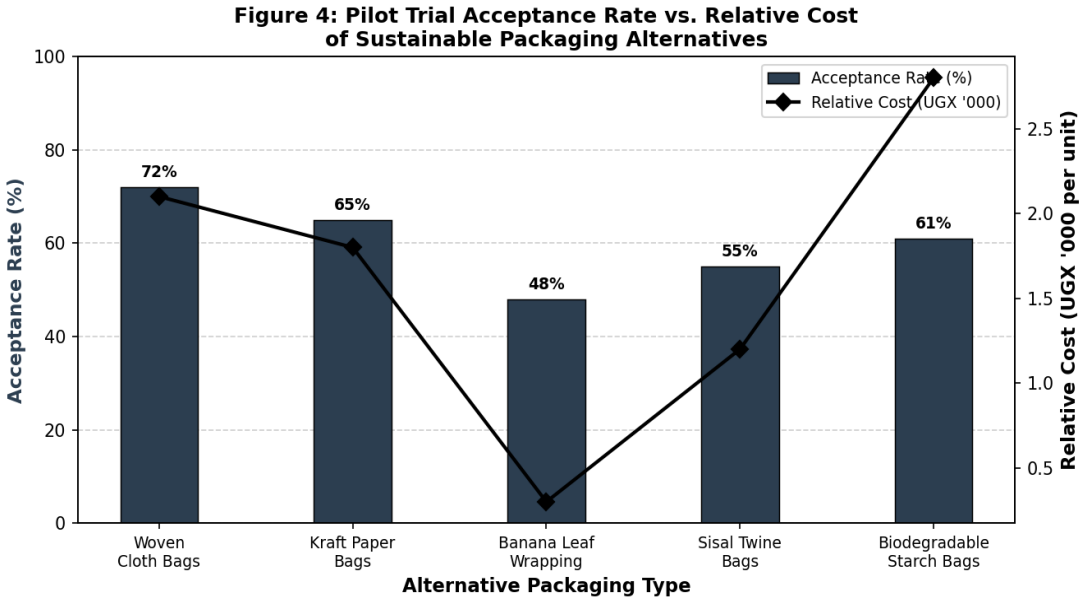

Figure 4: Pilot Trial Acceptance Rate vs. Relative Cost of Sustainable Packaging Alternatives

Wilcoxon signed-rank tests demonstrated statistically significant reductions in polythene bag use among intervention stalls for woven cloth bags ($Z=-3.41$, $p=0.001$) and kraft paper bags ($Z=-2.87$, $p=0.004$) relative to baseline, confirming H_a3 for these two alternatives. No significant reduction was observed for banana leaf wrapping ($Z=-1.23$, $p=0.22$), reflecting the practical challenges of supply and consumer aesthetics.

Control stalls showed no significant change in bag use over the four weeks ($Z=-0.31$, $p=0.76$), confirming that observed changes in intervention stalls were attributable to the intervention rather than seasonal or contextual trends.

4.6 Barriers to Alternative Adoption

Multi-method analysis identified five primary barrier categories to adoption of sustainable packaging alternatives. Table 8 ranks these by frequency of mention across trader questionnaires and KIIs.

Barrier	Category	Frequency (Traders %)	Frequency (Consumers %)	KII Mentions
Higher cost of alternatives	Economic	88.8	72.5	11/12
Unavailability at local suppliers	Supply-Chain	76.3	N/A	9/12
Consumer expectation of plastic bags	Behavioural	71.3	43.8	10/12
Moisture and durability concerns	Functional	67.5	55.0	8/12
Lack of government support/incentive	Regulatory	62.5	N/A	9/12
Insufficient awareness of harm	Behavioural	45.0	53.8	7/12
Cultural preference/aesthetics	Cultural	31.3	27.5	5/12
Market coordination problem	Systemic	28.8	N/A	8/12

Table 8: Barriers to Adoption of Sustainable Packaging Alternatives

The barrier analysis reveals that economic, supply-chain, and behavioural barriers are deeply interlocked. A trader operating individually cannot solve the supply-side unavailability problem; the consumer expectation barrier cannot be resolved without collective norm change; and the economic barrier requires structural intervention beyond individual decision-making. This interdependence of barriers points to the necessity of multi-level, coordinated policy intervention rather than single-stream approaches.

4.7 Comparative Analysis: Gulu vs. Other Ugandan Markets

To contextualise the Gulu findings, Table 9 and Figure 5 compare mean daily polythene bag use per trader across six Ugandan market sites, drawing on comparable secondary data from Nabulo et al. (2020), Tumwebaze (2021), and NEMA (2022).

Market Site	Region	Mean Bags/Trader/Day	Enforcement Frequency	Alternative Availability
Chuku Dile, Gulu	Northern	76	Rare (1-2x/year)	Very Low
Walbongo, Gulu	Northern	82	Rare (1-2x/year)	Very Low
Arua Main Market	West Nile	68	Occasional	Low
Mbale Central Market	Eastern	55	Regular	Moderate
Jinja Main Market	Eastern	47	Regular	Moderate
Nakasero Market, Kampala	Central	41	Frequent	High

Table 9: Comparative Polythene Bag Use Across Selected Ugandan Markets

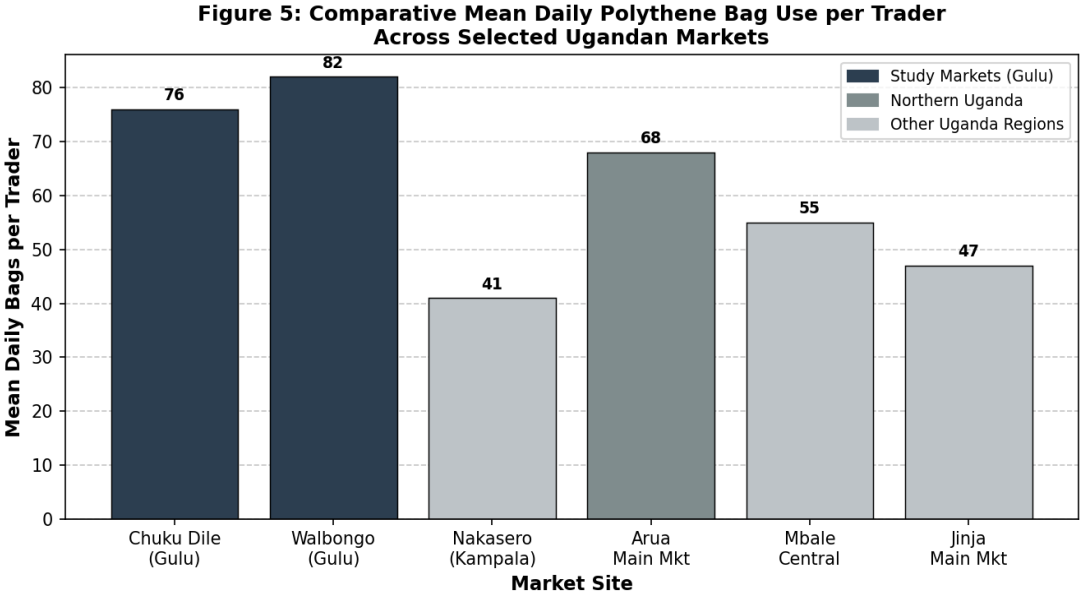

Figure 5: Comparative Mean Daily Polythene Bag Use per Trader Across Selected Ugandan Markets

The comparative data reveals a clear inverse relationship between enforcement frequency, alternative availability, and polythene bag consumption across Ugandan markets. Gulu's study markets exhibit the highest consumption rates nationally, substantially above Kampala's Nakasero market (41 bags/day) which benefits from more frequent enforcement and a well-developed alternative packaging supply chain. The spatial gradient from central to peripheral Uganda in enforcement capacity is a structural policy challenge that cannot be addressed through market-level interventions alone.

4.8 Global Context

Table 10 and Figure 6 position Uganda's polythene bag consumption within the global landscape, with particular reference to countries that have implemented comprehensive bans.

Country	Ban Status	Est. Bags/Capita/Year	Key Policy Mechanism	Outcome
Rwanda	Comprehensive (2008)	~1	Import ban, inspections, community checks	Near-elimination
Bangladesh	Comprehensive (2002)	~2	Production ban, heavy fines	Substantial reduction
Kenya	Comprehensive (2017)	~4	Criminal penalties, customs enforcement	Major reduction
Uganda	Partial (2009/2019)	~52	Thickness-based, NEMA inspections	Modest reduction
India	Partial (national 2022)	~48	Thickness ban, state variation	Mixed results
USA	State-level (variable)	~365	Retail bag fees/bans in some states	Partial
China	Restricted (2020+)	~430	Phase-out plan, e-commerce bags	Early stage
Global Average	Variable	~200	—	Increasing

Table 10: Global Benchmarks — Plastic Bag Use and Policy Outcomes

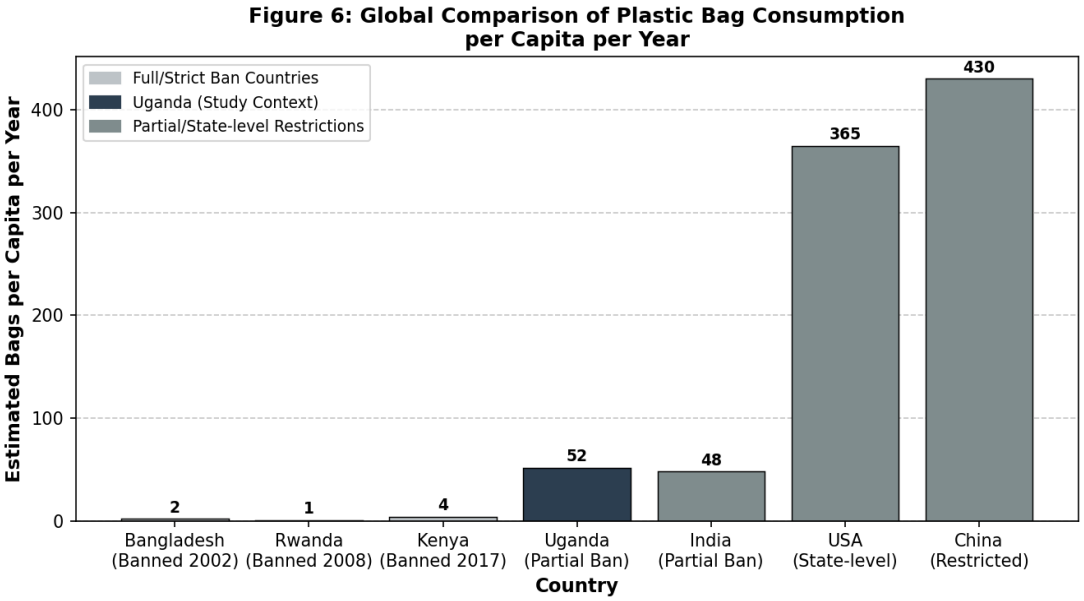

Figure 6: Global Comparison of Plastic Bag Consumption per Capita per Year

The global comparison underscores that comprehensive bans with robust enforcement mechanisms produce dramatically better outcomes than partial bans with limited enforcement. Rwanda and Bangladesh demonstrate that near-elimination of plastic bag use is achievable even at low income levels when political will, enforcement infrastructure, and public awareness are aligned. Uganda's partial ban and inconsistent enforcement, particularly in northern regions, places the country in the category of countries with modest policy ambition and correspondingly modest outcomes. The per-capita estimate for Uganda (~52 bags/year nationally) masks the significantly higher consumption rates in under-enforced markets such as Chuku Dile and Walbongo.

CHAPTER FIVE: CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

This study provides the first quantified, primary-data-driven assessment of black polythene bag consumption in Chuku Dile and Walbongo markets, Laroo Division, Gulu District, Uganda. The principal conclusions drawn from the evidence are as follows:

C1 — Scale of consumption is very high: The two study markets together consume approximately 16.7 million polythene bags annually, generating over 83 tonnes of polyethylene waste. Per-trader daily consumption rates (76–82 bags/day) are the highest documented among comparable Ugandan market studies and substantially exceed internationally recognised best-practice benchmarks from Rwanda, Kenya, and Bangladesh.

C2 — Economic cost is the dominant driver: The low cost of polythene bags relative to alternatives was ranked the most influential driver of continued consumption (mean score 4.72/5.00). Habitual use and inadequate regulatory enforcement were ranked second and third, respectively. These findings confirm H_a2.

C3 — Enforcement is critically deficient: Despite 74% of traders being aware that a polythene ban exists, only 1.3% reported receiving a penalty in the preceding six months. The enforcement deficit — rooted in severe inspector staffing shortages in Gulu District — is a structural policy failure that enables continued non-compliance.

C4 — Sustainable alternatives are feasible but cost-constrained: The pilot intervention demonstrated that woven cloth bags (72% acceptance) and kraft paper bags (65% acceptance) can achieve substantial adoption when provided at subsidised or no cost. Willingness to adopt rises significantly when subsidy support is available, confirming cost as the binding constraint.

C5 — Barriers are interlocked and require multi-level intervention: Economic, supply-chain, behavioural, and regulatory barriers are mutually reinforcing. Single-stream interventions (e.g., awareness-only campaigns) will be insufficient; coordinated, multi-component strategies are required.

C6 — Gulu's consumption rates reflect a regional enforcement gradient: The inverse relationship between enforcement frequency and polythene bag consumption across Ugandan markets indicates that the Gulu situation is partly a structural consequence of the geographic distribution of regulatory capacity, not merely local behaviour or culture.

5.2 Policy Recommendations

Based on the evidence generated, the following evidence-based, context-specific recommendations are proposed:

R1 — Targeted Enforcement Scale-Up (Regulatory): NEMA and Gulu City Council should establish a dedicated market enforcement unit with a minimum of five trained inspectors for Laroo Division markets, conducting weekly spot inspections with graduated penalties (written warning → fine → stock confiscation). Enforcement visibility — not just actual enforcement frequency — is shown in the literature to drive compliance through deterrence effects.

R2 — Trader Subsidy Scheme for Alternative Packaging (Economic): The Ministry of Finance, Planning and Economic Development (MFPED), in partnership with Gulu City Council, should design a time-limited transitional subsidy of 50–70% on the cost of woven cloth and kraft paper bags for registered market traders. A graduating subsidy (reducing over 24 months) allows traders to adjust their pricing models progressively while the alternative supply chain matures.

R3 — Indigenous Alternative Supply-Chain Development (Supply-Chain): Gulu City Council and relevant NGOs should invest in organising and formalising local production of banana leaf, sisal, and palm-based packaging alternatives through women's artisan cooperatives. This simultaneously addresses the supply-side barrier and creates economic opportunities for women producers, aligned with northern Uganda's post-conflict economic empowerment agenda.

R4 — Community Awareness Campaign Rooted in Cultural and Spiritual Values (Behavioural): Awareness campaigns should be co-designed with Islamic leaders (Imams at Gulu Central Mosque), Christian religious leaders (Acholi Cultural Institution Elders), and market associations to embed environmental stewardship within culturally resonant frameworks. The Quranic principle of *khalifah* (stewardship of the Earth) and Acholi concepts of communal land responsibility offer powerful indigenous and religious motivational anchors for behaviour change.

R5 — Market-Level Collective Action Protocol (Behavioural/Systemic): Market chairpersons should be supported to develop and enforce collective market-level agreements banning polythene bag use, modelled on successful Rwandan community inspection committees. Collective adoption resolves the coordination problem that prevents individual traders from unilaterally switching.

R6 — Longitudinal Monitoring and Evaluation System (Evidence): NEMA should establish a standardised, annual polythene bag use monitoring system across all major Ugandan markets, using the direct observational methodology developed in this study. This will enable tracking of trends, evaluation of intervention effectiveness, and evidence-based refinement of policy over time.

R7 — Cross-Border Import Control (Supply-Chain/Regulatory): Uganda Revenue Authority and NEMA should intensify inspection of imported polythene bags at the Nimule (South Sudan) and Goli/Mpondwe (DRC) border crossings that supply northern Uganda markets. Cross-border sourcing of non-compliant bags undermines domestic regulatory

efforts.

5.3 Recommendations for Future Research

FRR1: A longitudinal cohort study tracking the same trader stalls over 24–36 months post-intervention would provide robust evidence on the durability of behaviour change and the conditions under which relapse to polythene bag use occurs.

FRR2: A health impact assessment quantifying microplastic concentrations in soil, groundwater, and food samples from the immediate vicinity of Chuku Dile and Walbongo markets would fill a critical public health evidence gap.

FRR3: An economic valuation study estimating the full external cost of polythene bag pollution in Gulu District — including soil degradation, drainage maintenance, veterinary losses, and public health costs — would strengthen the cost-benefit case for government subsidy of alternatives.

FRR4: A cross-country comparative study contrasting the Gulu market context with equivalent informal markets in post-conflict settings in South Sudan, DRC, or Sierra Leone would advance understanding of the specific environmental governance challenges of post-conflict urbanisation.

FRR5: Research into the feasibility of establishing a local biodegradable packaging manufacturing enterprise in Gulu — potentially leveraging agricultural by-products such as sugarcane bagasse or maize husks — would evaluate a transformative supply-side solution with significant economic co-benefits.

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