



Exploring stakeholder perceptions of Pay-As-You-Throw (PAYT) for household solid waste management in the City of Cape Town

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PREFACE AND ACKNOWLEDGMENTS

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ABSTRACT

Pay-as-you-throw (PAYT) is widely regarded as one of the most effective economic instruments for advancing waste management practices, particularly for increasing recycling and reducing landfill waste. This study explores stakeholders' perceptions of PAYT for household waste in the City of Cape Town Metropolitan Municipality (CCT). Data were collected through a survey questionnaire completed by 127 households and 10 municipal waste officials. The questionnaire included structured statements assessed using a 5-point Likert scale and two open-ended questions where respondents identified opportunities and challenges for PAYT implementation in CCT. The findings indicate strong support for PAYT, with both municipal and household respondents agreeing that its implementation could enhance recycling and waste diversion from landfills. Respondents also believed that CCT could successfully implement PAYT, provided that key factors such as accurate waste billing, public participation, education, transparency, and a robust recycling infrastructure were in place. While there was strong support for a weight-based PAYT system, respondents rejected replacing the current wheelie bins with a bag system. Respondents identified PAYT as a potential opportunity to boost recycling, waste diversion, and public awareness, but also raised concerns about challenges such as illegal dumping, increased waste costs, poverty, inequality, stakeholder buy-in, and the sustainability of the secondary goods market. These findings provide valuable insights into the potential for PAYT in CCT and highlight the need for careful planning to address challenges before its implementation.

Keywords: *Pay-As-You-Throw; Unit-based pricing; variable rate pricing; volumetric taxes; waste charges; City of Cape Town Metropolitan Municipality*

ABBREVIATIONS AND ACRONYMS

ADFs	Advanced Disposal Fees
ARFs	Advanced Recycling Fees
CACs	Command and Control Strategies
CCT	City of Cape Town Metropolitan Municipality Metropolitan Municipality
COGTA	Cooperative Governance and Traditional Affairs
CWMI	The Cornell Waste Management Institute
DEA	Department of Environmental Affairs
DEAT	Department of Environmental Affairs and Tourism
DEFF	Department of Environment, Forestry and Fisheries
DFFE	Department of Forestry, Fisheries and the Environment
DRSs	Deposit- Refund Systems
EEA	European Environment Agency
EIs	Economic Instruments
ELV	End of life vehicle
EC	European Commission
EU	European Union
EPA	US Environmental Protection Agency
EPR	Extended Producer Responsibility
FNAS-REC	Faculty of Natural and Agricultural Sciences Ethics Committee
GHG	Greenhouse gases
GNI	Gross National Income

GNR	Government Notice Regulation
IDB	Inter-American Development Bank
MDEP	Massachusetts Department of Environmental Protection
MUDs	Multi-Unit Dwellings
MSW	Municipal Solid Waste
MSWM	Municipal Solid Waste Management
MSWTS	Municipal Solid Waste Tariff Strategy
NEMA	National Environmental Management Act, 1998
NEM: WA	National Environmental Management: Waste Act, 2008
NPSWM	National Pricing Strategy for Waste Management
NWMS	National Waste Management Strategy
NWU	North-West University
NWU-SCRE	North-West University Senate Committee for Research Ethics
OECD	Organisation for Economic Co-operation and Development
PAYT	Pay-as-you-throw.
PC	Personal Computer
PET	Polyethylene Terephthalate
PROs	Producer Responsibility Organisations
QR	Quick Response
RFID	Radio-Frequency Identification
RSA	Republic of South Africa
SARS	South African Revenue Service
SAWIS	South African Waste Information System

SMEs	Small and Medium-sized Enterprises
UHF	Ultra-High Frequency
UK	United Kingdom
UNEP	United Nations Environment Programme
US	United States of America
WEEE	Waste from electrical and electronic equipment

KEY DEFINITIONS

Command and control (CAC) instruments: *Tools/instruments that are based on governments prescribing rules and restrictions through legislation and regulations, supported by norms and standards and meaningful enforcement to regulate environmental behaviour (Roos, 2023).*

Category A Municipality: *A municipality that has exclusive municipal executive and legislative authority in its area (Constitution of the Republic of South Africa, 1996).*

Domestic Waste: *Waste, excluding hazardous waste, that emanates from the premisses that are used wholly or mainly for residential, educational, health care, sport, or recreation purposes, which include:*

- (a) Garden and park wastes*
- (b) Municipal waste*
- (c) Food waste (National Environmental Management: Waste Amendment Act, 26 of 2014).*

Economic instruments: *A policy, tool, or action which has the purpose of affecting the behaviour of economic agents by changing their financial incentives in order to improve the cost-effectiveness of environmental and natural resources management (UNEP, 2005a: 5).*

Environment: *The surroundings within which humans exist and that are made of*

- (i) The land, water, and atmosphere of the earth;*
- (ii) Micro-organisms, plant and animal life;*
- (iii) Any part or combination of (i) and (ii) and the interrelationships among and between them; and*
- (iv) The physical, chemical, aesthetic, and cultural properties and conditions of the foregoing that influence human health and well-being (National Environmental Management Act, 107 of 1998).*

Frequency-based PAYT: *Frequency-based PAYT means that the scheme is based on the frequency with which a container is set out for collection (Watkins et al., 2012: 86)*

Formal household: *formal households include formal houses with a brick/concrete structure, flats and apartments, cluster houses, townhouses, semi-detached houses or any formal dwelling situated in a backyard, such as a room or garden cottage where a household or single person resides (Stats SA, 2022: 68)*

Greenhouse gases: *Gases in the earth's lower atmosphere (troposphere) that cause the greenhouse effect. Examples include carbon dioxide, chlorofluorocarbons, ozone, methane, water vapour, and nitrous oxide (Miller, 2007: G8).*

High-income countries: *Countries with a gross national income (GNI) per capita of \$12, 476 more (Kaza et al., 2018: 7).*

Household Solid Waste: *Household solid waste comprises those unwanted items that arise in a domestic dwelling: discarded products such as furniture, clothing or toys, used packaging, and food waste (Waite, 1995, cited in Chappells and Shove, 1999: 269).*

Hybrid PAYT: *Hybrid PAYT combines frequency-based schemes with volume-based or weight-based schemes (Zeschmar-Lahl et al., 2016: 157).*

Identification and weighing of the bin: *The tariff is determined on the basis of the weight of waste in the delivered bin, which has a chip or a tag, an electronic device that is detected by the garbage truck. The container's contents are weighed by a mechanism incorporated in the garbage truck (Agència de Residus de Catalunya, 2010: 14).*

Lower-income countries: *Countries with a gross national income per capita of \$1,025 or less (Kaza et al., 2018: 7).*

Lower middle-income countries: *Countries with a gross national income per capita between \$1,026 - \$4, 035 (Kaza et al., 2018: 7).*

Multi-component charge: *The waste charge consists of two or more types of fees, a fixed fee, and a variable fee, and under PAYT, the fixed portion covers the basic costs of waste management service, including general administrative expenses, bin rental, billing, supervision, recycling, education, and information costs, etc., while the variable portion is based on service rendered (Bilitewski, 2008b: 2764).*

Municipal solid waste (MSW): *A heterogeneous collection/mixture of wastes produced in urban areas, the nature of which varies from region to region (UNEP, 2005b: 23).*

Organic Waste: *waste from food scraps, yard (leaves, grass, brush), food process residues and wood (Gebremedhin et al., 2018: 26).*

Pay-As-You-Throw (PAYT): *Pay-as-you-throw, also known as "variable rate pricing or "unit-based pricing" "user charges" or "volumetric tariffs" is a system in which residents pay for*

municipal solid waste management services per unit of waste discarded rather than solely through a fixed fee or property tax (Massachusetts Department of Environmental Protection, 2004: 3).

Pay-per-bag: The user pays the tariff in advance, by purchasing standardised bags for disposing of waste. The collection service only accepts this kind of bag, bags are distributed by the council or collaborating retailers and tend to vary according to size (Agència de Residus de Catalunya, 2010: 14).

Pay-per-bin with individual tally: Each user or group of users is allocated a receptacle of known volume that can be identified by means of a chip or a tag. These electronic devices can be read by collection service using equipment installed in the collection vehicle or portable device carried by the operator. All the receptacles that are collected can be recorded and tariff calculated based on the number of collections. Users can choose the volume of their receptacle (Agència de Residus de Catalunya, 2010: 14).

Pay-per-bin with a predetermined frequency: In this case, the allocated bin is collected according to a fixed schedule. Users can choose both the receptacle's volume and the collection frequency from options offered by the council (Agència de Residus de Catalunya, 2010: 14).

Pay-by-volume with a volume chamber incorporated into the container: The receptacle has a device that opens to allow a maximum volume of waste to be thrown away on each use. The user has to identify him/herself prior using a magnetic card (Agència de Residus de Catalunya, 2010: 14).

Pay-by-weight with a weighing system incorporated in the bin: This is similar to the pay-by-volume with a volume chamber and the user has to identify him/herself prior using a magnetic card, but the bin has a weighing system instead of a volume chamber. The weight of the waste thrown away by the user is recorded (Agència de Residus de Catalunya, 2010: 14).

Single component charge: *A waste charge consists of only one type of fee, and under PAYT, a single component charge means the waste charge is fully variable, and waste charges are purely based on the volume or weight of the bin or container (Bilitewski, 2008b: 2764).*

Upper middle-income countries: *Countries with a gross national income per capita between \$4,036 - \$12, 475 (Kaza et al. 2018: 7).*

Volume-based PAYT: *Volume-based PAYT means that the scheme is based on the choice of container size and its volume (Watkins et al. 2012: 86)*

Waste: *Waste means -*

(a) Any substance, material, or object, that is unwanted, rejected, abandoned, discarded, or disposed of, or that is intended or required to be discarded or disposed of, by the holder of that material or object, whether or not such substance, material or object can be re-used, recycled or recovered and includes all wastes as defined in Schedule 3 of this Act; or

(b) Any other substance, material, or object that is not included in Schedule 3 that may be defined as a waste by the Minister by notice in the Gazette,

but any waste or portion of waste, referred to in paragraphs (a) and (b), ceases to be a waste-

(i) Once an application for its re-use, recycling, or recovery has been approved or, after such approval, once it is, or has been re-used, recycled, or recovered;

(ii) Where approval is not required, once waste is, or has been re-used, recycled, or recovered;

(iii) Where the Minister has, in terms of section 74, exempted any waste or a portion of waste generated by a particular process from the definition of waste; or

(iv) Where the Minister has, in the prescribed manner, excluded any waste stream or a portion of the waste stream from the definition of waste (National Environmental Management: Waste Amendment Act, 26 of 2014).

Waste management activity: Any activity listed in Schedule 1 or published by notice in the Gazette under section 19, and includes-

(a) the importation and exportation of waste;

(b) the generation of waste, including the undertaking of any activity or process that is likely to result in the generation of waste;

(c) the accumulation and storage of waste;

(d) the collection and handling of waste;

(e) the reduction, re-use, recycling, and recovery of waste

(f) the trading in waste;

(g) the transportation of waste;

(h) the transfer of waste;

(i) the treatment of waste; and

(j) the disposal of waste (National Environmental Management: Waste Act, 59 of 2008)

Weight-based PAYT: Weight-based PAYT means that the scheme is based on the weight/mass of material collected in a given container (Watkins et al., 2012: 86)

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CHAPTER 1 INTRODUCTION

1.1 Background

Solid waste management affects everyone globally, as both individuals and governments make decisions regarding consumption and waste disposal that impact health and the environment (Kaza *et al.*, 2018). Improper waste management leads to pollution and environmental degradation on local, regional, and global scales, with adverse effects on human health and economic activities (Bosman *et al.*, 2018).

Globally, about 40% of waste is landfilled, largely because it is the most cost-effective disposal method (Kaza *et al.*, 2018). In South Asia and Sub-Saharan Africa, over two-thirds of waste is landfilled, with 69% in open dumps. Key environmental concerns associated with landfilling include leachate contamination and airborne emissions from waste decomposition (Bosman *et al.*, 2018). Urban solid waste management is also costly, particularly in low- and middle-income countries, where it consumes nearly 20% and 10% of municipal budgets, respectively (Kaza *et al.*, 2018).

In 2016, global municipal solid waste generation was approximately 2.01 billion tonnes annually, projected to rise to 3.40 billion tonnes by 2050 (Kaza *et al.*, 2018). Key drivers of this increase include economic growth, population expansion, and rapid urbanisation. As countries progress economically, per capita waste generation also rises. While East Asia and Pacific countries generate the most waste overall, high-income countries have the highest per capita waste generation. Conversely, Sub-Saharan Africa and South Asia are projected to experience the most significant increases, with waste levels tripling and doubling, respectively (Bosman *et al.*, 2018).

To address these challenges, governments worldwide implement various policy instruments to regulate waste management. National and local governments share responsibilities: central governments set laws, standards, and guidelines, while local governments enforce regulations for households, businesses, and industries (Kaza *et al.*, 2018). Historically, waste governance relied on "command and control" instruments (CaCs), but there has been a shift toward economic instruments (EIs), particularly in developed countries. EIs use incentives and disincentives to influence behaviour and address market failures.

The adoption of EIs in waste management is growing, offering improved service delivery and reduced waste issues (United Nations Environmental Programme (UNEP), 2005a). UNEP (2005a) categorises EIs into three types: revenue-raising, revenue-providing, and non-revenue instruments. Waste charges, a common revenue-raising tool, include user fees, disposal charges

(or "tipping fees"), and product charges. Variable user charges—popularly known as Pay-As-You-Throw (PAYT)—charge residents based on the amount of waste discarded, instead of a fixed fee or property tax (Massachusetts Department of Environmental Protection, 2004). PAYT transforms waste management into a utility-like service, optimising waste management policies by encouraging separation and recycling (Bilitewski, 2008a).

PAYT has been widely adopted in developed countries (Skumatz & Freeman, 2006; Skumatz, 2008; Sakai *et al.*, 2008; Dijkgraaf & Gradus, 2009; Kevrekidou, 2016; Emmanouil *et al.*, 2022). Kling *et al.* (2016) compared various economic instruments, including PAYT, landfill taxes, Extended Producer Responsibility (EPR) fees, and deposit-refund systems. They found PAYT to be the most effective, offering strong incentives for waste reduction and behavioural change. PAYT charges households per unit of waste disposed of, promoting recycling, composting, and reduced consumption (Massachusetts Department of Environmental Protection (MDEP), 2004; Department of Environmental Affairs (DEA), 2016). Traditional waste financing relies on blanket fees or general taxes, paid regardless of service usage. In contrast, PAYT represents a paradigm shift, applying the "Polluter Pays Principle" at the household level.

1.2 Problem statement and rationale for the study

PAYT has been widely adopted in developed countries around the globe (Skumatz, 2008), and the number of municipalities with PAYT programmes is increasing around the world (Manni & Runhaar, 2014; Elia *et al.*, 2015). PAYT programmes in the US grew from approximately 100 jurisdictions in the late 1980s to over 7,100 by 2006, covering about 25% of the population (Skumatz, 2008). It is credited with diverting 4.6 to 8.3 million tonnes of waste annually (Skumatz & Freeman, 2006). PAYT is well known and widely implemented in many municipalities around Europe over the last ten years (Morlok *et al.* 2017). In the European Union (EU), PAYT has been embraced in numerous countries, including Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Italy, Luxembourg, the Netherlands, Sweden, and Switzerland (Reichenbach, 2008; Dijkgraaf & Gradus, 2009). In fact, a study conducted by European Commission in 2012, about 17 EU member states employed some PAYT scheme for several municipalities, while three of them including Austria, Finland and Ireland implemented PAYT across all municipalities (Romano & Masserini, 2023). Beyond Europe and North America, countries such as Australia, Japan, and South Korea have long implemented PAYT, with similar initiatives emerging in Mexico (Sakai *et al.*, 2008) and isolated cases in Chile and Brazil (DEA, 2016). China has also recently introduced PAYT in order to deal with increasing municipal solid waste challenges (Yao & Zhou, 2023; Zhang *et al.*, 2023).

Despite this global trend, PAYT has yet to gain significant traction in developing countries, including South Africa, which still predominantly relies on flat periodic waste charges (DEA, 2016). In South Africa, the National Pricing Strategy for Waste Management (NPSWM), established under Section 13A(1) of the National Environmental Management: Waste Act (Act No. 59 of 2008, as amended), provides the legislative framework for PAYT. The Municipal Waste Sector Plan (2012) also identifies PAYT as a potential mechanism for addressing waste financing and charging (DEA, 2012a). However, no South African municipality has implemented PAYT for household waste to date.

The NPSWM emphasises that successful PAYT implementation requires effective financial and administrative systems, including accurate billing and cost recovery mechanisms (DEA, 2016). Additionally, essential prerequisites include infrastructure to support waste prevention, reduction, recycling, and composting, alongside sustained public engagement and buy-in (European Commission (EC), 2011). This infrastructure enables residents to reduce waste sent to landfills, which in turn lowers household waste management costs.

Globally, researchers have extensively studied public perceptions and acceptance of PAYT, both before and after its implementation (Dunne *et al.*, 2008; Sakai *et al.*, 2008; Brown & Johnstone, 2014; Lakhan, 2015; Oduro-Kwarteng *et al.*, 2015; Kevrekidou, 2016; Emmanouil *et al.*, 2022; Yao & Zhou, 2023; Zhang *et al.*, 2023). However, research on PAYT perceptions and acceptance is limited outside the EU, North America, and parts of Asia. Given the critical role of stakeholder perceptions in PAYT's success, further research is necessary, particularly in developing country contexts.

This study aims to explore stakeholder perceptions of PAYT in South Africa, focusing on the City of Cape Town Metropolitan Municipality (CCT) as a study area. The CCT is a leading municipality in waste management, with 100% of formal households receiving weekly waste removal services provided by the City or appointed contractors (CCT, 2023). The City funds waste management primarily through tariffs, disposal charges, and equitable national government contributions for indigent households, supplemented by property rates (CCT, 2023). Its robust financial and administrative systems for billing and cost recovery make the CCT an ideal study area for evaluating PAYT's viability as a waste management tool.

1.3 Research aim, question and objectives

This research aims to explore stakeholder perceptions of PAYT as a fiscal instrument for household solid waste management in the City of Cape Town Metropolitan Municipality. This research explores the following questions:

- *What are the perceptions of stakeholders, namely households and municipal waste managers (officials), regarding PAYT as a fiscal instrument for household solid waste management in the City of Cape Town?*

To meet the research aim, the following research objectives were set:

- **Research objective 1:** To explore the perceptions of households regarding PAYT as a fiscal instrument for household solid waste management in the City of Cape Town.
- **Research objective 2:** To explore the perceptions of municipal waste officials regarding PAYT as a fiscal instrument for household solid waste management in the City of Cape Town.

1.4 Scope of the research

The scope of the research is limited to the City of Cape Town (CCT) stakeholders, particularly, formal households and CCT waste officials. The research explores perceptions of PAYT, looking at PAYT feasibility in the CCT, PAYT acceptance, PAYT pricing structure and charge model; PAYT benefits and challenges – related to solid municipal waste only. The research was conducted in 2024.

1.5 Assumptions and limitations

The following research assumptions were made:

- The CCT will support the research in terms of allowing City waste officials to be interviewed and provide assistance with the emailing list for household surveys.
- Participants will honestly answer questions administered during the interview.
- The required number of samples for the survey will be collected.

1.6 Potential contribution of the research

Although PAYT is provided for in South African waste-related strategies, it has not yet been extensively implemented in the country at a municipal level. Furthermore, little research has been conducted on the topic in the African and South African contexts. This research will contribute to the existing body of knowledge on PAYT in the developing country context.

The research will potentially contribute to increased awareness about the importance of public engagement during the waste policymaking process, and also provide information and awareness to residents about the modern waste fee systems as compared to traditional flat fee systems for household waste.

1.7 Structure and outline of the dissertation

The research will be structured in the following chapters:

- **Chapter 1 Introduction** focuses on the introduction, problem statement, research aim, and objectives of the study.
- **Chapter 2 Literature Review** presents the literature review of the study, describing PAYT in detail, where it has been implemented successfully internationally, the impact, various of PAYT, benefits, and challenges, and studies on its stakeholders perceptions of PAYT.
- **Chapter 3 Research Methodology** focuses on the research area, research methodology, research design, data collection methods, data analysis and ethical considerations, and methodological limitations.
- **Chapter 4 Results and Discussion** presents the interpretation and discussion of results. Results are analysed and presented in this chapter.
- **Chapter 5 Conclusions and Recommendations** presents conclusion and recommendations, and recommendations for future research. .

1.8 Conclusion

In conclusion, **Chapter 1** introduced the adverse impacts of waste management on local, regional, and global perspectives. Current waste generation volumes and projected volumes by 2050 in various regions of the world were then highlighted. The chapter then briefly dealt with various policy instruments available to governments and society to manage waste including command and control tools, and market-based instruments. PAYT, a popular market-based instrument in developed countries was introduced. Lastly, the chapter covered the problem statement and rationale for the study, research aims and objectives, the scope of the research, and assumptions and limitations of the research. The next chapter, **Chapter 2**, provides the literature review for the study.

CHAPTER 2 LITERATURE REVIEW

2.1 Introduction

All research builds on the foundation of past scholarship. As Saunders et al. (2007:55) aptly state, *“there is little point in reinventing the wheel...the work that you do is not done in a vacuum, [but] builds on the ideas of other people who have studied the field before you.”* A literature review, therefore, is more than just mapping and assessing existing studies; it helps identify knowledge gaps, refine research questions, and contextualise the current study. Furthermore, it reveals how other researchers have addressed methodological and design issues, including the tools they used to answer their research questions. Importantly, it anchors new findings in the broader academic discourse.

This literature review is structured into six sections: Environmental governance approaches to waste management (Section 2.2), an overview of fiscal-based instruments for waste management in global, regional, and local contexts (Section 2.3 to 2.5), the PAYT concept and its models (Section 2.6), considerations for the implementation of PAYT (Section 2.7), key benefits and challenges of PAYT (Section 2.8), and stakeholder perceptions of PAYT (Section 2.9).

The literature search drew from academic journals, the Boloka NWU Institutional Repository, government reports, and policy documents, focusing on studies about PAYT worldwide. Keywords such as *“Pay-As-You-Throw,” “Pay-As-You-Throw AND Africa,” “Pay-As-You-Throw AND South Africa,” “Unit-based pricing for household waste,” “variable rate pricing for household waste,” “volumetric taxes,” “waste charging,” and “acceptability of PAYT”* were used individually and in combination across Google Scholar, Scopus, and Boloka NWU Institutional Repository.

Most available literature focuses on PAYT's nature, models, benefits, challenges, and its impact on municipal solid waste management and recycling. These studies are largely concentrated in the US, Canada, European Union countries, and some Asian countries, including China, Japan, and South Korea. However, research on stakeholder perceptions and acceptance of PAYT is relatively scarce and mainly limited to these regions. Notably, no published studies address the perceptions, acceptance, or implementation of PAYT in South African municipalities.

2.2 An overview of governance approaches towards waste management

Governing instruments for waste management are framed within the general environmental management governing instruments including command and control-based instruments, incentive and disincentive or fiscal-based instruments (also referred to as market-based or financial instruments), agreement-based instruments, and civil-based instruments (Nel & Alberts,

2018). These instruments may be integrated and combined in many ways to form hybrid approaches, and in many cases, effective environmental management may only be achieved when these suits of approaches are combined and integrated (Nel & Alberts, 2018). The sub-sections below provide an overview of the different governance approaches in the context of waste management.

2.2.1 Command and control approaches

Command-and-control approaches to waste governance rely on government authorities prescribing rules, restrictions, norms, standards, and other requirements through legislation, regulations, and enforcement mechanisms. The “command” aspect refers to the establishment of these rules and standards, while the “control” component entails monitoring compliance and enforcing penalties for non-compliance (UNEP, 2016). These instruments are traditionally favoured for their clarity and enforceability, as they set explicit obligations for waste generators and handlers.

In the South African context, command-and-control instruments dominate waste management governance. One could argue that waste management is one of the most regulated activities in the country, given the sheer volume of regulations, norms, and standards in place. These include waste management licences and permits for waste-related activities such as storage, transportation, treatment, and disposal of waste; norms, and standards for storage, treatment, and disposal of waste to landfills; norms and standards for the sorting, shredding, grinding, crushing, screening or baling of general waste, industry waste management plans; etc.

Despite the prevalence of command-and-control instruments, criticisms exist regarding their inflexibility, high administrative burden, and limited ability to incentivise innovation. Scholars argue that complementing these approaches with market-based or civil-based mechanisms could enhance their effectiveness (Godfrey & Oelofse, 2017).

2.2.2 Fiscal/market-based approaches

Fiscal or market-based approaches use economic incentives or disincentives to influence behaviour, encouraging individuals and businesses to adopt environmentally responsible practices while discouraging harmful activities. These instruments operate on the principle of internalising environmental externalities, meaning that the environmental and social costs of waste generation are reflected in economic decision-making (OECD, 2016). By altering cost structures, market-based approaches encourage waste reduction, recycling, and sustainable consumption, providing flexibility for stakeholders to meet environmental objectives cost-effectively.

Examples of waste-related market-based instruments include emission or carbon taxes, which are levied on greenhouse gas emissions from waste disposal processes, such as landfill operations, to encourage waste diversion to less polluting options like recycling and composting (European Environment Agency (EEA), 2016). Material and input taxes target the use of environmentally harmful materials, such as single-use plastics or excessive packaging, by making these options more expensive and incentivising the adoption of sustainable alternatives. Subsidies, on the other hand, provide financial incentives to businesses and municipalities for investments in recycling infrastructure, waste-to-energy technologies, or composting facilities.

Advanced recycling fees (ARFs) represent another market-based tool, where an upfront charge is included in the price of a product to cover the costs of recycling or safe disposal at the product's end of life (US EPA, 2020). Extended Producer Responsibility (EPR) frameworks further shift the burden of managing post-consumer waste to producers, requiring them to finance or directly manage the collection and recycling of their products. This system not only incentivises producers to design products with a longer life cycle but also reduces waste generation (Godfrey, 2018). Deposit-refund schemes are a complementary approach, where consumers pay a deposit when purchasing products such as beverage containers, which is refunded upon proper recycling or disposal. These systems have been effective in increasing recycling rates and minimising litter.

Another significant market-based approach is unit-based pricing, commonly referred to as Pay-As-You-Throw (PAYT). Under PAYT schemes, households or businesses are charged based on the amount of waste they generate, often through volumetric tariffs or variable rate pricing. This direct link between waste generation and disposal costs encourages users to reduce waste and increase recycling, making PAYT a widely studied and effective instrument (Skumatz & Freeman, 2006).

While market-based instruments offer flexibility and efficiency, they are not without challenges. Administrative complexities in setting up and monitoring these systems can be significant, particularly in developing countries. Equity concerns also arise, as low-income households may bear a disproportionate financial burden if these instruments are not carefully designed. However, when integrated with command-and-control measures, market-based approaches can form a dynamic and effective waste governance framework, leveraging financial incentives alongside regulatory enforcement to achieve sustainable waste management goals (Alzamora & Barros, 2020).

2.2.3 Civil-based approaches

Civil-based approaches emphasise the empowerment and active engagement of civil society in promoting sustainable waste management practices. These approaches rely on tools such as education and awareness campaigns, capacity building, public participation in governance processes, and access to information (UNEP, 2016). By equipping individuals, communities, and organisations with the knowledge and resources needed to make informed decisions, civil-based approaches foster a sense of shared responsibility for environmental stewardship. The role of media and information dissemination is also pivotal, as it enhances transparency and accountability while driving behavioural change (DEA, 2011).

In South Africa, civil-based approaches to waste management often have a hybrid nature, as they are frequently supported or mandated by legislation and regulations. For instance, the National Environmental Management: Waste Act No. 59 of 2008 explicitly promotes public participation in environmental decision-making, requiring consultations and stakeholder engagement during the development of waste management policies, strategies, and industry waste management plans (RSA, 2008). This legislative backing ensures that civil-based approaches are institutionalised within broader governance frameworks.

Education and awareness campaigns are central to these efforts, often focusing on promoting recycling, waste separation at source, and reducing waste generation (Godfrey & Nahman, 2007). Programmes such as the *“War on Waste”* and community-based clean-up initiatives mobilise citizens to take collective action. Capacity-building initiatives target community organisations, equipping them with skills to manage waste-related challenges effectively and advocate for improved waste management services in their areas (DEA, 2011).

However, despite the potential of civil-based approaches to transform waste management, challenges remain. Limited financial and institutional capacity, particularly in marginalised communities, often hinders the effective implementation of these programmes. Moreover, the success of such initiatives depends heavily on sustained political will, community buy-in, and access to accurate and timely information. Strengthening partnerships between government, civil society, and the private sector is therefore essential to maximise the impact of these approaches (UNEP, 2016).

2.2.4 Agreement based approaches

Agreement-based environmental approaches rely on voluntary agreements between industries, industry associations, and regulatory authorities to address specific environmental challenges. These agreements typically aim to promote cooperative solutions by fostering commitments to

improved environmental performance without the need for strict regulatory enforcement. Scholtz (2004) highlights that such approaches can be particularly effective in building partnerships, encouraging innovation, and enabling flexibility in achieving environmental goals.

In South Africa, agreement-based approaches are explicitly supported under Section 35 of the National Environmental Management Act No. 107 of 1998 (NEMA). This section provides a framework for entering into environmental management cooperation agreements between the government and stakeholders. Such agreements are aimed at aligning industrial activities with sustainable development goals while granting industries some operational flexibility. The integration of these agreements into the legislative framework renders them hybrid in nature, combining the voluntary aspects of cooperative arrangements with the formal oversight of regulatory instruments (RSA, 1998).

Examples of agreement-based approaches in South Africa include the development of sectoral environmental charters and voluntary commitments to reduce waste generation, improve energy efficiency, or phase-out hazardous substances. These agreements often work in tandem with market-based and civil-based approaches to address complex environmental problems. However, their success depends on the willingness of stakeholders to cooperate, the strength of enforcement mechanisms for monitoring progress, and the establishment of clear, measurable objectives (Scholtz, 2004).

2.2.5 Hybrid approaches

Hybrid approaches combine elements of different waste governance strategies - such as command-and-control, civil-based, and fiscal mechanisms - creating integrated frameworks to address environmental challenges more effectively. These approaches leverage the strengths of multiple systems to achieve better environmental outcomes while accommodating the diverse needs of stakeholder.

An example of such integration is the mandatory public participation process in waste management licencing, which is a legal requirement under South African environmental law. This combines command-and-control elements, as it is enforced through legislation, with civil-based principles that emphasise community engagement and stakeholder empowerment (RSA, 2008). Similarly, EPR schemes exemplify a hybrid between command-and-control and fiscal-based approaches. These schemes impose legally binding obligations on producers while incorporating economic incentives, such as fees or subsidies, to encourage sustainable production and waste reduction (Godfrey, 2018).

Another notable hybrid is the South African Waste Information System (SAWIS), mandated under the National Waste Information Regulations (GNR. 625, 2012). This system integrates civil-based approaches by improving access to waste-related data and fostering transparency, while relying on command-and-control mechanisms for enforcement and compliance (DEA, 2011). These examples illustrate how hybrid approaches enable synergy, addressing the limitations of standalone strategies and enhancing overall effectiveness.

2.3 An overview of fiscal-based approaches and waste management on a global level

Although command-and-control (CAC) mechanisms and economic instruments (EIs) often complement each other, EIs offer several advantages over CACs. These advantages include greater flexibility, cost efficiency, and the potential to incentivise behavioural changes through market-based mechanisms. Since the 1980s, the use of EIs in solid waste management policy has grown significantly in developed countries. This trend reflects their effectiveness in addressing complex waste challenges. More recently, developing countries have also shown increasing interest in integrating EIs into waste management policies to enhance sustainability and efficiency (Nahman & Godfrey, 2010).

EIs encompass a wide range of tools, which UNEP (2005a) classifies into three main categories: revenue-raising instruments, revenue-providing instruments, and non-revenue instruments.

Revenue-raising instruments generate funds to support waste management systems. These include various charges, fees, and taxes designed to cover costs associated with solid waste management activities. Examples include waste user charges, disposal charges (e.g., landfill tipping fees), product charges, virgin material taxes, landfill taxes, and pollution taxes (UNEP, 2005a). These instruments not only generate revenue but also encourage waste minimisation and recycling by imposing financial penalties for waste disposal or the use of non-sustainable materials.

Revenue-providing instruments, on the other hand, involve subsidies that directly incentivise desired behaviours, such as waste minimisation, recycling, or the adoption of improved waste management practices. These instruments may include tax credits and rebates for businesses that adopt sustainable practices, reductions in user charges for recycling participants, recycling credits, development rights for waste management facilities, and funds to support solid waste system improvements (UNEP, 2005a). Such subsidies help reduce financial barriers to sustainable waste management practices, encouraging wider participation.

Non-revenue instruments combine the incentive effects of both charges and subsidies, aiming to align economic and environmental objectives. These include tools such as deposit-refund systems, (DRSs) which require consumers to pay a deposit for products that are refunded upon return for proper disposal or recycling. EPR schemes require producers to take responsibility for the post-consumer stage of their products. Other non-revenue instruments include recycled content requirements, which mandate minimum levels of recycled materials in products, and take-back systems, which ensure that end-of-life products are properly managed (UNEP, 2005a).

These EIs can be applied at various stages of the waste management cycle, from waste generation and collection to processing and disposal (see Figure 2-1). By targeting different points in the cycle, EIs provide a comprehensive approach to addressing waste challenges.

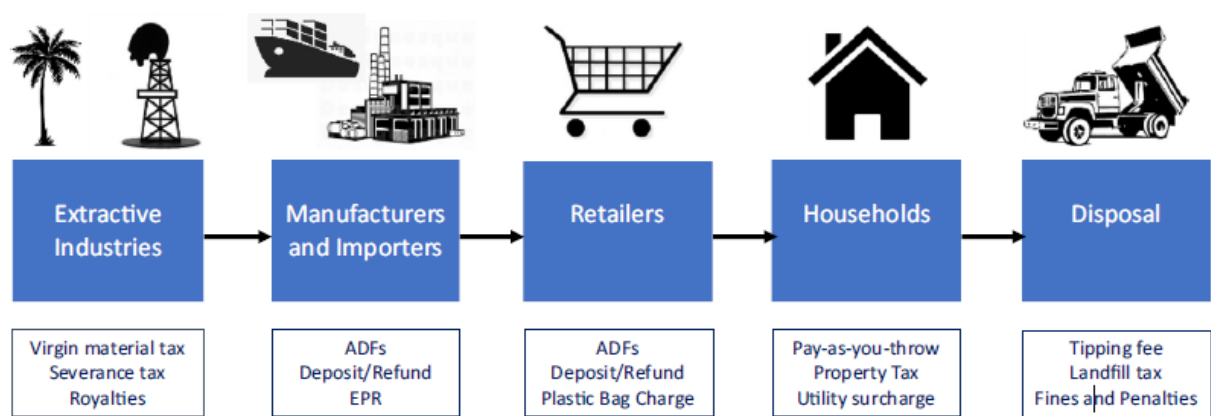


Figure 2-1: EIs and waste cycle (Source: Matheson 2022)

The sub-sections to Section 2.3 examine some of the most common EIs applied in solid waste management, such as taxes, user charges, subsidy reductions, subsidies, EPR and DRSs.

2.3.1 Taxes

Green taxes, also known as eco-taxes, are an important economic instrument used to improve solid waste management by imposing taxes at various stages, from extraction to disposal. These taxes aim to reduce the environmental impact of waste and incentivise sustainable practices across the lifecycle of products and materials (Prats *et al.*, 2020).

Virgin material taxes, or input taxes, are typically levied on extractive industries for the use of virgin materials. The primary goal of such taxes is to discourage reliance on virgin materials, encourage the use of recycled alternatives, and internalise the environmental costs associated with extraction. Virgin material taxes can also be applied to hazardous materials to promote the

substitution of non-hazardous inputs, further supporting environmental sustainability (Matheson, 2022).

Product taxes are another form of green tax, aimed at products with high levels of waste, significant environmental impact, or low recyclability. These taxes serve to reduce the demand for products that are difficult to manage at the end of their life cycle. Advanced Disposal Fees (ADFs) and Advanced Recycling Fees (ARFs) are specific types of product taxes levied to prepay the costs associated with the disposal or recycling of waste generated from certain products (Matheson, 2022). These fees are designed to ensure that producers contribute to the costs of managing the waste they generate.

Product taxes have been widely applied to various pollutive items, including motor vehicle batteries, tires, plastic packaging, vehicles, and lubricating oils (Nahman & Godfrey, 2010). One of the most common examples of eco-taxes globally is the tax on plastic bags, implemented in numerous countries to reduce plastic waste and encourage more sustainable alternatives (IDB, 2003; Matheson, 2022).

Taxes may also be imposed at the disposal stage, particularly at landfills. In addition to landfill "tipping fees," which cover the cost of disposal and allow for profit, landfill taxes are levied to address the externalities associated with landfilling, such as environmental harm and long-term ecological damage. These taxes are particularly common in European countries, where they have proven to be an effective means of reducing landfill use and promoting recycling and waste diversion (IDB, 2003; Matheson, 2022). Overall, green taxes, as a category of economic instruments, are more prevalent in Europe than in other regions, reflecting the continent's progressive environmental policies and commitment to sustainable waste management (IDB, 2003).

2.3.2 User charges

Waste user charges are a common EI used globally to fund waste management systems, typically applied to both households and businesses. These charges can be structured in two main ways: flat-fee systems and variable-rate systems, such as PAYT. Flat-fee systems are the most common, with charges often based on property value, location, or a fixed amount irrespective of the volume or weight of waste generated (Matheson, 2022). While flat fees provide a stable revenue stream, they do not incentivise waste reduction or improve waste management practices. In contrast, PAYT systems, which link the fee directly to the volume or weight of waste produced, create a financial incentive for households and businesses to minimise waste and increase recycling.

Despite its advantages, PAYT is not widely implemented in low-income countries due to its high administrative and compliance costs. As a result, it is most commonly found in high-income countries, such as those in Europe, the US, Japan, South Korea, and, more recently, China (IDB, 2003; Matheson, 2022; Kaza *et al.*, 2018; Zheng *et al.*, 2023). PAYT systems have proven effective in promoting waste reduction behaviours and are considered one of the most efficient means of incentivising sustainable waste management practices. However, the high setup and operational costs associated with PAYT have limited its widespread adoption, particularly in lower-income regions.

2.3.3 Subsidy reductions

In many countries, the costs of waste management services are not fully covered by user fees, and as a result, local governments often rely on subsidies or transfers from central governments. Studies show that local governments typically receive between US\$4 and US\$10 per capita per year in subsidies for waste management services (Kaza *et al.*, 2018).

To address the financial gap and improve the efficiency of waste management systems, one approach is to reduce or even eliminate these subsidies. By doing so, competition can be encouraged, leading to more efficient service delivery and greater cost-effectiveness. This market-based approach has been implemented in several cities across the United States, where the removal of subsidies has stimulated competition and innovation in waste management practices (IDB, 2003). Such strategies can also incentivise local governments to explore alternative funding models, including the increased use of economic instruments to support waste management programmes.

2.3.4 Subsidies

While much of the discussion above focuses on reducing pervasive subsidies in solid waste management, subsidies can also play a beneficial role in various stages of waste management. These subsidies often come in the form of grant funding for training, research, recycling programmes, and waste management infrastructure (UNEP, 2005b). Additionally, subsidies may include preferential tax treatments, such as tax-exempt bonds issued by state or local governments for the construction of pollution control or alternative waste treatment technologies. Tax credits can also be provided to industries that incorporate recycled materials into their production processes (UNEP, 2005b).

These types of EIs are widely used across the globe. For instance, in the United States, tax-exempt bonds have been issued by state and local governments to fund waste-to-energy infrastructure, and tax credits have been granted for landfill gas generation projects (IDB, 2003).

In Europe, countries like Belgium and the Netherlands offer preferential tax rates for investments in energy efficiency and energy recovery from waste, while the United Kingdom (UK) provides recycling credits to companies that collect and recycle waste (IDB, 2003). In Asia, India offers preferential loans for waste-to-energy infrastructure projects, and in Africa, Ghana has used accelerated depreciation and tax exemptions to support private companies entering the solid waste collection sector (IDB, 2003).

These examples demonstrate the versatility of subsidies as economic instruments in solid waste management, highlighting their potential to drive innovation, improve waste treatment technologies, and promote sustainable practices.

2.3.5 Extended Producer Responsibility (EPR)

Extended Producer Responsibility (EPR), first pioneered in Germany in the 1990s, is an EI that places the legal responsibility on manufacturers and importers to manage the post-consumption phase of their products, including their packaging. EPR incentivises manufacturers to design products that minimise waste, promote reuse, and encourage recycling. Under an EPR regime, producers typically pay intermediaries or even local municipalities to collect and manage their end-of-life products. In some cases, they may also offer incentives to consumers to encourage recycling (Matheson, 2022). By shifting the burden of waste management costs from local municipalities to producers, importers, and consumers, EPR promotes a more sustainable and circular economy.

The EPR regime has been widely adopted for managing polluting and hazardous waste streams, particularly in packaging, batteries, oils, paints, tires, end-of-life vehicles (ELVs), and waste electrical and electronic equipment (WEEE). EPR schemes are now implemented in numerous countries across the globe. Most OECD countries and many emerging economies have adopted EPR programmes for key waste streams, including packaging, electronics, batteries, and vehicles (OECD, 2014). In Europe, all EU Member States have established EPR schemes for four major waste streams. In North America, both the United States and Canada have implemented EPR schemes for a wide range of products. In Latin America and the Caribbean, OECD members such as Chile and Mexico, as well as Argentina, Brazil, and Colombia, have introduced EPR programmes (OECD, 2014). In Asia, countries including Japan, the Republic of Korea, and rapidly emerging economies like China, India, Indonesia, Malaysia, and Thailand have begun implementing EPR schemes (OECD, 2014).

In contrast, while EPR and waste management policies have advanced in many parts of the world, their application in Africa remains limited. South Africa, however, has made significant strides in

implementing EPR regulation. The Department of Forestry, Fisheries and the Environment (DFFE) has implemented EPR Regulations under the NEM:WA to address the environmental impacts of end-of-life products. On 5 November 2020, the DFFE published EPR Regulations and notices for specific waste streams, including paper and packaging, electrical and electronic equipment (WEEE), and lighting. These regulations aim to provide a framework for the development, implementation, monitoring, and evaluation of EPR schemes for producers, as mandated under Section 18 of the NEMWA. The purpose is to ensure the effective and efficient management of these identified waste streams while promoting the principles of the circular economy. The regulations encourage producers and producer responsibility organisations (PROs) to take responsibility for the end-of-life management of their products, including recycling and waste minimisation. Through these efforts, South Africa aims to align with global waste management standards, reduce waste to landfill, and encourage circular economy practices, with the ultimate goal of minimising environmental harm caused by waste. While the implementation of EPR in South Africa is still in its early stages compared to more developed regions, these efforts represent a significant step toward a more sustainable waste management system in the country.

2.3.6 Deposit-Refund Systems (DRSs)

Deposit-Refund Schemes (DRSs) combine both taxes and subsidies to incentivise recycling and reduce waste. In a DRS, a surcharge (tax) is imposed on the consumer at the time of purchase of a waste-generating product, and a refund (subsidy) is provided when the product is returned for recycling or reuse (Taylor, 2000). The product must be durable, reusable, or recyclable, and it cannot be consumed with the product itself. DRSs are most commonly associated with beverage containers such as steel, aluminium, glass, and plastic bottles, although they can also apply to other items like batteries, light bulbs, cars, and tyres (Nahman & Godfrey, 2010; Taylor, 2000). As a policy tool under EPR) the costs of operating the DRS are typically borne by the producers, as the deposit collected from the consumer is refunded upon the return of the item (Laubinger *et al.*, 2022).

DRSs are widely used in waste management, particularly for beverage containers, which are the most common products subject to such schemes. These schemes are often voluntary, especially for reusable or refillable containers such as glass or PET plastic bottles (UNEP, 2005a; UNEP, 2005b; Watkins *et al.*, 2019; Laubinger *et al.*, 2022). However, the scope of DRSs has expanded beyond reusable beverage containers to include single-use containers. By the end of 2022, it was estimated that around 352.9 million people globally lived in regions where DRSs had been implemented for single-use drink containers (Reloop, 2022). This expansion highlights the increasing recognition of the effectiveness of DRSs in promoting recycling, reducing waste, and supporting the circular economy.

2.4 Overview of fiscal-based approaches and waste management in Africa

In Africa, various policy instruments have been put in place to address pollution and waste management; however, the lack of effective implementation and enforcement of waste legislation in many African countries has contributed to a culture of impunity, weakening the overall effectiveness of waste management efforts (Godfrey *et al.*, 2020). The application of EIs in solid waste management in Africa remains limited, and even when such instruments are used, they are often poorly designed and ineffective (Oelofse, 2018; Godfrey *et al.*, 2020). International experience has demonstrated that EIs can be highly effective in promoting waste management practices that move waste up the waste hierarchy. The underutilisation of EIs in Africa thus represents a "lost opportunity," given the substantial potential of these instruments to drive sustainable waste management (UNEP, 2005a: 20).

In some African countries, there are examples of limited EI applications. For instance, in Ghana, subsidies have been employed to incentivise private companies to establish solid waste collection services (IDB, 2003), while taxes and charges have been used to discourage the importation of old cars, although with limited success (Oelofse, 2018). User charges such as monthly solid waste fees or municipal rates are applied in cities like Gaborone (Botswana) and Harare (Zimbabwe), though their effectiveness varies. In Kenya, a combination of user charges, subsidies, licences, preferential taxes, and a deposit-refund system for beverage containers have been implemented, though these measures are applied to a limited extent (Oelofse, 2018). These examples indicate that while EIs are used in certain regions of Africa, their full potential is yet to be realised, and there remains significant room for improvement in their design and implementation.

2.5 Overview of fiscal-based approaches for waste management in South Africa and its legal framework

South Africa stands out as one of the few African countries that have adopted EIs in solid waste management to a significant extent. A range of user charges, such as monthly solid waste fees or municipal rates, are levied across various municipalities (Oelofse, 2018). Additionally, South Africa imposes product taxes on items such as plastic bags, tyres, and incandescent light bulbs (Oelofse, 2018), alongside mandatory EPR fees for a number of waste streams. As mentioned earlier, these include electrical and electronic equipment, lighting, paper, plastic, glass, and metal packaging, portable batteries, pesticide containers, and lubricant oils, with the implementation of these fees beginning in 2020.

South Africa also has voluntary, industry-initiated buy-back and deposit-refund schemes, mainly targeting glass and plastic beverage containers, as well as steel containers (Nahman & Godfrey,

2010). However, despite the broad use of EIs, Nahman and Godfrey (2010) argue that the effectiveness of these instruments remains limited. In many cases, they are primarily used for cost recovery or revenue generation, rather than as tools to encourage behavioural change. A notable example is the product tax levied on plastic bags, which aimed to reduce production and waste. However, only a small fraction (7%) of the R90 million tax revenue collected in 2006 was allocated to the Buyisa-e-Bag recycling initiative, highlighting the challenges in using EIs effectively for environmental outcomes (Nahman, 2010).

This suggests that while South Africa has made strides in incorporating EIs, there is still a need for more targeted and strategic implementation to achieve meaningful waste management and behavioural change.

The sub-sections below provide an overview of the legal and strategic framework for fiscal instruments in waste management in South Africa.

2.5.1 National Environmental Management Waste Act, 2008 (Act 59 of 2008)

The National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008), as amended (also referred to as the “Waste Act” and “NEM:WA”), provides a comprehensive framework for the implementation of EIs in solid waste management in South Africa. As one of the key legislative documents in the country, the Waste Act includes several provisions that support the use of EIs for promoting sustainable waste management practices. Chapter 3A of the NEM:WA, for instance, mandates the development of a pricing strategy for waste management charges. This strategy is not intended solely for cost recovery or revenue generation. Section 13A (2) (f) and (g) explicitly state that the pricing strategy should outline the creation and monitoring of incentives and disincentives aimed at the minimisation, reuse, recycling, and recovery of waste. This provision aligns with the principles of a circular economy, where the goal is to reduce waste generation and encourage the recycling of materials.

In addition, the pricing strategy may allow for differential waste management charges based on factors such as the volume of waste disposed of. This provides a mechanism for incentivising waste minimisation by rewarding households and businesses that produce less waste. Furthermore, Section 18 of the Waste Act specifically addresses EPR, defining it as measures that extend a producer’s financial or physical responsibility for a product to its post-consumer phase. This is a key provision in promoting the recycling and recovery of products and materials that would otherwise end up in landfills.

Lastly, Section 69 of the Waste Act provides broader support for the use of EIs, including EPR, DRSSs, and other incentives and disincentives aimed at encouraging a change in behaviour

towards waste generation and management. These provisions allow policymakers to implement various EIs that may not be explicitly detailed in the Waste Act but can be derived from its overall objectives. By supporting the development of innovative pricing mechanisms, subsidies, and market-based instruments, the NEM:WA plays a crucial role in shaping the future of solid waste management in South Africa, ensuring both environmental sustainability and economic efficiency.

2.5.2 National Waste Management Strategy (2011, 2020)

The National Waste Management Strategy (NWMS) is a key legislative instrument under the Waste Act, designed to help achieve the overarching goals of waste management in South Africa. The first NWMS was published in 2011, and it is required to be updated every five years. The 2011 NWMS emphasised that before the implementation of any economic instruments EIs, an appropriate tariff setting for user charges must be established to ensure full-cost accounting in waste management (DEA, 2011). The strategy identified several EIs for implementation, including mandatory EPR schemes for various waste streams (DEA, 2011). In addition, the strategy considered the use of DRSs, product taxes, landfill taxes, special taxes for hazardous waste disposal, tax rebates, and benefits, as well as development financing for waste management infrastructure.

The revised 2020 NWMS builds upon the previous strategy and references a suite of EIs identified by the Department of Environment, Forestry, and Fisheries (DEFF) in 2016. The 2020 update emphasises the role of EPR in achieving waste management objectives, with particular focus on the development and implementation of EPR schemes for Waste Electrical and Electronic Equipment (WEEE), paper and packaging, and lighting (DEFF, 2021a). However, the strategy also highlights challenges with user charges, particularly in municipalities with high levels of poverty, where such charges have proven politically unsustainable. For instance, the product tax on plastic bags, while levied to encourage waste reduction, has not been effectively earmarked for waste management purposes (DEFF, 2021a).

The 2020 NWMS is built around three pillars, with two of them focusing on the use of EIs. Pillar 1, *Waste Minimisation*, provides enabling EIs, such as subsidies or incentives, mainly for the implementation of EPR schemes. It also advocates for the use of Advance Recycling Fees (ARFs) within the context of EPR. Pillar 2, *Effective and Sustainable Waste Services*, emphasises the role of producers in supporting waste separation at the source. Through EPR fees, producers are expected to contribute to post-consumer waste collection, recycling, reuse, and recovery. This approach reflects a comprehensive, market-based strategy aimed at creating a circular economy for waste management in South Africa, where the private sector plays an active role in both the economic and environmental aspects of waste management.

2.5.3 Municipal Solid Waste Tariff Strategy (2012)

The Municipal Solid Waste Tariff Strategy (MSWTS) of 2012, is a key requirement under the 2011 NWMS and aims to provide a structured framework and guidance to municipalities in setting appropriate tariffs for solid waste management services. The goal of the strategy is to ensure full cost accounting for waste management, enabling municipalities to sustainably manage their waste services. The MSWTS outlines several principles for determining waste tariffs, including cost recovery and the "polluter pays" principle. This means that the costs associated with the externalities of waste generation and disposal should be borne by those who generate the waste, promoting accountability and responsibility at the source (DEA, 2011).

The strategy encourages municipalities to explore various tariff options, such as general property rates, as well as specific user charge mechanisms like PAYT or combined approaches. These options aim to incentivise waste reduction, recycling, and proper disposal by directly linking the costs of waste management to the volume or weight of waste generated.

Additionally, the MSWTS recognises the importance of supporting municipalities through capital and operational subsidies, which can help to bridge financial gaps in waste management services and encourage the development of sustainable infrastructure and programmes (DEA, 2011). By aligning waste tariffs with the principles of fairness, efficiency, and environmental responsibility, the MSWTS seeks to improve the financial viability of waste management services while also promoting sustainable waste practices across South Africa's municipalities (DEFF, 2021a).

2.5.4 National Pricing Strategy for Waste Management (2016)

The National Pricing Strategy for Waste Management (NPSWM) of 2016, is a legislative requirement of the NEM:WA and is designed to support the goals outlined in the 2011 NWMS. The NPSWM provides a framework for the application of economic instruments (EIs) within the broader fiscal and taxation policy of South Africa, specifically across the waste value chain. It outlines a suite of EIs to be used in waste management services, aiming to provide incentives and disincentives that encourage behavioural change. The strategy also offers guidance on how and when particular EIs should be applied.

Importantly, the strategy highlights that the *"selection and use of EIs must also be aligned with the polluter pays principle where all generators of waste including businesses and households are responsible for the costs of managing the waste generated,"* which includes not only the direct financial costs of collection, treatment, and disposal but also externalities such as environmental impacts (DEA, 2016: 6). Thus, the strategy emphasises that where EIs are implemented, social costs must be taken into account.

The NPSWM classifies these EIs into three categories: upstream instruments, downstream instruments, and subsidy-based instruments. Upstream economic instruments incentivise or disincentivise behaviour among agents involved in the production of goods that eventually become waste. These include material and input taxes, product taxes, advance recycling fees, deposit-refund schemes, and EPR fees. Downstream instruments target consumers who generate waste and include mechanisms such as PAYT, also known as "unit-based pricing," "variable rate pricing," or "volumetric tariffs," and waste disposal taxes, including landfill and incineration taxes. Subsidy-based instruments aim to encourage waste recycling, reuse, and recovery and may include tax incentives or credits, capital financing, grants, or combinations of these, to provide financial support for the improvement of various aspects of solid waste management (DEA, 2016).

Regarding implementation, the NPSWM highlights the importance of evaluating and assessing EIs before their application, considering potential socio-economic impacts, including external social and environmental costs. Key stakeholders in the collection and disbursement of waste management charges and taxes include the national government (National Treasury through the South African Revenue Service (SARS) and/or Waste Management Bureau) and municipalities. For EPR schemes, which the NPSWM addresses comprehensively, the strategy provides for both government-managed and industry-managed schemes. With the publication of the EPR regulations in 2020, the industry-managed approach has become the preferred model.

The NPSWM also outlines that the monitoring and evaluation of EIs within the waste sector will involve various stakeholders, including the National Treasury, SARS, the Department of Environmental Affairs and Waste Management Bureau, the Department of Trade and Industry, municipalities, obligated industries, PROs, and the Product Steering Committee.

2.6 Pay-as-you-throw (PAYT) as a fiscal-based approach for waste management

As indicated in Section 2.3, user charges are among the most widely applied EIs for waste management, and these charges can either be flat-fee systems or variable rate systems. One prominent variable user charge system is Pay-as-you-throw (PAYT), also known as "unit-based pricing" or "variable rate pricing." Under PAYT, residents pay for municipal solid waste management services based on the amount of waste they dispose of, rather than paying a fixed fee or property tax (MDEP, 2004). PAYT operates under the simple concept that, instead of paying for waste collection and disposal through a flat fee or property tax, residents are charged per unit of waste disposed of, much like how they are billed for utilities such as water and electricity.

Since the 1990s, many countries have recognised PAYT as an effective economic tool for managing household waste (Sakai *et al.*, 2008). However, the origins of PAYT can be traced back much further. The City of San Francisco in the United States has implemented some form of PAYT since 1932 (Cornell Waste Management Institute (CWMI), 2000), while Austria began its implementation as early as 1945 (Reichenbach, 2008). In the United States, the Environmental Protection Agency (EPA) published its first guidebook for the implementation of PAYT in 1994, and the European Union initiated pilot programmes and studies in the 1990s, followed by the publication of a PAYT guidebook in 2004 (Sakai *et al.*, 2008). To date, PAYT has been widely implemented in developed countries around the globe including the US, the EU (Skumatz, 2008; Manni & Runhaar, 2014; Elia *et al.*, 2015; Morlok *et al.* 2017; Romano & Masserini, 2023). In Asia, Japan introduced PAYT in the early 1970s, South Korea followed suit in 1995 (Sakai *et al.*, 2008).

Although PAYT is well established in developed countries, PAYT experiences in developing countries are limited and literature scarce (Welivita *et al.*, 2015). China has also recently introduced PAYT in order to deal with increasing municipal solid waste challenges (Yao & Zhou, 2023; Zhang *et al.*, 2023). A few PAYT cases have been implemented in other developing countries such as Mexico, Chile and Brazil (Sakai *et al.*, 2008; DEA, 2016). Within the African context, there is very limited use of EIs in waste management including use of PAYT (Oelofse, 2018). In Ghana, PAYT was introduced in 2008 in a few communities in Kumasi, however, the objective was to ensure full cost recovery, and not for influencing waste-related behaviour (Oduro-Kwarteng *et al.*, 2015). Despite mention of PAYT in South Africa's waste legal framework (see section 2.5 above), PAYT has not been implemented in any municipality in South Africa.

2.6.1 PAYT models

PAYT models are highly flexible and can take various forms, each with distinct strengths and weaknesses. The principal alternatives for the implementation of PAYT are based on the work of Reichenbach (2004), cited in Agència de Residus de Catalunya (2010) (Figure 2-2).

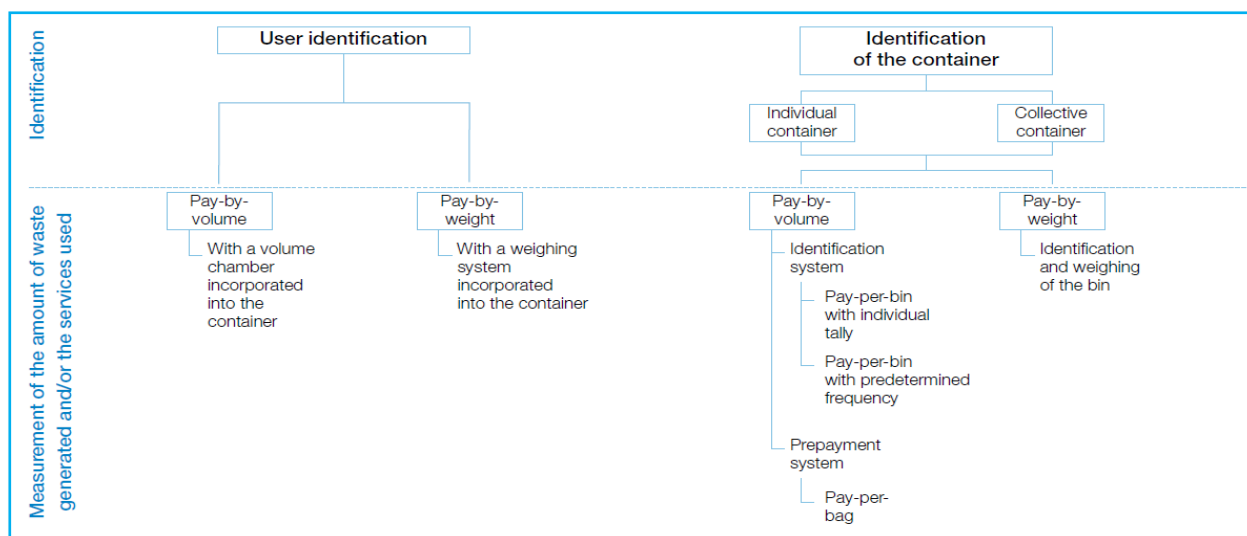


Figure 2-2: Principal alternatives for PAYT implementation (Source: Agència de Residus de Catalunya, 2010)

Watkins *et al.* (2012) assessed various PAYT systems in 27 EU countries and found that approximately nineteen of those countries had implemented one or more forms of PAYT. Although the PAYT systems varied from country to country and even within countries, the study concludes that the most important PAYT systems include:

- Volume-based schemes (choice of container size)
- Sack-based systems (number of sacks set out for collection)
- Weight-based systems
- Frequency-based systems, often combined with volume and/or weight-based systems.

Reichenbach (2008) considers all pre-paid systems, including sack-based systems (also known as bag systems), tags, stickers, or tokens, as subsystems of volume-based systems. However, Zeschmar-Lahl *et al.* (2016) present pre-paid systems as additional systems, arguing that the volume of a sack directly correlates with its weight and that the fee must be paid for each bag/sack. Despite this, it remains unclear how a bag/sack's volume correlates with its weight, particularly as various waste products will have different weights.

Under the sack or bag system, a household buys one or more empty bags, which vary in size and price accordingly. The size is related to volume rather than weight, and the full sack is not weighed once filled and upon collection. Given these considerations, Reichenbach (2008) and Agència de Residus de Catalunya (2010) argue that all pre-paid PAYT systems belong to volume-based

systems. Therefore, one can conclude that PAYT systems may essentially be either volume-based systems; weight-based systems; or hybrid systems.

2.6.1.1 Volume-based PAYT systems

Volume-based systems are based on the size or volume of the container used for waste disposal. These containers can be bags, sacks, or bins, with varying sizes, and the costs of payment increase with the size of the container. Volume-based systems can either be based on user identification or container identification (Figure 2-2).

In systems based on user identification, the user identifies themselves using a magnetic card, which allows the container to open and permit a maximum volume of waste, as the volume chamber is integrated into the bin (Agència de Residus de Catalunya, 2010). In container identification systems, households may pay per bin, based on a known volume allocated to them or selected by themselves, either on an individual tally or a predetermined frequency. Alternatively, a prepared volume system, such as bags, may be used (Agència de Residus de Catalunya, 2010).

The bag system is one of the most common PAYT systems in both Europe and the US (MDEP, 2004; Skumatz & Freeman, 2006; Watkins *et al.*, 2012). Under this system, households purchase “official” distinctively marked, standard-sized waste bags, with sizes ranging from 10 to 30 gallons (45 L to 136 L) in the US. These bags are available from municipal offices, approved community centres, and collaborating retailers such as local grocery and convenience stores. The cost of the bag includes waste collection, transportation, and disposal; however, some municipalities also charge a separate customer charge to cover fixed waste management costs (MDEP, 2004). Only these official bags are collected by municipal solid waste departments or their contractors. This system incentivises households to reduce waste and purchase smaller bags.

Closely related to the bag system is the stickers or tags system. Instead of purchasing bags, households purchase stickers or tags, often color-coded according to size (MDEP, 2004). The stickers are affixed to any bag or waste bin of the household's choice, and bags or bins without stickers are not collected. Some municipalities provide stickers for bulky items, such as appliances and furniture, with the required number of stickers depending on the size of the item for collection by waste workers (MDEP, 2004).

The bin system uses standardised bins, ranging from 60, 120, 240, and 660 liters to 1100 liters. Each household or group of users is allocated a bin of known volume, which is identified using a chip or tag that can be electronically read by technology installed in the collection vehicle or by a portable reader carried by the operator (Agència de Residus de Catalunya, 2010). This system is

more common in EU countries (Morlok *et al.*, 2017; Watkins *et al.*, 2012). The larger the bin, the higher the fee, with these systems typically combined with the frequency of collection, which may be offered or prescribed by municipalities or chosen by households. Households are incentivised to select the smallest container and fewer collections.

Other volume-based PAYT systems that are common in the US include punch card systems, franchise systems, and the any size container system. Under the punch card system, households purchase a card that allows them to dispose of a set volume of waste a defined number of times. For example, in Granville community, Massachusetts, households can choose from various punch cards, such as a \$64 card for sixteen 55-gallon punches, a \$60 card for thirty 30-gallon punches, a \$25 card for 52 five-gallon punches, or a \$50 card for a few pickup loads (MDEP, 2004). However, punch cards are only used at landfills or transfer stations.

The any size container system works similarly to punch cards, where households bring waste containers to drop-off facilities and are charged per container. Containers are assumed to be of “average size” and subject to a weight limit, although they are not weighed (MDEP, 2004).

Under the franchise system, households subscribe to a “waste package,” which includes a specific number and/or size of bins collected at a predetermined frequency. Households are billed based on their chosen package (MDEP, 2004).

2.6.1.2 Weight-based PAYT systems

In the US, the weight-based scheme was first piloted in 1989 under the name “garbage by the pound,” where waste collection vehicles were equipped with scales to weigh waste containers and charge customers accordingly (Skumatz & Freeman, 2006). Pay-by-weight systems may also be based on either user identification or container identification (Figure 2-2).

When based on user identification, the user identifies themselves using a magnetic card, and the weighing system is integrated into the bin. On the other hand, when based on container identification, the bin is equipped with a chip or tag that can be electronically read by onboard computers installed in the collection vehicle or by a portable reader carried by the operator. Weighing is done through scales mounted on the collection vehicle (Agència de Residus de Catalunya, 2010). These systems record the actual waste collected from the household, and customers are billed accordingly. Weight-based systems are not as common in the US and Canada (Skumatz & Freeman, 2006), but are more prevalent in EU countries (Watkins *et al.*, 2012).

To further enhance the understanding of weight-based systems, it is important to consider their advantages and challenges. Advantages of weight-based systems include more accurate cost allocation based on the actual amount of waste generated, which can create stronger incentives for waste reduction and recycling (Skumatz & Freeman, 2006). It also ensures that households or businesses that generate larger amounts of waste are charged accordingly, promoting fairness in waste management billing (Agència de Residus de Catalunya, 2010).

However, challenges include the technical complexity of implementing weight-based systems, particularly the need for specialised equipment such as scales and electronic identification systems (Watkins *et al.*, 2012). There can also be issues related to the potential for residents to improperly dispose of waste to avoid paying, such as using illegal dumping or placing waste in others' bins (Reichenbach, 2008). Additionally, the accuracy of weight measurements can be affected by external factors, such as moisture content in the waste, which may lead to inconsistencies in billing (Zeschmar-Lahl *et al.*, 2016).

In practice, weight-based systems often coexist with other forms of volume-based or frequency-based systems to offer a more comprehensive and flexible approach to waste management. By combining these different systems, municipalities can address a wider range of waste management behaviours and more effectively incentivise waste minimisation, recycling, and proper disposal practices (Sakai *et al.*, 2008).

2.6.1.3 Hybrid PAYT systems

Hybrid systems often use a combination of PAYT alternatives, such as the combination of volume-based systems with frequency of collection. Households can choose the size of the container and the frequency of collection based on the various packages offered by the municipality (Agència de Residus de Catalunya, 2010). This flexibility enables households to select a waste management option that aligns with their needs and waste generation patterns.

In the US, hybrid systems combine various PAYT models, including franchise systems and the tag or sticker system (Skumatz & Freeman, 2006). For example, a household may subscribe to a franchise “waste package” with a predetermined service level and billing, but any extra waste generated beyond the package’s limit can be paid for through the use of tags or stickers. This hybrid approach allows for both fixed service fees and variable charges based on additional waste disposal, creating an adaptable and fairer pricing structure for waste management.

2.6.2 Comparison of different PAYT systems

Various PAYT systems offer different advantages and disadvantages (see Table 2-1). Evidence suggests that volume-based systems generally provide the weakest incentives for waste prevention and recycling, while the best results are achieved when weight-based systems are implemented (Watkins *et al.*, 2012; Zeschmar-Lahl *et al.*, 2016; see Table 2-1 below). However, pre-paid bag systems also showed good performance in promoting waste minimisation and recycling (Zeschmar-Lahl *et al.*, 2016). As Watkins *et al.* (2012) point out, the greatest shortcoming of volume-based systems is that once a household has purchased or subscribed to a bin size, the marginal cost of reducing the quantity of waste disposed in that bin is effectively zero. Hence, there is little incentive to reduce the waste beyond the capacity of that bin.

Although bags come with some advantages, such as low technological complexity and low implementation costs (see Table 2-1), they also have several drawbacks. Unlike bins, bags cannot be reused, and animals can tear them, scattering waste or even damaging them during lifting, especially if they are overfilled, leading to littering and inconveniences for collection staff. In addition, households using bins may object to switching to bags due to concerns over practicality and the potential for increased revenue uncertainty. The number of bags households purchase can fluctuate significantly, leading to unpredictable revenue streams (MDEP, 2004).

As a result, Agència de Residus de Catalunya (2010) suggests that the pay-per-bag system is the easiest and cheapest to implement when no specific bin is in place. However, where bins are already provided, an automatic identification system can be added to streamline the process and better integrate the waste management system.

Table 2-1: Comparison of various PAYT systems (Source: Agència de Residus de Catalunya, 2010: 14)

Parameters	Container Identification systems				User Identification systems	
	Pay-per-bin with individual tally	Pay-per-bin with a predetermined frequency	Pay -per-bag	Identification and weighing of the bin	Pay-by-volume with a volume chamber incorporated	Pay-by-weight with a weighing system incorporated in bin
Prevention and recycling incentive	Average	Low	High	Very high	High	Very high
Technological complexity	High	Low	Low	Very high	Very high	Very high
Implementation cost	High	Average	Low	Very high	Very high	Very high
Maintenance cost	Average	Low	High	Very high	High	High
Certainty of revenue	High	Very high	Average	High	Average	Average
Fraud risk	Low	Very low	Average	Low	Average	Average
Collection efficiency	High	Low	High	Low	High	High
Convenience for users	High	High	Average	High	Average	Average

2.7 Consideration for implementation of PAYT

This section deals with key considerations for the successful implementation of PAYT including prerequisites for implementing PAYT (Section 2.7.1); technical and logistical aspects (Section 2.7.2); and pricing models for PAYT (Section 2.7.3).

2.7.1 Key prerequisites for the implementation of PAYT systems

The successful implementation of PAYT systems depends on several key factors. These include mainly the pre-existing infrastructure to support waste prevention, recycling, and composting activities (EC, 2011); consultation and engagement with all stakeholders; existence of financial and administrative systems for waste management including correct billing and cost recovery systems.

2.7.1.1 Pre-existing infrastructure to support waste prevention and recycling

Before any PAYT system can be successfully implemented, municipalities should ensure that pre-existing infrastructure for waste prevention, recycling, and composting activities is in place. This is crucial because, while residents are being charged for the residual waste they dispose of, they must also have access to the necessary resources and services to help them reduce the waste they generate. A well-developed waste management system that includes robust recycling programmes, composting facilities, and public awareness campaigns can significantly support residents in minimising their residual waste. Without these complementary systems in place, the incentive to reduce waste through a PAYT system could be diminished, as residents may not have the means or infrastructure to recycle or compost effectively (Schneider *et al.*, 2015; Skumatz & Freeman, 2006).

For instance, many municipalities that have successfully implemented PAYT systems have simultaneously developed extensive curb-side recycling programmes and composting initiatives. These programmes not only reduce the volume of waste going to landfills but also help to lower the amount residents need to dispose of through the PAYT system. If residents are unable to recycle or compost easily, they may be less motivated to minimise the amount of waste they produce, as the charge for waste disposal will primarily impact the residual waste that is difficult to divert. This lack of supporting infrastructure could lead to frustration and decreased participation in the PAYT programme (MDEP, 2004). Therefore, municipalities need to prioritise the creation or enhancement of recycling and composting services to align with the goals of PAYT systems and ensure their effectiveness in promoting waste minimisation (Watkins *et al.*, 2012).

Moreover, research suggests that the presence of complementary systems can strengthen the overall impact of PAYT programmes, encouraging behaviour changes that lead to waste reduction and increased recycling rates (Sakai *et al.*, 2008). Without such infrastructure, residents may not view the PAYT system as fair or effective, especially if they are unable to divert a significant portion of their waste. Thus, municipalities must ensure that the infrastructure for waste reduction, recycling, and composting is well-established before implementing PAYT to maximise both the environmental and financial benefits of these programmes (Zeschmar-Lahl *et al.*, 2016).

2.7.1.2 Engagement and consultation with stakeholders

Public involvement is a critical aspect of the successful implementation and sustainability of PAYT systems. Taking time and dedicating resources to engage with the community - through public forums, meetings, and open lines of communication - can help minimise confusion and build understanding about how PAYT works (MDEP, 2021). This process also serves to address residents' concerns and gain buy-in from municipal officials. Public awareness campaigns should be ongoing and extensive to educate citizens about the benefits of PAYT, how it functions, and how it encourages waste reduction and recycling (EC, 2011).

Zeschmar-Lahl *et al.* (2016) agree with this approach, emphasising that the highest recycling rates and lowest residual waste quantities are achieved in weight-based systems when there is well-established infrastructure and high citizen awareness. This underscores the importance of both system readiness and public education in driving positive outcomes in waste management.

In South Africa, the National Pricing Strategy for Waste Management (NPSWM) highlights the necessity of extensive stakeholder consultation before implementing PAYT systems (DEA, 2016). Engaging with municipalities, households, and other relevant stakeholders is crucial to understanding the need for such systems and selecting the most appropriate waste pricing models. The consultation process must carefully consider several factors, such as the existing pricing structures for waste services, the capacity for monitoring and enforcement, the potential impact on low-income households, and the price elasticity of demand for waste management services (DEA, 2016). By taking these elements into account, municipalities can ensure that the introduction of PAYT is both effective and equitable, aligning with the needs of all stakeholders.

2.7.1.3 Cost recovery for waste management

Another important factor that the DEA (2016) emphasised is that municipalities must have financial and administrative systems in place before implementing PAYT. This includes having correct billing and cost-recovery systems to ensure the smooth operation of the waste management service. One of the largest financial challenges for municipalities is the coverage of

operational expenditures for waste management, which typically requires a robust cost-recovery system for long-term sustainability (Kaza *et al.*, 2018).

In higher-income countries, waste management systems tend to be more developed, with mature billing systems often integrated with property or utility taxes, which makes the collection of waste fees more efficient and standardised. These systems are more common in upper-middle and high-income countries, where municipalities can ensure comprehensive coverage and sustainability in waste management financing. However, in lower-middle-income and low-income countries, waste fees are often collected door to door, which can be more challenging in terms of administration and ensuring full cost recovery (Kaza *et al.*, 2018).

In South Africa, as an upper-middle-income country, the Municipal Solid Waste Tariff Strategy (DEA, 2012b) promotes the principle of full cost accounting for waste services. This principle is designed to ensure that waste management fees reflect the actual costs of providing the service, including operational, administrative, and environmental costs. However, despite this guidance, very few municipalities, outside of the larger metropolitan areas, have fully implemented cost accounting for waste services (Nahman *et al.*, 2021). This highlights a significant gap in the financial sustainability of waste management services in many municipalities, which can complicate the successful implementation of PAYT systems that rely on accurate cost-recovery models.

2.7.2 Technical and logistical aspects

Technical and logistical aspects of PAYT systems involve considerations such as container or bin types, bin identification, and the processes for waste measurement. These aspects are closely interrelated with user identification and the waste measurement processes employed (Agència de Residus de Catalunya, 2010; Elia *et al.*, 2015). Among the various PAYT schemes, bin identification remains the most popular in Europe (Reichenbach, 2008). Containers can be assigned to individual households or shared among multiple users.

In bag-based systems, pre-paid bags or stickers serve as a simple form of bin identification, with waste measurement based primarily on volume. Bag systems are characterised by their low technological complexity and straightforward implementation (see Table 2-1). For collection efficiency, bags should be distinctively coloured and printed with the municipality's logo or emblem, ensuring easy recognition and preventing unauthorised use (Agència de Residus de Catalunya, 2010). Bags designated for recyclables should ideally be translucent or clear to allow for content visibility.

Bags can be distributed by municipalities and collaborating retailers, such as local grocery stores, although some retailers may request a markup for distribution (MDEP, 2004). However, Agència de Residus de Catalunya (2010) argues that additional profit margins are unnecessary, as the influx of customers purchasing bags is compensation enough for participating retailers.

For individual bin users, bin identification can be achieved through barcodes, QR codes, or stickers attached to the bin, linking it to the user or household (Agència de Residus de Catalunya, 2010). These identifiers can be read by handheld devices or transponders installed on collection vehicles (Zeschmar-Lahl *et al.*, 2016). Advanced technologies, such as Radio-Frequency Identification (RFID) with Ultra High Frequency (UHF), offer more reliable and faster user identification (Elia *et al.*, 2015).

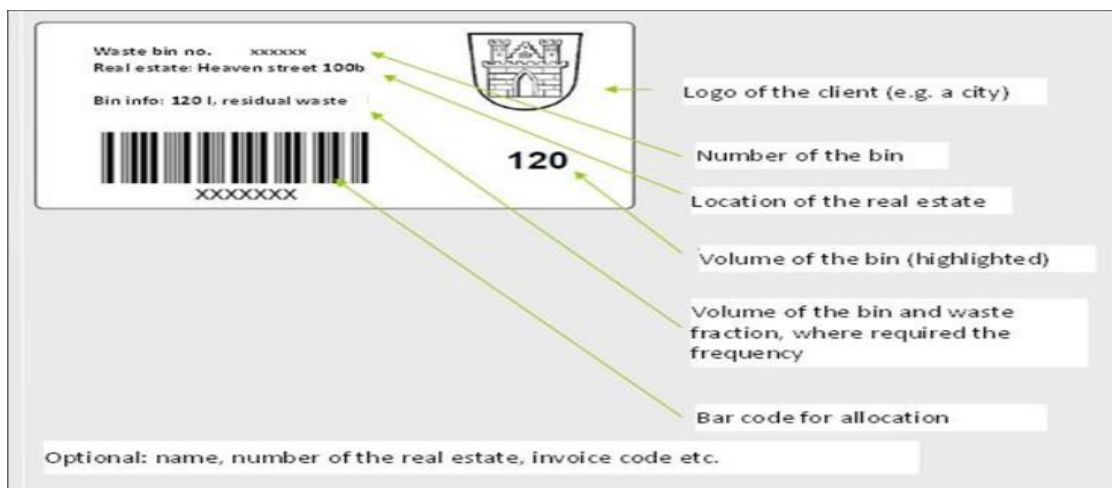


Figure 2-3: Examples of information automatically read by a bin identification system (Source: Zeschmar-Lahl *et al.*, 2016).

Collection vehicles must be equipped with onboard computers and specialised software to record bin or user information and the corresponding waste volume or weight. This information should be processed and securely stored in a centralised database (Agència de Residus de Catalunya, 2010). For bin weighing, scales integrated into collection vehicles (Figure 2-4) should be maintained and calibrated regularly to ensure accurate measurements.

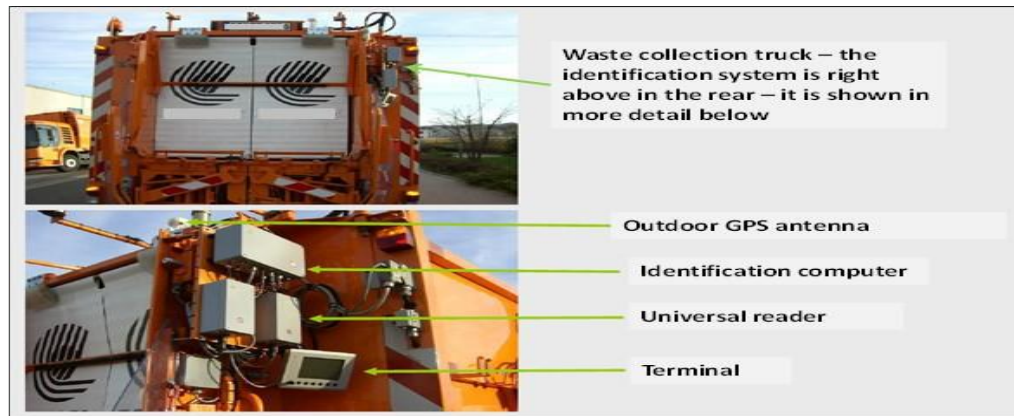


Figure 2-4: Waste collection vehicle fitted with identification and a weighing system
(Source: Zeschmar-Lahl *et al.*, 2016)

In cases where waste containers are shared among multiple users, identifying the waste generator is essential. The chamber system is a common solution for such situations, especially in high-density urban areas or multi-story residential buildings (Reichenbach, 2008). This system requires users to authenticate themselves—either with a physical or electronic key—before depositing waste (Agència de Residus de Catalunya, 2010). Once the user is identified, the chamber can measure either the volume or weight of the waste deposited, depending on the configuration (Figure 2-5). Technologies available for chamber systems include cameras, ultrasonic sensors, weighing sensors, and LED indicators (Elia *et al.*, 2015). These systems are particularly effective in promoting accountability in shared spaces while ensuring accurate billing for waste disposal.

To successfully implement such systems, municipalities need to ensure that equipment is adequately maintained and supported by robust financial and administrative systems. Public education and engagement are equally critical to encourage user compliance and understanding of the technological systems in place. By addressing these technical and logistical considerations, municipalities can create more equitable and effective PAYT systems for managing waste.



Figure 2-5: Large bins that are shared are and identify the user first (Source: Zeschmar-Lahl *et al.*, 2016)

2.7.3 Pricing mechanisms

Several studies have explored the design of pricing models for PAYT systems, focusing on achieving a balance between equity, efficiency, and revenue stability (Bilitewski *et al.*, 2004, cited in Bilitewski, 2008b; Karagiannidis *et al.*, 2005; Le Bozec, 2008; Elia *et al.*, 2015). One widely referenced framework, developed by Bilitewski *et al.* (2004), emphasises two main approaches: one-component charges and multi-component charges (Figure 2-6). Each approach has unique characteristics and implications for implementation.

A one-component charge is a fully variable system, where households are billed solely based on the volume or weight of the waste they generate. This model does not include a fixed fee, so households that do not dispose of any waste incur no charges (Karagiannidis *et al.*, 2005). While this simplicity is attractive, the model poses challenges for municipalities due to its lack of revenue stability, which can undermine the financial viability of waste management systems. In contrast, multi-component pricing models incorporate both fixed and variable charges, offering a more balanced approach. The fixed component ensures revenue stability by covering the basic costs of waste management services, including administrative expenses, billing systems, education, and supervision (Karagiannidis *et al.*, 2005). Fixed charges are particularly crucial for maintaining infrastructure that supports kerbside collection of recyclables and composting services, which are key to a successful PAYT system (Bilitewski, 2008b). By providing financial stability, fixed charges enable municipalities to invest in sustainable waste management practices.

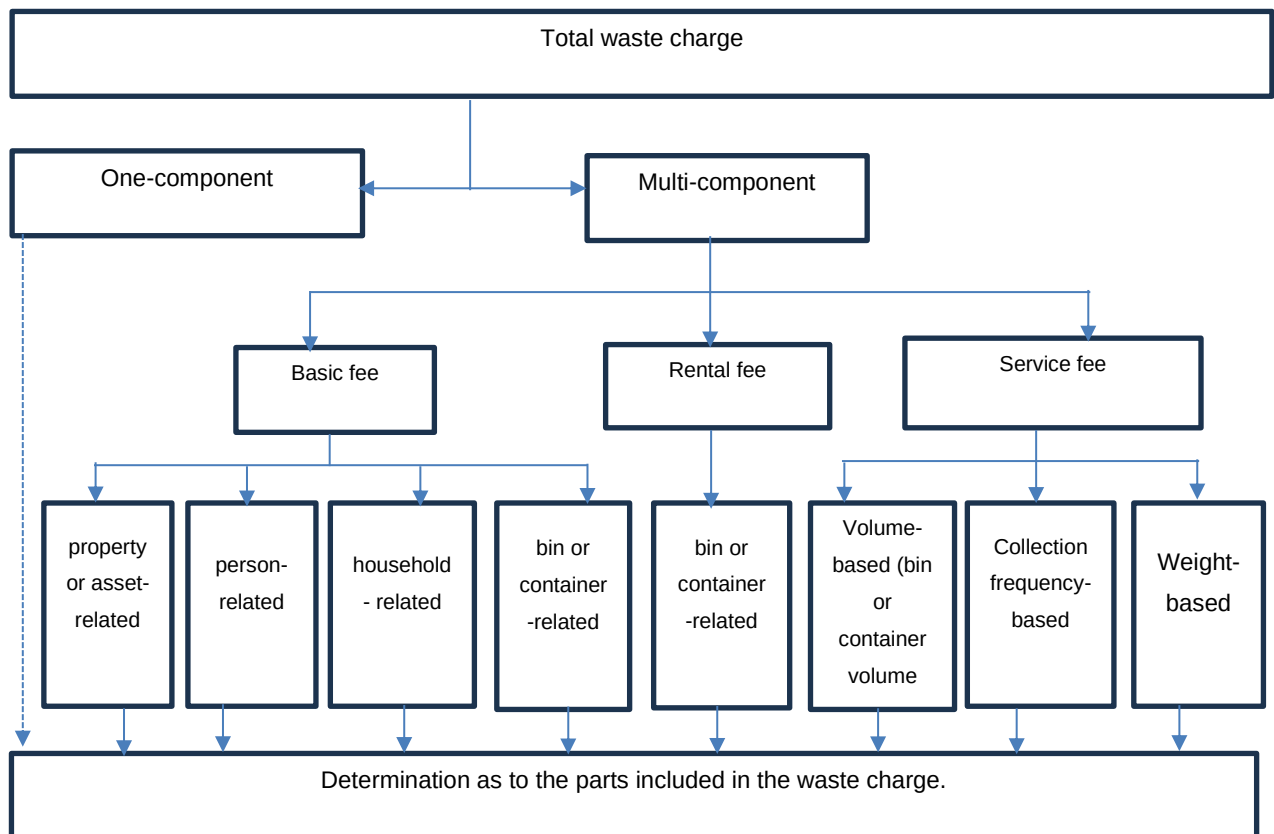


Figure 2-6: Suitable components for the design of PAYT waste charges (Adapted from Bilitewski, 2008b).

The variable portion of the multi-component system is tied directly to the service provided and is proportional to the volume or weight of residual waste collected. This component offers dynamic incentives for waste reduction, as households can lower their overall charges by generating less waste (Elia *et al.*, 2015). By encouraging waste minimisation, the variable charge aligns the financial interests of residents with environmental goals, leading to higher recycling rates and lower residual waste quantities. In addition to fixed and variable charges, some systems may include bin rental fees or other supplementary charges. However, these fees must remain reasonable to avoid creating financial burdens or discouraging participation (Agència de Residus de Catalunya, 2010).

The success of PAYT pricing models depends on several critical factors. Multi-component systems are particularly effective in ensuring revenue stability while incentivising waste reduction (Bilitewski, 2008b). Transparency is essential to gain public trust and acceptance; households must clearly understand how fees are calculated and the rationale behind them (Agència de Residus de Catalunya, 2010). Furthermore, it is vital to manage public perception carefully. PAYT

systems should not be seen as a way to disproportionately increase waste charges, which can lead to resistance. Public awareness campaigns and engagement efforts are necessary to explain the benefits of PAYT and address any misconceptions (Agència de Residus de Catalunya, 2010).

Economic feasibility is another important consideration. Ukkonen and Sahimaa (2021) caution that new PAYT charges must not render waste management operations unprofitable. A well-designed multi-component system can ensure financial sustainability while promoting environmentally responsible behaviour. Evidence suggests that this approach strikes the right balance between revenue certainty and incentivising waste minimisation, making it a preferred choice for municipalities implementing PAYT systems.

2.8 Key benefits and challenges of PAYT

PAYT provides both households and municipalities with a number of benefits including fairness and equity, costs control, increased recycling, and improved environmental quality. However, PAYT is argued to also present some key challenges such as illegal dumping, concerns about cost, revenue uncertainties and administrative burdens. The following sections discuss these in detail.

2.8.1 Key benefits of PAYT

According to literature, the key benefits of PAYT systems for waste management include equity (fairness), cost control, waste reduction, increased recycling, and environmental quality. The sub-sections below discuss these aspects individually.

2.8.1.1 Equity (fairness)

Under PAYT, households that generate and dispose of more waste are charged more, as opposed to flat-rate systems where all residents pay the same amount regardless of the quantity of waste they produce. This approach is grounded in the principle of fairness, as it aligns waste management charges with individual usage. Proponents argue that it is unjust for households producing minimal waste to subsidise those generating significantly more, making PAYT a more equitable solution. Similar to utility services such as water and electricity, waste management under PAYT ensures that those who use more of the service bear a proportionate share of the cost (Skumatz, 2008). Residents who produce and dispose of larger volumes of waste consequently face higher costs, creating an incentive to reduce waste generation.

The fairness of PAYT systems has been explored from broader perspectives, particularly concerning the equity of costs. According to Batllell and Hanf (2008), one of the key benefits of PAYT is its ability to achieve cost equity. This concept, as defined by Le Grand (1982) and cited

in Batllell and Hanf (2008), posits that public expenditure should be allocated in a way that all individuals incur the same private cost per unit of service used. PAYT exemplifies this principle by ensuring that all households pay the same rate per unit of waste disposed, addressing equity concerns in waste management (Skumatz, 2008; EC, 2011; MDEP, 2004).

However, the application of cost equity in PAYT is more complex than it appears. Batllell and Hanf (2008) caution that the cost of waste collection services is influenced by multiple factors beyond the quantity of waste generated. For instance, legal and political considerations, urban density, economic contexts, and technical constraints can all affect the cost structure of waste collection. In low-density residential areas characterised by single-family homes spread over large areas, waste collection is often more expensive due to longer travel distances and fewer households served per route. Conversely, high-density urban areas with multi-family housing allow for more efficient waste collection, potentially lowering costs.

While PAYT promotes fairness by aligning costs with waste generation, achieving true equity requires careful consideration of these contextual factors. Municipalities implementing PAYT must address disparities in service costs across different regions and household types to ensure that the system is perceived as equitable by all residents. Balancing fairness with practicality, PAYT provides an opportunity to foster environmentally responsible behaviour while aligning waste management costs more closely with individual consumption.

2.8.1.2 Cost control

PAYT schemes help control costs for both households and municipalities by incentivising waste reduction. Households can reduce their fees by generating less waste, while municipalities benefit from lower waste disposal and management costs due to increased recycling and reduced landfill use (MDEP, 2004). However, the literature presents mixed findings regarding the cost implications of PAYT. For example, Karagiannidis *et al.* (2008) demonstrated that a PAYT scheme could decrease costs for both authorities and citizens if a waste reduction of at least 5.4% is achieved, with collection, transportation, and disposal costs potentially decreasing by 13.9%. Similarly, Skumatz (2008) found no significant differences in household waste charges between PAYT and non-PAYT communities, while citing Frable and Berkshire (1995), who reported that two-thirds of PAYT communities in Iowa and Wisconsin experienced stable or reduced waste costs.

International studies also support the cost-saving potential of PAYT. Slavik and Pavel (2013), analysing variable waste charges in the Czech Republic, found that waste costs were comparable in PAYT and non-PAYT municipalities. Morlok *et al.* (2017) observed that waste fees in Germany's

Aschaffenburg County decreased following the implementation of a weight-based PAYT system, even with the additional equipment and activities required. The authors concluded that PAYT systems, particularly weight-based ones, are not inherently more expensive than alternative waste management models. The County of Aschaffenburg implemented PAYT for residual waste, bio-waste, bulky waste, and separate paper collection, achieving cost reductions alongside improved waste management outcomes. Similarly, Beukering *et al.* (2009) highlighted that differential and variable waste rates are cost-effective tools for waste reduction and increased recycling.

However, some studies reveal that PAYT can lead to higher municipal costs. For instance, Lakhan (2015) found that municipalities in Ontario, Canada, with PAYT systems incurred 8% higher waste management costs. These additional expenses were attributed to administrative, maintenance, and enforcement requirements associated with PAYT implementation. These findings indicate that while PAYT can lead to cost savings under the right conditions, municipalities must account for potential operational costs and ensure that anticipated waste reductions and cost efficiencies are realised to achieve long-term financial sustainability.

2.8.1.3 Waste reduction and increased recycling and diversion from landfill

PAYT systems do not only promote recycling and composting but also encourage source reduction and influence purchasing behaviours towards products with minimal or recyclable packaging (DEA, 2016). By charging households based on the waste they generate, PAYT provides a financial incentive to reduce waste, recycle, and compost, aligning with the principles of a circular economy. For instance, in the US, PAYT has been credited with diverting approximately 6.5 million tonnes of municipal solid waste (MSW) annually from landfills (Skumatz, 2008). Similarly, in Europe, studies have demonstrated significant increases in source-separated recyclable waste, with selective collection systems achieving increases of 70% or more following the introduction of PAYT (Bilitewski *et al.*, 2004, cited in Reichenbach, 2008). Watkins *et al.* (2012) also observed that PAYT schemes across Europe have effectively reduced waste generation while boosting the collection of source-separated materials.

The success of PAYT in reducing residual waste generation is evident globally. In Japan, case studies from four municipalities reported reductions of 20 to 30% in household residual waste following the implementation of PAYT (Sakai *et al.*, 2008). Other countries, such as Australia and South Korea, have also reported positive outcomes, demonstrating the system's adaptability across different socio-economic and waste management contexts (OECD, 2006). Remarkably, even in countries without PAYT, its potential effectiveness is acknowledged, indicating its perceived value in waste reduction strategies (Sakai *et al.*, 2008).

Numerous studies underscore PAYT's significant impact on waste reduction. Research has highlighted its effectiveness, especially when combined with robust infrastructure and high levels of public awareness (Dahlén *et al.*, 2007; De Jaeger & Eyckmans, 2015; Folz & Giles, 2002; Morlok *et al.*, 2017; Noehammer & Byer, 1997; Reichenbach, 2008; Houtven & Morris, 1999, cited in Ukkonen & Sahimaa, 2021). These findings confirm that PAYT can drive substantial changes in waste generation behaviour, fostering a shift towards more sustainable waste management practices on a global scale.

2.8.1.4 Improved environmental quality

PAYT programmes contribute significantly to improved environmental quality by reducing waste generation and increasing recycling at the household level. Waste management practices often result in adverse environmental and societal impacts, both directly and indirectly, with waste disposal being particularly problematic in the context of PAYT. Landfills, for example, emit methane, a potent greenhouse gas, as organic waste decomposes, and incineration of synthetic materials like plastics contributes to air pollution and greenhouse gas emissions (MDEP, 2004; Zeschmar-Lahl *et al.*, 2016). Methane emissions from landfills are a major contributor to the greenhouse gas footprint of waste management systems. Additionally, landfills generate leachate that can contaminate surface and groundwater resources, further compounding environmental risks.

By reducing the volume of waste sent to landfills and incinerators, PAYT helps mitigate these environmental impacts. The system curtails greenhouse gas emissions from landfilling and incineration and reduces the generation of other air and water pollutants (MDEP, 2004; Skumatz, 2008). Moreover, diverting waste from landfills through increased recycling and composting extends the operational lifespan of existing landfill sites and decreases the demand for new disposal facilities, which often require significant financial and environmental investments.

Increased recycling driven by PAYT also conserves natural resources by reducing the need for virgin materials. This shift contributes to a decrease in fossil fuel consumption and minimises resource depletion, aligning waste management practices with broader sustainability goals (Zeschmar-Lahl *et al.*, 2016). In these ways, PAYT serves as a key instrument for promoting environmental sustainability and reducing the ecological footprint of waste management systems.

2.8.2 Key challenges of PAYT

While PAYT programmes offer significant benefits, they also present a set of challenges that require careful consideration and mitigation (MDEP, 2004). These challenges, while not impossible to mitigate, include illegal dumping, concerns about multi-unit housing, potential

impacts on poor households, revenue uncertainties, administrative burdens, and the need for strong political and public support.

2.8.2.1 Illegal dumping

Illegal dumping is a prominent concern associated with PAYT programmes, as many solid waste managers fear that the financial incentives to reduce waste might lead households to improperly dispose of waste to avoid charges. This concern has been widely documented. For instance, a survey of over 1,000 communities in the US revealed that illegal dumping was the most significant fear related to PAYT implementation (Skumatz, 2008).

Despite this, empirical evidence suggests that illegal dumping is more of a perceived risk than an actual widespread problem. Studies in the US, including research conducted in Massachusetts, indicate that illegal dumping fears are often exaggerated (CWMI, 2000; Skumatz & Freeman, 2006). Similar findings have been observed internationally. For example, Dahlén and Lagerkvist (2010) reported no increase in illegal dumping after PAYT implementation in three Swedish municipalities. In the Netherlands, studies by Dijkgraaf and Gradus (2004) and Allers and Hoeben (2010) also found no evidence of increased illegal dumping or "waste tourism" between municipalities with and without PAYT.

Nevertheless, some research highlights specific instances where illegal dumping has occurred. For example, in Oostzaan, Netherlands, Linderhof *et al.* (2001) identified that 4 to 5% of waste was diverted to neighbouring municipalities or disposed of through friends or relatives in areas without PAYT. Other studies have documented illegal waste disposal practices, such as dumping waste in parking lots, neighbours' bins, or even burning waste, in countries including Denmark, Ireland, Spain, and South Korea (OECD, 2006; Puig-Ventosa, 2008; Dahlén & Lagerkvist, 2010; Bel & Gradus, 2016).

Interestingly, the phenomenon of illegal dumping appears to be temporary in many cases. The OECD (2006) observed that the practice often spikes immediately after PAYT is introduced but tends to return to baseline levels as residents adapt to the new system. This aligns with findings from Fullerton and Kinnaman (1996), who reported that illegal dumping accounted for 28 to 43% of the observed waste reduction in Charlottesville, Virginia, following PAYT implementation. This suggests that illegal dumping may function as a "short-term protest activity" rather than a persistent issue.

While the extent of illegal dumping associated with PAYT remains contested in the literature, many studies suggest that it is not a significant or long-term problem when proper enforcement, monitoring, and public education are in place. Further research, particularly in diverse

geographical and socio-economic contexts, is essential to conclusively determine the relationship between PAYT and illegal dumping.

2.8.2.2 Concerns about multi-unit housing complexes

Implementing PAYT in multi-unit dwellings (MUDs) poses unique challenges, as these housing structures increasingly dominate urban landscapes. PAYT has been predominantly implemented in single-family homes and small apartment complexes (up to eight units), with limited applications in larger multifamily buildings (Skumatz & Freeman, 2006; Skumatz, 2008). This disparity arises from logistical complexities, such as shared waste containers and the difficulty in attributing waste generation to individual households. Despite these challenges, experts argue that PAYT programmes should not be delayed solely due to the obstacles presented by MUDs. Cities are encouraged to proceed with PAYT for other housing types while continuing to develop tailored solutions for multifamily buildings (Skumatz, 2008).

Recent technological advancements have made it increasingly feasible to implement PAYT in MUDs, even in buildings with shared waste systems. User identification systems, such as RFID tags or smart cards, can link waste disposal activities to specific households, ensuring accountability (Elia *et al.*, 2015). These systems can be integrated with bins equipped to measure either the weight or volume of deposited waste, enabling accurate tracking and billing based on individual contributions (Agència de Residus de Catalunya, 2010). Additionally, chamber systems, which are specifically designed for high-rise buildings with shared containers, track household usage before the waste enters communal bins, making them an effective solution in dense urban areas (Reichenbach, 2008; Zeschmar-Lahl *et al.*, 2016) (see Figure 2-5).

Practical applications of these technologies demonstrate their viability in addressing the challenges of PAYT implementation in MUDs. For example, several municipalities in Europe have successfully adopted PAYT schemes in large multifamily buildings using such innovations (Reichenbach, 2008). These systems are often accompanied by extensive education and awareness campaigns to ensure that residents understand and adhere to the new waste management protocols. While implementing PAYT in MUDs requires significant initial investments and more complex infrastructure compared to single-family homes, these hurdles are not insurmountable. The successful integration of PAYT into MUDs is critical for expanding its reach and achieving broader environmental and waste reduction objectives.

2.8.2.3 Concerns about poor households

The concern that PAYT schemes might disproportionately affect poor households is valid, particularly in regions with significant socio-economic disparities. Waste composition often varies

by income level, with poorer households typically generating a higher proportion of organic waste, such as food scraps and garden waste, while higher-income households produce lighter waste dominated by packaging materials from consumer goods (Kaza *et al.*, 2018). This difference in waste composition can make PAYT appear more burdensome to poorer households, as the weight-based or volume-based billing models may result in higher charges for those generating denser organic waste.

Addressing this inequity requires thoughtful policy design. Skumatz and Freeman (2006) and Skumatz (2008) argue that PAYT systems can be structured similarly to other utilities, such as water and electricity, by incorporating discounted or "lifeline" rates for low-income households. This approach ensures that basic waste management services remain accessible and affordable, mitigating the potential financial strain. Such systems can also include tiered pricing models or subsidies funded through general municipal revenues or targeted grants, reducing the cost burden on vulnerable groups while maintaining the overall integrity of the PAYT system.

In the African context, implementing PAYT in low-income areas presents unique challenges and opportunities. In many African cities, informal settlements lack formalised waste management systems, and households may rely on informal waste collectors or community-based systems (Kaza *et al.*, 2018). The introduction of PAYT in such areas requires careful consideration of socio-economic realities and existing waste practices. Community engagement and participatory planning are essential to developing a system that aligns with local needs. Subsidies or alternative payment mechanisms, such as mobile money or community-based credits, can make PAYT feasible and equitable for poorer households (Godfrey *et al.*, 2019). Additionally, integrating organic waste composting programmes could help households manage wet waste on-site, reducing the volume and weight of waste sent for collection and lowering PAYT fees.

For PAYT to succeed in Africa and other regions with high levels of poverty, it must be designed with inclusivity and equity at its core. This entails not only implementing financial safeguards for low-income households but also investing in education, awareness campaigns, and infrastructure to ensure the programme's accessibility and effectiveness across diverse socio-economic contexts (NPSWM, 2016; Skumatz, 2008).

2.8.2.4 Revenue uncertainties

Revenue uncertainty is one of the major challenges associated with implementing PAYT schemes, as highlighted by interviews with municipalities and waste transporters in the United States (Skumatz, 2008). In cities like Seattle, Washington, and other case studies, there were significant concerns about the potential for a substantial decrease in revenue upon implementing

PAYT, with estimates showing reductions in revenue ranging from 50% to 67% (Skumatz, 2008). These concerns stem from the fact that PAYT relies on user fees, which fluctuate based on the volume or weight of waste generated. Since waste disposal volumes can vary from month to month, predicting revenue becomes a complex task, requiring municipalities to adopt robust financial and economic analyses to ensure that revenue from waste charges adequately covers the overall costs of municipal solid waste management (Elia *et al.*, 2015).

The level of revenue uncertainty largely depends on the pricing model adopted for the PAYT scheme. In systems where a one-component, fully variable charge is applied, without any fixed charge, revenue uncertainty tends to be high due to the direct dependence on waste generation levels, which can be unpredictable. On the other hand, revenue uncertainty can be significantly reduced when both fixed and variable charges are applied, a multi-component pricing model that is increasingly favoured in practice (Bilitewski, 2008b; Le Bozec, 2008). This model allows for a more stable revenue stream by ensuring that some costs are covered by a fixed charge, while the variable portion reflects the actual volume or weight of waste generated.

In the context of South Africa and other African countries, adopting a multi-component pricing model could help mitigate the financial risks associated with PAYT schemes. Given the variability in waste generation and socio-economic factors in these regions, implementing a mixed charging system could provide a more predictable revenue base, ensuring that municipal solid waste management remains financially sustainable. Additionally, integrating revenue from other sources, such as landfill taxes or EPR schemes, could further strengthen the financial stability of PAYT systems (NPSWM, 2016).

2.8.2.5 Administrative burdens and costs

Administrative burdens associated with PAYT schemes encompass both an increased workload and the costs of implementation. PAYT introduces additional costs that include educating the public, identifying users or containers, as well as investing in waste measurement technologies, software, and new accounting mechanisms. These costs can be broken down into initial investment costs and ongoing maintenance costs. The total costs depend largely on the type of PAYT scheme chosen, with the bag system and pay-per-bin system generally having the lowest implementation and maintenance costs, respectively (also see Table 2-1).

Research in the United States suggests that while communities do incur additional up-front costs to implement PAYT, these costs are typically recovered over time through cost savings resulting from increased recycling rates and reduced waste disposal volumes (MDEP, 2004). Skumatz (2008) found that monthly waste costs for households using PAYT were not significantly higher

than those of non-PAYT households. However, the workload during the initial stages of implementation will increase, and municipalities may require temporary staff to manage the transition (Skumatz, 2008). It is important to note that in the United States, many PAYT schemes are based on the bag system, which has relatively low implementation costs. In contrast, PAYT systems that incorporate user or container identification systems and measurement tools are typically more expensive. Several authors agree that PAYT involves additional investment costs and increases administrative workload (Dahlén & Lagerkvist, 2010; Ukkonen & Sahimaa, 2015; Lakhan, 2015).

Research conducted in Aschaffenburg, Germany, demonstrates that after the implementation of PAYT, the total waste management system fee was lower than it had been before the scheme was introduced (Zeschmar-Lahl *et al.*, 2016). Importantly, the Aschaffenburg PAYT scheme used a weight-based system and involved the separate collection of dry recyclables at the household level. These authors note that: *“the fear that a weight-based system is more expensive did not prove true”* (Zeschmar-Lahl *et al.*, 2016: 163). A recommended approach is to select a PAYT scheme that complements existing waste management and recycling systems, which can help minimise the costs of the transition (Skumatz, 2008). Additionally, securing central government grant funding for initial investment costs can help lower fees for local authorities, leaving them with only the responsibility for recovering maintenance and operational costs.

For further discussion of PAYT costs, also see Section 2.8.1.2 above.

2.8.2.6 Implementation and political support

Getting PAYT schemes approved by city councils often proves to be more challenging than designing and implementing the actual scheme (Skumatz, 2008). The main barrier is political, as city councils are generally sensitive to *“fixing things that are not broken”* and may prefer to keep the traditional flat fee in place. In many cases, city councils might approve the concept of PAYT but delay its implementation, leaving it to the next elected council to address, which has been described as *“kicking the can down the road”* (Skumatz, 2008).

In Europe, EU member states have been encouraged to adopt Extended Producer Responsibility (EPR) schemes, PAYT, landfill taxes, and incineration fees through various waste management policies and directives (Watkins *et al.*, 2012). By 2012, seventeen out of the 27 EU member states had introduced PAYT for municipal solid waste (Watkins *et al.*, 2012). Since PAYT is central to EU waste management policy, political support at both the national and municipal levels is often easier to obtain compared to countries without such frameworks. Similarly, in South Korea and Japan, PAYT was implemented nationwide by central governments, with South Korea introducing

it as early as 1995 (Sakai *et al.*, 2008). Therefore, political backing from both national and local governments is essential for the successful rollout of PAYT.

In South Africa, the National Pricing Strategy for Waste Management (NPSWM) of 2016 recognises PAYT as one of the policy tools for moving waste up the hierarchy. However, it does not mandate its use for municipalities, acknowledging that many South African municipalities currently lack the administrative, billing, and infrastructure systems required to implement PAYT (NPSWM, 2016). Once a city council approves PAYT, the next crucial step is to engage residents through stakeholder involvement.

Securing resident support for PAYT schemes is often a significant challenge, particularly in large cities. In cases where there have been no user fees for waste management previously, PAYT can be seen as an additional tax. Sakai *et al.* (2008) note that one of the main challenges for large municipalities in adopting PAYT is the substantial effort required to gain citizens' acceptance. However, studies have shown that once PAYT schemes are implemented, they tend to become very popular among residents (Skumatz, 2008). This highlights the importance of stakeholder engagement before and after the implementation of PAYT. Many studies have examined stakeholder perceptions of PAYT both before and after its introduction, focusing on its impact on waste recycling and disposal. While these impacts are well-documented, this research aims to explore other aspects of PAYT.

2.9 Stakeholder perceptions of PAYT

Understanding stakeholder perceptions is crucial in the success of PAYT systems because public acceptance directly influences the effectiveness and sustainability of waste management programmes. If residents perceive PAYT as fair, transparent, and beneficial, they are more likely to comply with the system, leading to higher recycling rates and reduced waste generation (Skumatz, 2008; Brown & Johnstone, 2014). Additionally, positive stakeholder perceptions can mitigate political resistance, facilitate smoother implementation, and foster greater community participation (Dunne *et al.*, 2008; Brown & Johnstone, 2014).

Section 2.9.1 and 2.9.2 outline literature on stakeholder perceptions of PAYT – both positive and negative.

2.9.1 Stakeholder perceptions: studies reporting positive PAYT experiences

Early research on residents' acceptance of PAYT was pioneered by the New York City Department of Sanitation, which found that approximately 57% of surveyed residents were interested in exploring PAYT. This suggests that PAYT might pose less political risk than many

assume (CWMI, 2000). Dunne *et al.* (2008) further investigated public acceptance of PAYT in Ireland and found that while residents initially resisted its introduction, acceptance grew once the system was implemented. Interestingly, in areas where waste services were privatised, residents were more willing to accept PAYT, whereas in areas where the local authority was responsible for waste management, PAYT became a more politically contentious issue. Additionally, Dunne *et al.* (2008) highlighted that PAYT schemes that were supported by extensive public awareness campaigns garnered greater public acceptance. The authors emphasised the importance of “*two-way communication*”, which involves a dialogue between authorities and the public, along with a willingness to adapt the programme if necessary.

Although Sakai *et al.* (2008) did not directly examine stakeholder perceptions, they reviewed several studies on public opinion regarding PAYT in Japan, both before and after its implementation. Their findings indicated that in most Japanese municipalities, residents’ acceptance of PAYT increased after the system was introduced. This suggests that exposure to PAYT could lead to greater acceptance once residents experience its benefits firsthand (Sakai *et al.*, 2008).

Brown and Johnstone (2014) conducted an analysis of support for PAYT as an environmental tax in four OECD countries - Canada, the Netherlands, Sweden, and Switzerland. They found that only 41% of survey respondents were supportive of introducing PAYT, while 11% were opposed. Notably, they also found that those who had already been exposed to PAYT were significantly more supportive of its implementation, suggesting that public resistance tends to decrease once the system is in place and its benefits become apparent. Brown and Johnstone (2014) echoed the sentiments of Dunne *et al.* (2008), stressing the importance of communication between policymakers and the public. They recommended that authorities provide more detailed information about the policy mechanics, potential impacts, and the rationale behind PAYT to help garner public support.

In Greece, Kevrekidou (2016) examined public attitudes toward the introduction of PAYT and found that almost 47% of respondents supported the scheme. The punch card weight-based system was the most preferred option, followed by the weight-based bin-per-property scheme. Volume-based PAYT systems were the least favoured. A similar study by Emmanouil *et al.* (2022) also investigated citizens’ knowledge and perceptions of PAYT in Greece, finding widespread support for its implementation, with a weight-based PAYT scheme being the most preferred.

These studies suggest that, despite initial resistance in some cases, public acceptance of PAYT tends to improve over time, particularly when residents are given opportunities for involvement and when clear, two-way communication channels are established. This also reflects the

importance of contextualising PAYT programmes to the preferences and needs of local communities, which can lead to greater success in programme adoption and sustained support.

2.9.2 Stakeholder perceptions: studies reporting negative PAYT experiences

Not all research reports positively on stakeholder perceptions of PAYT. Lakhan (2015) explored stakeholder views of PAYT among households, packaging producers, and municipal waste managers in Ontario, Canada. The study found that a majority of households opposed PAYT, citing reasons such as perceived unfairness, inconsistent enforcement, and the time-consuming nature of the system. However, municipal managers and packaging producers generally agreed that PAYT was an effective policy for encouraging household recycling. Despite this, they also acknowledged challenges such as the difficulty of administering the system, the need for additional resources, and concerns over potential increases in illegal dumping.

Lakhan (2015: 454) suggests that the opposition among households stemmed from inefficiencies in PAYT implementation and a lack of enforcement, which contrasts with other studies showing greater support for PAYT in communities already exposed to it. Similarly, Oduro-Kwarteng *et al.* (2015) found that in Ghana, most respondents were against PAYT, citing a lack of consultation as a primary concern.

This highlights the importance of comprehensive public engagement prior to implementing PAYT policies, as emphasised in other research. In China, Yao and Zhou (2023) found that while 54.53% of respondents in major cities such as Beijing, Tianjin, and the Hebei region supported PAYT, this was considered relatively low acceptance. Zhang *et al.* (2023) further explored this issue in Beijing and found even lower support, with only 42.6% of respondents in favour, reinforcing the low acceptance of PAYT in urban China.

In conclusion, while PAYT systems have shown promise in promoting waste reduction and recycling, stakeholder perceptions play a crucial role in their successful implementation and long-term sustainability. Positive experiences often stem from clear communication, robust public engagement, and the gradual integration of PAYT into communities. However, negative perceptions, particularly around issues of fairness, enforcement, and consultation, can hinder acceptance, as seen in various case studies across the globe. Therefore, addressing concerns through tailored outreach, proper infrastructure, and ongoing dialogue is essential for fostering broader support and overcoming resistance to PAYT systems.

2.10 Chapter summary

In summary, Chapter 2 discussed all the current literature on PAYT, starting with different PAYT models implemented around the world. Detailed analysis of weight-based schemes, volume-based schemes, and hybrid systems were discussed. Performance of various PAYT schemes in terms of levels of waste prevention and recycling incentives, technological complexity, implementation and maintenance costs, revenue certainties, convenience for users, etc. was presented. The chapter then looked at the general benefits and challenges for PAYT implementation, and key considerations for implementation of PAYT including pricing model and measurement technologies. Lastly, it examined the literature of research on stakeholder's perceptions of PAYT. Chapter 3 provides an overview of the methodology followed to address the aim of the research.

CHAPTER 3 METHODOLOGY

3.1 Introduction

This chapter outlines the research methods employed to collect and analyse data to answer the research question, namely: *What are the perceptions of stakeholders, namely households and municipal waste managers (officials), regarding PAYT as a fiscal instrument for household solid waste management in the City of Cape Town?*

The chapter provides an overview of the research approach and design, a description of the study area, participant selection, data collection, and data analysis. The chapter further provides the consideration of ethical aspects, as well as methodological assumptions and limitations.

3.2 Research approach

According to Salkind (2012), research is an intensive activity that is based on the work of others and generates new ideas to pursue and questions to answer. Research approaches can be either quantitative or qualitative or use both approaches in mixed-methods research. In terms of philosophical underpinnings and assumptions, the quantitative approach identifies with positivism or objectivism (Castellan, 2010). Positivism evolved mostly from natural science research and supposes that both physical and social reality “*the absolute truth*” do exist independent of the observer (Castellan, 2010: 4; Leedy and Ormrod, 2015: 25). In contrast, the qualitative approach identifies with post-positivism or interpretivism, which believe that reality is socially constructed, there are multiple realities and multiple truths based on one’s construction of reality (Sale *et al.*, 2002). The research approaches and methods adopted in a research design are underpinned by researcher’s philosophical assumptions and are intertwined with research design and research methods (Figure 3-1).

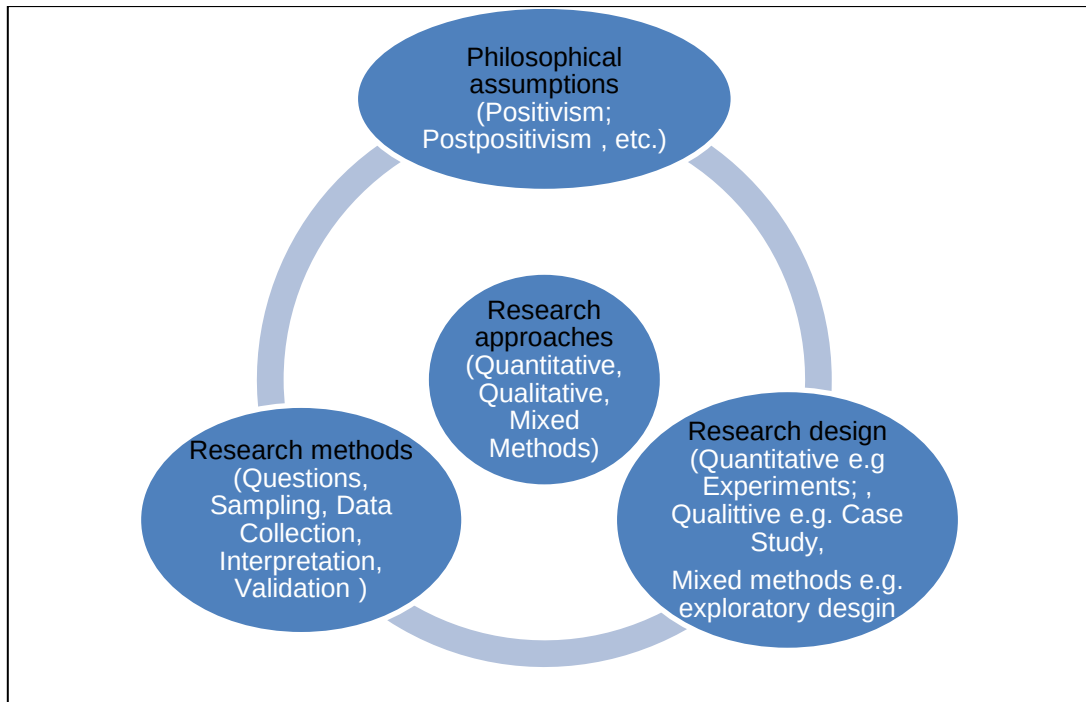


Figure 3-1: Interconnection of philosophical assumptions, approaches, and methods, Source: Cresswell (2014).

The research used *mixed-methods research* where both quantitative and qualitative research approaches are used to answer the research question. Mixed methods design involves integrating quantitative and qualitative research designs and data in a study (Cresswell, 2014).

Generally, quantitative, and qualitative approaches involve a similar process of identifying the research problem, reviewing related literature, and collecting and analysing data (Leedy and Ormrod, 2015). However, the fundamental difference is that quantitative research involves numerical data while qualitative research involves nonnumerical data. Table 3-1 presents the typical characteristics of quantitative and qualitative approaches. Qualitative research seeks a better understanding of complex situations, and exploratory in nature, and builds theories from the ground up rather than testing of objective theories. Quantitative and qualitative research approaches may also be combined in so many ways, limited only by the researcher's imagination, creativity, and the nature of the research problem (Leedy & Ormrod, 2015). Such a combination is called mixed-method research. Many research problems have both quantitative and qualitative dimensions, and researchers must use both approaches to fully address them (Leedy and Ormrod, 2015). Several arguments for mixed-method research are presented by various authors such as completeness, complementarity, triangulation, etc. (Sale *et al.*, 2002; Leedy & Ormrod, 2015).

Table 3-1: Typical characteristics of quantitative and qualitative approaches(from Castellan, 2010)

Characteristic	Quantitative	Qualitative
Philosophical underpinnings and assumptions	Positivist perspective; objective reality; the researcher is independent of that which is being researched	Postpositivist perspective; naturalistic, social, multiple, and subjective reality; the researcher interacts with that being researched.
Methods/types of research	Experimental; quasi-experimental; single and subject and descriptive; comparative; correlational; ex post facto	Phenomenology; case study; ethnography; grounded theory; cultural studies
Purpose/goal of research	Generalisation; prediction, explanation	Understanding; insight, contextualisation, and interpretation
Questions or hypothesis	A hypothesis is an informed guess or prediction	Question is evolving, general, and flexible
Those being researched	Randomly selected sample, proportionally representative of the population	Usually a small number of non-representative cases
Those conducting the research	Etic (outside's point of view); objective; neutral; detached and impartial	Emic (insider's point of view); personal involvement and partiality
Data collection	Questionnaires, surveys, tests, etc. in the form of numbers and statistics	Written documents from field work; interviews; pictures, observations; objects, etc.
Data analysis	Deductive process; statistical procedures	Inductive process; codes; themes; patterns to theory

3.3 Research design

Research design is a logical sequence that connects the empirical data to the research questions, a logical plan for getting from here to there (Yin, 2018). It's a "blueprint" for the research, that not only deals with research questions, but also what data are relevant, how to collect that data, and how to analyse the results (Yin 2018). Others call it strategies of inquiry (Cresswell, 2014), and Leedy and Ormrod (2015) simply describe research design as the general structure that guides data collection and analysis to address the research question.

This research used mixed-methods research where both quantitative and qualitative research approaches are used to answer the research question. Mixed methods design involves integrating quantitative and qualitative research designs and data in a study (Cresswell, 2014). Thus, the mixing of both provides a stronger understanding of the problem or the question than each method on its own (Cresswell, 2014).

This research collected both quantitative and qualitative data through a survey. Quantitative data (based on an ordinal/numerical scale) were collected using the structured section of a survey questionnaire where participants had to indicate their levels of agreement (on a Likert scale of 1 to 5) with pre-determined statements on PAYT. These structured statements were combined with open-ended questions in which participants were required to identify opportunities and challenges related to PAYT, thus generating qualitative data. Qualitative data was also generated from follow-up interviews conducted with a few key municipal waste personnel.

3.4 Research setting

This research was conducted in the context of a specific research setting. Section 3.4 provides the research setting selection criteria, as well as a description of the study area.

3.4.1 Selection criteria for the research setting

A research setting (also referred to as study area/case study) was selected to explore the research aim based on the selection criteria outlined below.

The municipality should:

- Have a well-established waste management infrastructure, including options for the diversion of waste from disposal;
- Have a robust financial and administrative system to reasonably implement PAYT;

- Have a well-established tariff structure for waste management. The municipality should already have a billing system in place for waste services, with the flexibility to incorporate variable rates;
- Demonstrate the potential and capacity for PAYT implementation; and
- Be willing to participate in the research.

Based on the selection criteria, the City of Cape Town (CCT) was selected as the study area to explore PAYT as a fiscal approach towards waste management. The CCT was selected mainly due to two reasons, it has a well-established waste management infrastructure, and robust financial and administrative systems for waste billing and cost recovery, which presents an ideal study area for exploring PAYT viability as a waste management tool. In this regard, the City or city-approved service providers provide a kerbside household waste collection weekly service for the city-issued 240L wheelie bin to all formal households, except for informal households, which remains a challenge (CCT, 2023). In terms of recycling infrastructure, the City has several initiatives in place. The CCT operates about 28 drop-off centres, where residents can drop off their clean recyclable waste, garden waste, bulky garage waste, clean builders' rubble, e-waste, waste oils, etc. The city plans to increase the number of drop-off centres such that there is a drop-off centre within a 3km radius of any resident (CCT, 2023).

The City also provides a kerbside collection of mixed dry recyclables to 22% of the formal households as part of its "Think Twice" separation at source programme (CCT, 2023). Households are provided with clear plastic bags, however, there are plans to issue households with 140L "green lid" bins to new service areas instead of the clear bag (CCT, 2023). Although the green lid bin will be more costly, however, it is reusable and may prove to be more cost-effective and environmentally beneficial than a clear plastic bag which increases waste. Currently, the mixed recyclables are collected by private contractors contracted by the CCT. The green lid bin will be collected every two weeks instead of the current weekly service done on the clear bag (CCT, 2023). In terms of cost recovery, waste collections are funded through a combination of waste tariffs (currently at R157.30 VAT excl. per month per bin), and central government equitable share and property rates for indigent households (CCT, 2023).

From a convenience perspective, the researcher is located in the CCT, which provided opportunities for recruitment of research participants, and face-to-face interviews. Lastly, the municipality expressed willingness to participate in the research, encouraging its waste management personnel to be involved in the research.

3.4.2 Description of the study area

The CCT, a Category A municipality is situated in the southern peninsula of the Western Cape province, South Africa, and covers approximately 2445 km² (CCT, 2023). The CCT is boarded by three district municipalities, the Overberg District in the southeast, Cape Winelands District in the east, and the West Coast municipality in the north. The metro stretches from Somerset West in the southeast to the small towns of Mamre and Atlantis in the north and also includes other towns such as Simon's Town, Fisk Hoek, Kuils River, Bellville, Kraaifontein, etc. (Figure 3-2).



Figure 3-2: City of Cape Town Metropolitan Municipality Metropolitan Municipality area

In 2022, the City's population was estimated to around 4, 756 million people, which constitutes about 66 percent of the Western Cape province population, also making it the second-largest city in South Africa in terms of population size (CCT, 2023). Although the population has grown from about 4 million in 2016, the annual growth rates have been decreasing, and it is estimated that

by 2040, the City's population will be around 5 843 462 (CCT, 2023). The number of households has seen a steady increase from 1 068 572 in 2011 to 1 462 156 households in 2021, and about 80,6 percent of these being formal households (CCT, 2022).

Population growth, economic growth, and rapid urbanisation are key drivers of waste generation, and consequently, the amount of solid waste generated in the CCT is expected to grow significantly. However, despite this population growth, the amount of waste sent to the landfill has not increased for the past 6 years (CCT, 2023). Unfortunately, only about 20 percent of waste generated was diverted from landfill in 2022, and 68 percent of this was builder's rubble (CCT, 2023). Furthermore, at the current waste production, the landfill space is provisionally projected to run out by 2032, and the planning for a new future landfill has been in planning for the last 20 years (CCT, 2023). Landfills are both socially and environmentally undesirable and thus there is a lot of uncertainty about the approval of new landfills considering the "Zero waste going to landfill" long-term expected outcome expressed in the 2020 National Waste Management Strategy. Therefore, more work is needed to increase the amount of waste diverted from the landfill.

3.5 Participant selection

Engaging with different stakeholders when exploring perceptions regarding PAYT as a fiscal instrument for household solid waste management is essential. Stakeholders, including residents, businesses, and waste service providers, offer valuable insights into practical challenges, economic implications, and potential social impacts (Wiesmeth, 2020). Their input may assist in tailoring the PAYT system to local needs, fostering community buy-in and compliance (Tarigan *et al.*, 2020). Households, the waste management industry, and local authorities are the main stakeholders in managing household waste, notwithstanding the important role of both provincial and national governments (Tarigan *et al.*, 2020).

For the purposes of this research, households of the CCT and municipal waste officials were purposively selected as the targeted participants. Households and municipal waste officials were regarded as ideal participants for exploring stakeholder perceptions of PAYT systems because both groups are directly affected by and responsible for the success of waste management policies.

Households are the primary generators of municipal solid waste, and any policy, such as PAYT, directly influences their daily waste disposal behaviours. Studies have shown that residents' attitudes, willingness to participate, and understanding of waste reduction efforts are central to the success of PAYT systems (Sidique *et al.*, 2010). Since PAYT introduces a financial incentive for reducing waste, it is important to explore how households perceive this incentive and whether

it influences their recycling habits. Negative perceptions of the system could lead to lower participation rates, undermining the intended outcomes of the programme. Additionally, understanding household preferences is critical for municipalities to design user-friendly PAYT programmes that cater to different socio-economic groups and ensure equitable access, particularly for low-income households (Kinnaman, 2006).

Household participation in PAYT is particularly important because their behaviour can be shaped by financial incentives linked to the amount of waste generated (Bel & Gradus, 2016). Households can provide valuable insights into the convenience and practicality of waste separation and disposal practices under a PAYT system, which are critical for the scheme's overall success (Linderhof *et al.*, 2001). Their feedback can inform improvements in the system, helping to address any challenges or barriers that may arise during implementation. Understanding how households perceive the fairness and effectiveness of the PAYT programme will also contribute to identifying the factors that influence their waste disposal behaviours and participation in recycling efforts.

Municipal waste officials, on the other hand, were essential participants in this study because they are responsible for designing, implementing, and managing waste management policies, including PAYT. Their top-down perspective complements household insights, as they have firsthand experience with the administrative, financial, and operational aspects of waste management (Dijkgraaf & Gradus, 2014). These officials can offer critical information on how PAYT could be integrated into existing waste management systems, as well as highlight potential financial and logistical challenges. For example, they understand the complexities of cost recovery, service delivery, and ensuring compliance with waste management regulations, which are important factors in determining the feasibility of PAYT (Guerrero *et al.*, 2013).

Involving both households and municipal waste officials also provides for a multi-faceted approach to understanding stakeholder perceptions of PAYT. Successful PAYT programmes depend on the buy-in from both the users (households) and the service providers (municipal officials). Research shows that involving stakeholders in policy design improves public acceptance and enhances the likelihood of successful implementation. Municipal waste officials' insights into the operational and financial aspects of PAYT, combined with household feedback on the system's user-friendliness and practicality (Dietz *et al.*, 2003), ensure that both perspectives are considered for the purposes of this research.

Additionally, both groups are essential for addressing knowledge gaps and behavioural barriers that may impact the success of PAYT. Households, for instance, may lack information on the financial and environmental benefits of PAYT, which might be an aspect that needs to be

addressed when implementing PAYT systems (Williams & Taylor, 2004). Municipal waste officials, on the other hand, may highlight operational difficulties and practicalities around implementing PAYT within the specific municipal context. Thus, incorporating the perspectives of both households and municipal waste officials in this research allowed for a pluralistic exploration of the challenges and opportunities that PAYT systems may present.

3.5.1 Selection and sampling of household participants

In survey research, data collection starts with knowing the pre-determined sample size, and the recruitment strategy (Ball, 2019). The research population is all the formal households under the CCT, which are provided with individual 240L wheelie bins, and weekly kerbside collection. According to CCT, there were 1,462 156 households in 2021, and about 80,6 percent of these were formal households, thus making 1 178 498 formal households (CCT, 2022). According to Saunders *et al.* (2007), at a 95 percent level of certainty, and for a 5 percent margin of error, one needs about 384 households as a representative sample for a population of 1,000,000 or more. Leedy and Ormrod (2015) also concur with a sample size of 400 for any population of 5,000 or more. However, these are samples based on a 100 percent response rate which is nearly impossible. Therefore, one needs to determine the required sample size taking into account the response rate. The response rates for web-based surveys may vary greatly, with a reasonable 30 percent response rate reported if surveys are conducted within the organisation, however, for internet-based surveys, it can be 11 percent or even lower (Saunders *et al.*, 2007).

Thus, assuming a 11% response rate, the actual sample size required was determined using the following formula:

$na = (n \times 100) / re\%$, where *na*, is the actual sample size required; *n* is the minimum size required (384), and *re%* is the estimated response rate (11%) (Saunders *et al.*, 2007: 214).

Therefore, to achieve a representative sample size at an estimated 11% response rate, about 3491 households would need to be sampled.

Sampling can generally be into two types, probability sampling, and non-probability sampling. The main difference between the two is that with the former, the sample is a representative sample of the population, and thus research findings can be generalised to the population, while the latter does not use a representative sample, thus research findings cannot be used to make statistical inferences about the population. For this research, the ideal sampling method would be to use stratified random probability sampling, where all the formal households in the CCT (the population) are stratified in terms of income levels, and then random sampling is used to sample a pre-determined number of households in each stratum. Stratified random sampling involves

dividing the population into two or more relevant and significant strata based on one or more attributes (Saunders *et al.*, 2007). It is argued that dividing the population into a series of strata means that the sample is more likely to be a representative sample of the population (Leedy & Ormrod, 2015; Saunders *et al.*, 2007).

However, due to limitations as highlighted in Section 1.5, including access to all the formal household addresses in the CCT, time and resources including financial resources required to conduct such a comprehensive survey, stratified random probability sampling was not used for this research. A non-probability convenience sampling was used for this research. This survey was limited to only households with access to the internet, and the target was at least 384 households.

3.5.1.1 Targeted number of household respondents

As indicated above, for a population 1 000 000 or more, the required sample size is 384. Therefore, with CCT formal households reported to be over 1 178 498 households, the target sample size was 384 households.

3.5.1.2 Selection and sampling household respondents

Non-probability convenience sampling was used to select the households to participate in the research. Convenience sampling involves selecting respondents haphazardly at ease of access such as interviewing people randomly at a shopping mall (Saunders *et al.*, 2007). In this study, the researcher sent the survey to only households with access to the Internet through a network of colleagues, clients, and acquaintances of the researcher with access to electronic email. In order to reach the targeted 384 responses, the questionnaires were distributed to approximately more than 500 people through various platforms (i.e. WhatsApp, e-mail, QR-code with embedded link, etc).

3.5.2 Selection and sampling of municipal officials

Purposive sampling was used to select the municipal officials to participate in the research. Purposive sampling is a non-random sampling technique where the researcher deliberately chooses the respondents for a particular purpose (Leedy & Ormrod, 2015). In this study, the researcher chose only city officials who deal directly with waste management and have internet access.

The municipal officials dealing with waste management extend to the entire Urban Waste Management value chain including Waste Collection, Cleansing & By-Law enforcement, Disposal Services, Commerce and Finance, Integrated Planning & Waste Strategy, etc. A request for

approval to undertake research involving the CCT officials was submitted through the City's online research request system. The request was approved, Reference: PSRR-1134 (ORP-hybrid), and the engagements with officials were limited to a maximum of twenty (20) CCT Waste Officials. Therefore, although the number of key waste management personnel was not known, the approved number, and hence the targeted number of municipal officials was 20.

3.6 Data collection

This research used both surveys and interviews to collect data. For households, only electronic surveys were used to collect data, and for municipal officials, data from electronic surveys were supplemented by interviews. Due to the required household sample size (see 3.5.1.1), online questionnaires were used to maximise the distribution potential and limit time related to data capturing. Since the number of municipal respondents was limited to twenty (20) by CCT, interviews were conducted to complement the survey data.

3.6.1 Surveys with households

Surveys involve acquiring information about one or more groups of people and then asking them to tabulate their answers (Leedy & Ormrod, 2015). Leedy and Ormrod (2015) also point out that surveys belong to a broader umbrella of quantitative approaches and are also called descriptive surveys or normative surveys. Thus, surveys provide descriptions of opinions or attitudes of a population by studying a sample of that population, and then drawing inferences from that population (Cresswell, 2014). While surveys have the advantage of being a relatively quick and easy way to collect data from larger respondent populations, they often lack the depth of data that can be gathered through interviews (Leedy & Ormrod, 2015).

Survey research may employ face-to-face or telephonic collection of data, or a written questionnaire (Leedy & Ormrod 2015). However, both interviews and questionnaires can be administered through electronic platforms these days. For the ease of distribution and data capturing, electronic surveys were employed to collect data from household respondents. While the use of electronic surveys has its advantages, it limits the distribution of the survey to respondents with electronic devices and internet access.

3.6.1.1 Developing the survey questionnaire

The Oxford Learner's Dictionary describes a questionnaire as "*a written list of questions that are answered by several people so that information can be collected from the answers*". In its broadest sense, questionnaires include all techniques of data collection where a participant is asked to respond to the same set of questions in a predetermined order (Saunders *et al.*, 2007).

Saunders *et al.* (2007) explain that, when designing individual questions for the questionnaire, researchers do one of three things, they adopt questions used in other questionnaires, or adapt questions used in other questionnaires, and/or develop their own questions. For the purposes of this research, the first two approaches were used.

The questionnaire had an introductory section where the research title and its aims were briefly mentioned, and also explained how the participants were selected, the research ethical clearance and ethics number, and the participant was older than 18 years old and gave consent to participate in the survey. Part A of the questionnaire which asked about socio-demographic characteristics was adapted from the work of the OECD (2023). Part B which enquired regarding perceptions of PAYT was adapted from the work of other authors who did similar research on PAYT, or other fiscal approaches related to waste management (Brown and Johnstone, 2014; Kevrekidou, 2016; Emmanouil *et al.*, 2022; Zhang *et al.*, 2023). Two separate questionnaires were developed for household, (Annexure A) and municipal participants (Annexure B). While the themes of the questions were similar, the context of each stakeholder group's positionality and perceptions of PAYT were provided for in the different questionnaires.

A five-point, numerical Likert scale was used to rate the respondent's level of agreement (Kevrekidou, 2016; Emmanouil *et al.*, 2022) to specific statements, with 1 representing complete or strong disagreement with the statement and 5 representing complete or strong agreement.

Two open-ended questions about the opportunities and challenges related to PAYT were added at the end of the questionnaires to evoke more in-depth, qualitative (descriptive) responses:

- *In your opinion, what are the opportunities for Pay-As-You-Throw (PAYT) for household solid waste management in the City of Cape Town?*
- *In your opinion, what are the challenges for Pay-As-You-Throw (PAYT) for household solid waste management in the City of Cape Town?*

Both questionnaires were captured in an electronic survey format (Google Forms) for ease of distribution. The survey allowed for anonymous capturing of responses, with no names or personal information being requested, and only basic socio-demographic information required from respondents.

3.6.1.2 Piloting the survey questionnaire

Authors suggest that questionnaires should be piloted (tested) before commencement of data collection to refine the questions so that respondents have no problems in understanding or responding to questions and recording data (Saunders *et al.*, 2007; Phellas *et al.*, 2011). The number of people used to test the questionnaire depends on the research questions, research

objectives, the size of the research project, and the money and time available. For smaller-scale research, researchers are unlikely to have sufficient time and money to conduct large-scale field trials, thus for most student questionnaires, the minimum number of pilot respondents is ten (Fink, 2003b, cited in Saunders *et al.*, 2007: 414).

For this research, the household questionnaire was piloted with a sample of ten fellow students and colleagues who included Cape Town residents and non-residents. Pilot respondents made some suggestions regarding the sequencing of questions and refinement of a few statements. The responses to pilot phase questionnaires were excluded from the data.

3.6.1.3 Distributing the survey questionnaire

In the past survey questionnaires were printed on paper and distributed to many participants via post. Nowadays survey questionnaires can be easily distributed through automated survey software on online platforms, email, and even social media to reach respondents (Ball, 2019). Self-administered web-based surveys have several limitations; however, they are relatively fast and cost-effective (see Phellas *et al.*, 2011 and Leedy & Ormrod, 2015). Several strategies were used to distribute the questionnaire. At the onset of the research, it was assumed that the City of Cape Town metropolitan municipality would be in a position to forward the survey questionnaire to their database of households or make a mailing list of households available to the researcher. However, due to the provisions of the Protection of Personal Information Act (4 of 2013), the municipality was not in a position to make personal information available.

The questionnaire was forwarded to a network of colleagues, clients, and acquaintances of the researcher who are also City of Cape Town residents, with access to electronic platforms, such as WhatsApp, or e-mail. The recipients were also encouraged to distribute the survey to their acquaintances residing in the City of Cape Town. A QR code was also generated using the link and printed and then distributed by the researcher at public places like shopping malls where people can scan it using smart phones (See Annexure C). The survey was available online from 8 May until 8 September 2024.

3.6.1.4 Obtaining informed consent

Even when a researcher uses a web-based survey to collect data, the ethical standards must be just as rigorous as they would be if the data were collected through face-to-face contact or the postal service (Leedy & Ormrod, 2015). Participants must be informed and agree to participate voluntarily in the study, and usually an informed consent letter and virtual “click to accept” button can serve for such purposes and their responses must remain confidential as they would in any study (Leedy & Ormrod, 2015). The survey had a cover letter with a brief introduction of the

research and its objectives, provision for confidentiality, permission to withdraw, ethical clearance, contact details of the researcher and supervisor, and lastly consent that the participant was older than 18 years old, and agreed to participate in the study.

Respondents could only continue with the survey if informed consent was provided (with an automatic “end this survey” setting if the respondent did not provide consent).

3.6.2 Surveys and interviews with municipal officials

Following the CCT approval, the email addresses of key personnel to engage with within the Waste Services Department was provided through the Integrated Planning and Waste Strategy office, and also the other key personnel who requested to be included in the survey as stipulated in the research approval letter (Annexure D). Thereafter, the link with the survey was sent to these key personnel and followed up regularly. As explained earlier, the survey questions for municipal personnel were similar to the household with the exception of a few contextual differences (see Annexure B). The total number of municipal officials approved to participate in the survey and follow up interviews was 20. After the survey was completed, follow-up interviews were scheduled and conducted with the officials who agreed to participate in the follow-up interviews. During the interviews, participants were asked to elaborate of the opportunities and challenges for PAYT implementation in the CCT.

3.6.2.1 Developing the questionnaire

The interview questionnaire was very similar with the survey as the municipal officials had to first complete the structured survey (Annexure B) before the follow-up interview was conducted. The follow-up interview was based on the open-ended section of the questionnaire only (Leedy and Ormrod, 2015), i.e. respondent's opinions on opportunities and challenges for PAYT implementation for household waste management in the CCT.

3.6.2.2 Piloting the questionnaire

The piloting process for both questionnaires are outlined in Section 3.6.1.2 above.

3.6.2.3 Conducting interviews

A total of ten (10) municipal officials completed the online survey. These respondents were invited to participate in follow-up interviews between 8 and 21 August 2024. The municipal waste officials who participated in the survey were contacted through telephone calls and emails to arrange for follow-up interviews. Only four of the ten municipal waste officials were available for follow-up interviews. The interviews were conducted using Microsoft Teams/Skype and were recorded. All

interviewees signed a consent form and were guaranteed confidentiality. All the municipal waste officials who participated in the follow-up interviews had prior participated in online survey, thus had a brief background of PAYT concept, and therefore it was only discussed if the participants had specific questions of PAYT. The interviewees were asked to provide their opinions regarding opportunities and challenges for PAYT implementation in the CCT.

3.7 Data analysis

According to Leedy and Ormrod, (2015: 229), “*numbers are meaningless unless we can find the patterns that lie beneath them*”. Quantitative, Likert-scale data (1 to 5 scale) collected from the structured part of the survey was imported from the survey results into a spreadsheet for further sorting. Data was then analysed through two-dimensional frequency tables and graphs using Microsoft Excel spreadsheets.

The qualitative data gathered from the two open-ended questions on the survey questionnaire or interviews where respondents were asked to identify opportunities and constraints for PAYT implementation, were thematically analysed. The thematic analysis of both the survey responses on opportunities and constraints and interviews was done manually and intuitively. The recorded interview data was transcribed to a Microsoft Word document and responses were categorised according to key themes by clustering similar phrases together. Basic frequency tables were developed as a basis for discussion of the themes and phrases mentioned by participants.

3.8 Ethical considerations

The research proposal was submitted together with an application for approval by Faculty of Natural and Agricultural Sciences Ethics Committee (FNAS-REC), and then North-West University Senate Committee for Research Ethics (NWU-SCRE). The research involved human respondents including CCT residents and CCT municipal officials, however, it did not include vulnerable people and minors under the age of 18. Based on the approval by FNAS-REC, NWU-SCRE approved the research, and the ethics number is NWU-01211-24-A9.

For the City of Cape Town officials to participate in the research, approval had to be obtained with the CCT. The NWU-approved research proposal, ethics approval, the letter from the supervisor, the questionnaires, and proof of registration were submitted to the CCT online research request system. The request was approved by the CCT Director: Policy & Strategy, Reference: PSRR-1134 (ORP-hybrid) subject to conditions stipulated on the approval.

3.9 Methodological assumptions and limitations

Leedy and Ormrod (2015: 263) posit that *“no research study can be perfect, and its imperfections inevitably cast at least a hint of doubt on its findings”*. Methodological limitations do impact the interpretation of the research findings. Hence, good researchers know and report on the weaknesses of their research (Leedy and Ormrod, 2015: 263), and both delimitations and limitations should be clearly stated. Research limitations arise mainly from two major categories, threats to internal validity and threats to external validity (Price and Murnan, 2004: 66). External validity of a research refers to the extent to which the results of the research may apply beyond the research itself, i.e. generalisation to the rest of the population. The key limitations of the research included:

- Non-probability convenience sampling was used, and therefore, the results of the research cannot be generalised to the entire CCT households, and also not to all CCT municipal officials.
- The target number of households respondents was 384, however, only about 127 households responded, which means there was 33% response rate. An inadequate response rate is of increasing concern the further it is from 100%. Although there is not set standard for minimum response rate, Price *et al.* (2004) suggest that any response rate less than 50% should be concerning. With a low response rate, the external validity or generalizability of the research results becomes questionable. Therefore, with the non-probability sampling that was used and the low response rate, the research results cannot be used to generalize across the CCT households.
- The target number of municipal officials was twenty (20), however only ten (10) responded on the survey, and four municipal officials had follow-up interviews.

3.10 Chapter conclusion

In conclusion, Chapter 3 discussed the research methodology, research approaches and methods, research design, data collection, and analysis. This research used mixed-methods research where both quantitative and qualitative research approaches were used to answer the research question. Data was collected through a structured survey questionnaire with predetermined closed and also open-ended questions. Follow-up interviews were also conducted with a few key municipal waste personnel. The next chapter, Chapter 4, presents and discusses the research findings.

CHAPTER 4 RESULTS AND DISCUSSION

4.1 Introduction

This chapter presents the results and discussions of the research findings. The data discussed in this chapter was gathered through surveys with households in the City of Cape Town, as well as municipal waste managers/officials working in the City of Cape Town Urban Waste Management Department.

The results are presented in accordance with the research questions:

- What are the perceptions of *CCT households*, regarding PAYT as a fiscal instrument for household solid waste management in the City of Cape Town?
- What are the perceptions of *CCT municipal waste managers (officials)* regarding PAYT as a fiscal instrument for household solid waste management in the City of Cape Town?

Section 4.2 provides the results of the household surveys, while section 4.3 focuses on the result of the surveys and follow-up interviews with municipal officials. Section 4.4 presents an integrated discussion of the results, and finally, Section 4.5 provides a chapter summary.

4.2 Results of household surveys

Section 4.2 provides the results of the household survey. The section is divided into three sub-sections, where Section 4.2.1 provides the basic socio-demographic profile of the household respondents, Section 4.2.2 outlines the results to the structured part of the survey questionnaire, and Section 4.2.3 discusses the opportunities and challenges related to the implementation of PAYT systems, which were identified as part of the open-ended section of the questionnaire.

A total of at least 384 households were targeted for the research, however, only 127 respondents participated in the research, which represents a 33% response rate. Although the response rate is low, it is still useful given that this is the only research conducted thus far on the perceptions of PAYT in the City of Cape Town, South Africa.

4.2.1 Socio-demographic characteristics of the household respondents

Basic socio-demographic data of household respondents were collected to understand the background of the respondents. Table 4-1 summarises the socio-demographic variables of the 127 household respondents. The socio-demographic data is only provided to provide information on the representative nature of the respondents. No further analysis or correlations are performed in relation to the socio-demographic background of the respondents.

Table 4-1: Demographic data of the household respondents (n = 127)

Socio-demographic variable	Frequency	Percentage
Gender		
Female	54	42.52
Male	73	57.48
Age		
18-39	47	37.01
40-49	47	37.01
50-59	22	17.32
60 or more	11	8.66
Highest level of education		
Grade 12/Matric	46	36.22
Tertiary education (undergraduate)	46	36.22
Tertiary education (post-graduate)	35	27.56
Current Employment status		
Unemployed	4	3.15
Self-employed	12	9.45
Private sector employee	106	83.46
Civil Servant	4	3.15
Pensioner	1	0.79
Household Income		
R0- R108 500 pa	9	7.09
R108 501 to R236 900 pa	12	9.45
R236 901 to R495 400 pa	32	25.20
R495 401 to R995 500 pa	51	40.16
R995 501 to R1 882 200 pa	23	18.11

4.2.1.1 Gender

In terms of gender distribution among the household respondents, the majority were male, comprising 57% of the total participants, while females accounted for approximately 43%. This does not fully align with the gender ratio in CCT, as a report from 2019 indicated a female: male ratio of 50.4%: 49.6% males (COGTA, 2020).

This gender distribution is noteworthy as it may influence the study's insights into perceptions of PAYT in the City of Cape Town. The predominance of male respondents could introduce a gendered perspective that may shape attitudes toward waste management policies differently

compared to a more balanced or female-majority sample. Research has shown that gender can significantly impact environmental attitudes and behaviours. For example, studies such as Zelezny *et al.* (2000) highlight that women often exhibit stronger pro-environmental attitudes and are more likely to engage in sustainable practices compared to men. Conversely, men may be more driven by the economic aspects of environmental policies, which could shape their views on the fairness and effectiveness of PAYT schemes (Dietz *et al.*, 2002).

Therefore, the skewed gender distribution in the present study should be considered when interpreting the results. A predominance of male perspectives could mean the findings might place more emphasis on the economic and practical implications of PAYT policies, potentially underrepresenting the broader environmental and communal concerns that a more balanced sample may reveal.

4.2.1.2 Age

In terms of age distribution, most respondents were between 18 and 47, with two significant age brackets: 37% of respondents were aged 18 to 39, and another 37% were aged 40 to 49. Approximately 17% of respondents fell within the 50 to 59 age range, while the remaining 9% were 60 years or older.

This age profile suggests that the study's findings are predominantly shaped by perspectives from younger to middle-aged adults. Age can influence how individuals perceive and engage with waste management policies like PAYT. For example, younger adults (18-39) may prioritise environmental sustainability and innovation, aligning with findings from studies that indicate younger generations tend to show greater concern for environmental issues and willingness to adapt new practices (Kafková, 2019). On the other hand, the 40 to 49 age group may emphasise practicality and economic considerations, reflecting a balance between environmental awareness and financial priorities (Van Liere & Dunlap, 1980). The smaller proportion of respondents aged 50 and above (26%) might limit the insights into how older populations view PAYT policies, potentially underrepresenting age-related concerns such as fixed incomes or limited physical capability to manage waste effectively. This age distribution should therefore be considered when interpreting the findings across all age demographics, as it may affect the study's applicability to older adults who could have different priorities and constraints in adopting PAYT systems.

4.2.1.3 Highest level of education

In terms of education, 36.22% of respondents had completed matric, while an equal percentage (36.22%) held an undergraduate degree. Additionally, about 27.56% had completed a postgraduate degree. Compared to the broader population in the City of Cape Town, where

approximately 56.6% of adults had completed matric and only about 19.8% had attained higher or tertiary education (CCT, 2022), this sample reflects an over-representation of individuals with higher education.

This discrepancy in educational attainment among respondents may influence perceptions PAYT policies. Research indicates that higher education levels are often associated with greater environmental awareness and a deeper understanding of the implications of waste management policies (Johnson *et al.*, 2004). Therefore, respondents with higher education might show more support for innovative waste management strategies, or they could evaluate PAYT policies from a more informed, critical perspective.

However, it is important to note that due to the sampling method's limitations and the relatively small sample size, no definitive correlation between education levels and the responses can be drawn. This over-representation may skew findings toward perspectives that may not be fully reflective of the general population's views on PAYT policies, emphasising the need for caution when interpreting these results.

4.2.1.4 Current employment status

A significant portion of the household respondents were employed in the private sector, making up 83.46% of the sample. About 9.45% of respondents were self-employed, while 3.15% were civil servants. The remaining respondents included 3.15% who were unemployed and 0.9% who were pensioners. This employment profile not only explains respondents' general access to resources such as the internet and email but also provides insight into how job security and income levels might influence their views on fiscal instruments like PAYT policies.

Access to stable employment and regular income can significantly impact individuals' tolerance for policies that involve financial contributions. Employed respondents, particularly those in the private sector or self-employed, may have higher disposable incomes, which can lead to a greater willingness to support environmental policies with economic implications, such as PAYT. Studies have shown that individuals with higher income levels are more likely to endorse fiscal tools that promote sustainability, as they may view these contributions as manageable investments for communal or environmental benefits (Choe & Fraser, 1998).

Conversely, those with limited or no income, such as the unemployed and pensioners, may have lower tolerance for such policies due to financial constraints. Fiscal instruments like PAYT could be perceived as an additional economic burden, impacting their acceptance and support. This can result in varied attitudes toward PAYT based on employment status and income level, influencing the overall perception captured in the study.

However, this employment distribution also indicates an under-representation of public sector employees, unemployed individuals, and pensioners. These groups might have different perspectives or challenges when considering PAYT policies, such as affordability or practicality. This limitation should be kept in mind when interpreting the results, as the study may not fully capture the views of those with limited access to digital resources or different economic constraints.

4.2.1.5 Household income

In terms of household income levels (and potentially linked to employment status discussed in Section 4.2.1.4), 40.16% of respondents fell within the income bracket of R495,401 to R995,500 per annum, indicating that a significant portion of the sample comprised middle-to-upper income earners. This was followed by 25.20% of respondents with annual household incomes ranging from R236,901 to R495,400. About 18.11% of respondents reported incomes between R995,501 and R1,882,200 per annum, placing them in the higher-income category. Approximately 9% of respondents had household incomes between R108,501 and R236,900 per annum, and the remaining 7.09% were in the lowest income bracket of R0 to R108,500 per annum.

These income distributions are essential for understanding tolerance for and perceptions of fiscal instruments like PAYT. As discussed in Section 4.2.1.4, higher-income households (which make up a large proportion of the respondents) may have more flexibility to absorb additional costs associated with PAYT schemes and may be more inclined to support such policies if they align with their environmental values and lifestyle (Choe & Fraser, 1998). Their financial security could lead to a perception of PAYT as a practical means of promoting waste reduction and environmental responsibility without significant financial strain.

On the other hand, respondents in lower income brackets may view PAYT policies through a different lens, perceiving them as potential economic burdens. For these households, even moderate increases in waste disposal fees could impact their budget, making them less receptive to PAYT policies. The financial implications could be seen as disproportionately affecting those with limited disposable income, influencing their level of support or opposition to such initiatives.

4.2.2 Results of the household survey

The results of the survey are presented below in Table 4-2. As explained earlier, a five-point Likert scale was used to rate the respondent's perceptions about PAYT where 1 = Strongly disagree, 2 = Disagree, 3 = Neither agree nor disagree (neutral), 4 = Agree, and 5 = Strongly agree.

Table 4-2: Level of agreement of household respondents (n = 127) to statements posed regarding PAYT in the City of Cape Town.

Statement	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Mean
1. I would support the implementation of PAYT as a waste collection system in the City of Cape Town (CCT).	3.9%	4.7%	14.2%	30.7%	46.5%	4.11
2. I believe that the majority of households in the City of Cape Town (CCT) would support the implementation of PAYT as a waste collection system.	5.5%	10.2%	33.1%	21.3%	29.9%	3.59
3. I believe that the City of Cape Town Metropolitan Municipality would be able to successfully apply a PAYT system for waste.	2.4%	7.1%	23.6%	39.4%	27.6%	3.83
4. I believe that the City of Cape Town has the correct waste billing and cost recovery systems in place to enable PAYT implementation.	3.1%	5.5%	26.0%	44.1%	21.3%	3.75
5. I believe that public consultation is important before considering policy mechanisms such as PAYT.	0.8%	0.0%	8.7%	33.1%	57.5%	4.46
6. I believe that education and awareness of households are important before considering policy mechanisms such as PAYT.	0.8%	0.0%	3.9%	37.8%	57.5%	4.51
7. I believe that transparency regarding the pricing model for PAYT is an important factor towards successful implementation.	0.8%	0.0%	5.5% ⁰	35.4%	58.3%	4.50

Statement	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Mean
8. I believe that access to recycling infrastructure (for paper, cardboard, plastic, etc.) is important to reduce volumes/weight of disposable waste (collected by the municipality) in support of PAYT systems.	0.0%	0.8%	16.5%	33.9%	48.8%	4.31
9. I <i>would not</i> consider illegal dumping of my household waste to reduce my PAYT charges.	3.1%	5.5%	13.4%	22.0%	55.9%	4.22
10. I <i>would not</i> consider mixing residual waste with recyclable waste to reduce my PAYT charges.	3.1%	7.1%	19.7%	22.8%	47.2%	4.04
11. I <i>would not</i> consider disposing residual waste in another household's waste bin to reduce my PAYT charges.	3.9%	4.7%	14.2%	21.3%	55.9%	4.20
12. I would reprimand a citizen a non-compliant citizen (i.e. those who illegally dispose of waste to reduce PAYT charges).	15.0%	20.5%	14.2%	17.3%	33.1%	3.33
13. I believe that punitive measures such as fines for unlawful behaviour (i.e. for illegal dumping or disposal of non-recyclable waste in recycling bags/bins) would help with the successful implementation of a PAYT system.	0.8%	3.1%	18.9%	30.7%	46.5%	4.19
14. Ranking of PAYT schemes (see Section 4.2.2.5)						
15. I would support the implementation of a volume-based PAYT system where charges are based on the volume of waste bins.	7.1%	12.6%	37.8%	26.0%	16.5%	3.32
16. I would support the implementation of a weight-based PAYT system, where waste bins are equipped with identification codes (e.g.,	3.9%	5.5%	22.8%	28.3%	39.4%	3.94

Statement	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Mean
barcodes, QR codes) for tracking purposes and are weighed during collection (e.g. vehicles retrofitted with weighing systems).						
17. I would support the implementation of a weight-based PAYT system, where wheelie bins are replaced by a bag-system.	44.1%	18.1%	18.9%	6.3%	12.6%	2.26
18. I would support the implementation of a hybrid PAYT system where a combination of weight or volume, and frequency is used to bill households for waste collection and disposal.	8.7%	24.4%	40.2%	12.6%	14.2%	2.99
19. PAYT charges can be either one-component or multi-component. One-component charges are fully variable, based solely on bin or container volume/weight, with no fixed charge. That means that if households do not dispose of any waste, there is no charge. I would support one-component charges for PAYT for waste.	4.7%	7.1%	26.8%	24.4%	37.0%	3.82
20. PAYT charges can be either one-component or multi-component. Multi-component charges include fixed costs (e.g., administration, bin rental) and variable costs (e.g., weight-based, volume-based). I would support multi-component charges for PAYT for waste.	6.3%	15.7%	40.9%	14.2%	22.8%	3.31

4.2.2.1 Support towards the implementation of a PAYT system in the City of Cape Town

Household support is crucial for the successful implementation of a PAYT waste management system. When households actively participate by adhering to waste separation and volume-based waste reduction practices, they directly contribute to the system's efficiency. This support fosters a sense of responsibility and accountability among residents, encouraging them to reduce waste generation and recycle more effectively.

Figure 4-1 outlines the level of agreement to the statement “*I would support the implementation of PAYT as a waste collection system in the City of Cape Town*”. The majority of the respondents (>76%) either agreed (30.7%) or strongly agreed (46.5%) to the statement. Approximately 14% of the respondents reacted neutral (i.e. neither agree nor disagree), while less than 9% of the respondents disagreed (4.7%) or strongly disagreed with the statement (Figure 4-1).

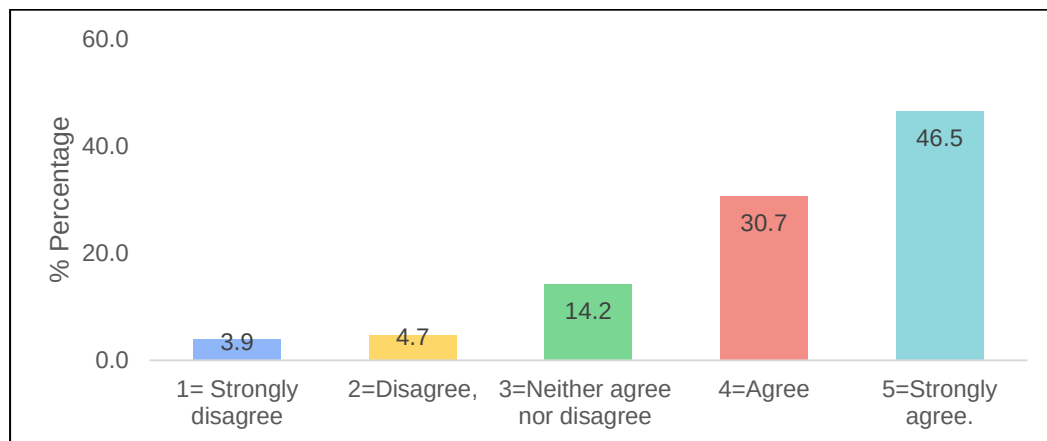


Figure 4-1: Responses towards *I would support the implementation of PAYT as a waste collection system in the City of Cape Town (Statement 1)*

The overwhelming support for PAYT suggests that residents may already be inclined toward environmentally responsible behaviour. PAYT systems are known to reduce waste generation and increase recycling rates by creating a direct economic incentive for households to reduce the amount of waste they produce (Miranda & Aldy, 1998). In fact, Miranda and Aldy (1998) observed that following implementation of PAYT, households change their waste behaviour in two stages, firstly, they divert their waste through increased recycling, and once they have maximised their waste diversion, they begin source reduction. If successfully implemented in Cape Town, it may lead to improved environmental outcomes by reducing the burden on landfills and enhancing resource recovery through recycling. Research has shown that when implemented with fairness

considerations, PAYT can be an equitable system that encourages waste reduction across socio-economic groups (Dijkgraaf & Gradus, 2004).

Figure 4-2 presents responses to the statement “*I believe that the majority of households in the City of Cape Town would support the implementation of PAYT as a waste collection system*”.

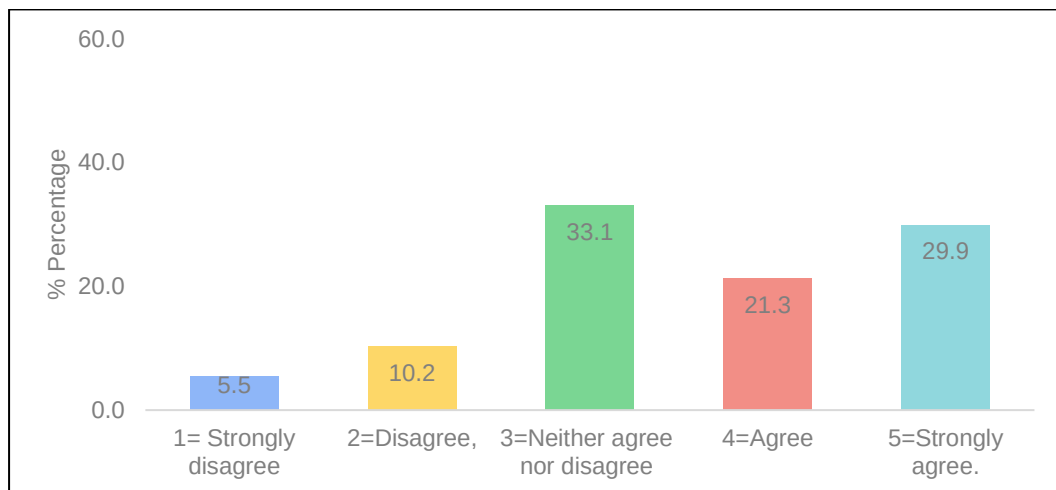


Figure 4-2: Responses towards *I believe that the majority of households in the City of Cape Town would support the implementation of PAYT as a waste collection system (Statement 2)*

More than half of the respondents agreed (21.3%) or strongly believed (29.9%) that other households would support PAYT systems. However, it is noteworthy that about one-third (33.1%) reacted neutral to this statement (neither agreeing nor disagreeing). A total of 15.7% of the respondents were not convinced that people would support PAYT as they either disagreed (10.2%) or strongly disagreed (5.5%).

When comparing the findings of Figures 4-1 and 4-2 to similar studies, notable trends are observed regarding household support for PAYT policies. Research by CWMI (2000) and Brown and Johnstone (2014) indicated that, like the present study, a majority of households showed support for PAYT prior to its implementation. This initial endorsement often stems from an understanding of the environmental benefits and perceived fairness of PAYT as a waste management strategy. However, studies by Dunne *et al.* (2008) and Sakai *et al.* (2008) highlighted initial resistance to PAYT policies before implementation. Interestingly, these studies found that support for PAYT generally increased after implementation as residents became more familiar with the system and experienced its benefits firsthand. This shift in attitude suggests that awareness and education campaigns play a critical role in easing the transition and fostering acceptance. Contrasting these findings, research by Lakhan (2015) in Ontario, Canada, as well

as studies by Yao and Zhou (2023) and Zhang *et al.* (2023) conducted in Beijing, China, reported that most respondents were not supportive of PAYT implementation. The reasons for resistance in these cases included concerns over financial impacts, equity, and practical challenges associated with waste separation and compliance.

4.2.2.1.1 Support towards volume-based versus weight-based PAYT systems

As explained in Chapter 2, PAYT schemes can be designed using different billing methods, most commonly weight-based or volume-based charges. Weight-based PAYT charges households based on the actual weight of their waste, providing a direct economic incentive to reduce waste generation. (Dijkgraaf & Gradus, 2004). In contrast, volume-based PAYT charges involve billing households based on the size of waste containers, or the number of bags used (Allers & Hoebe, 2010). Both systems have shown effectiveness in reducing waste generation, but the choice between them depends on local factors such as cost, infrastructure capabilities, and public acceptance (Allers & Hoebe, 2010).

Figure 4-3 presents responses towards the statement “*I would support the implementation of a volume-based PAYT system where charges are based on the volume of waste*”.

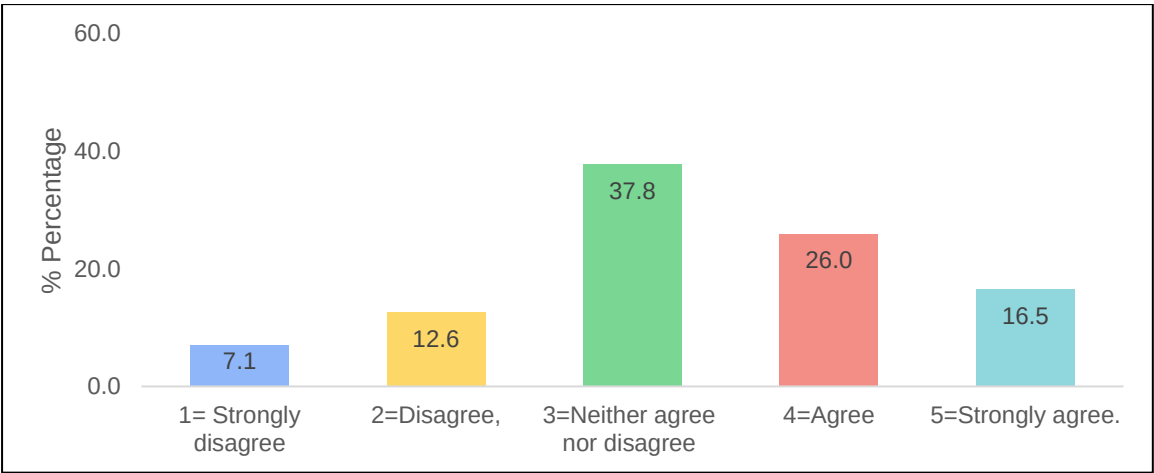


Figure 4-3: Responses towards *I would support the implementation of a volume-based PAYT system where charges are based on the volume of waste bins (Statement 15)*

The household survey results indicate that the majority of respondents (42.5%) either agreed or strongly agreed with the statement regarding support for volume-based PAYT systems, suggesting a favourable outlook toward volume-based systems. Meanwhile, a significant portion of respondents (37.8%) remained neutral, possibly indicating uncertainty or a lack of strong

opinions on the matter. Only 19.7% of respondents expressed disagreement or strong disagreement with the statement, showing a relatively smaller level of opposition. These findings point to general support for volume-based PAYT systems among the majority of respondents, although the notable neutral segment uncertainly or unfamiliarity about volume-based PAYT systems, or PAYT in general.

Figure 4-4 shows responses to the statement “*I would support the implementation of a weight-based PAYT system, where waste bins are equipped with identification codes for tracking purposes and are weighed during collection*”.

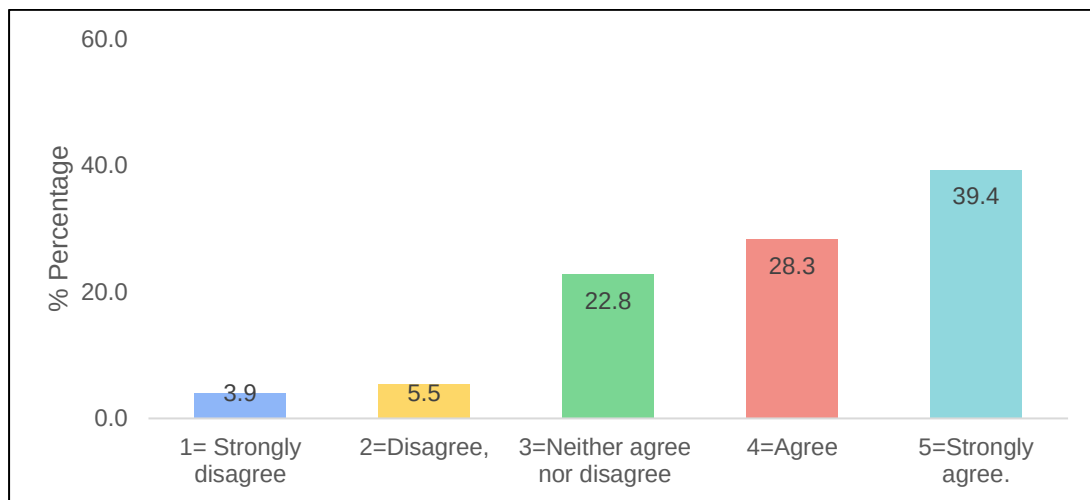


Figure 4-4: Responses towards *I would support the implementation of a weight-based PAYT system, where waste bins are equipped with identification codes for tracking purposes and are weighed during collection* (Statement 16)

Approximately 68% of household respondents agreed or strongly agreed with the statement indicating their support for a weight-based PAYT system, where waste bins are equipped with identification codes and weighed during collection. In comparison, a smaller proportion of respondents (22.8%) reacted neutrally, suggesting that while many were positive, some may remain unsure or cautious about the implications of weight-based billing. Only 9.4% of respondents disagreed or strongly disagreed, indicating minimal resistance to this approach among the surveyed group.

These responses, when compared to the findings in Figure 4-3, show that weight-based PAYT systems gained more definitive support compared to volume-based systems. This difference may highlight the perception that weight-based systems are more equitable, charging residents only

for the waste they actually produce. Similar research indicates that weight-based PAYT systems are often preferred over volume-based systems due to their perceived fairness and accuracy in charging households. Studies by Dijkgraaf and Gradus (2004) and Dahlén and Lagerkvist (2010) suggest that weight-based systems create stronger incentives for waste reduction, as households are charged based precisely on the weight of the waste they generate. In contrast, Allers and Hoeben (2010) noted that volume-based systems, while simpler and cost-effective, may encourage practices such as waste compaction, which undermines the incentive to reduce waste volume effectively.

Figure 4-5 shows responses to the statement “*I would support the implementation of a weight-based PAYT system, where wheelie bins are replaced by a bag-system*”.

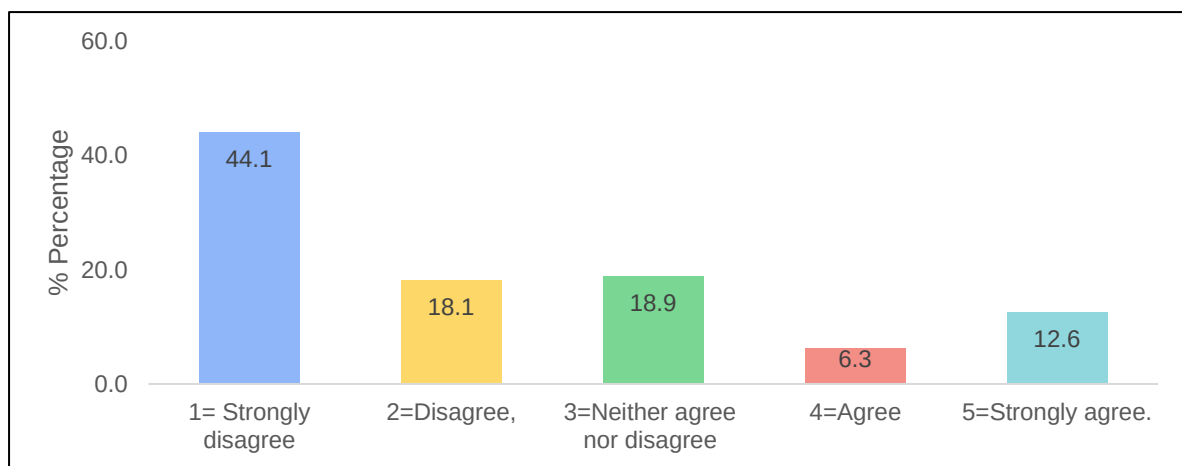


Figure 4-5: Responses towards *I would support the implementation of a weight-based PAYT system, where wheelie bins are replaced by a bag-system* (Statement 17)

While support for weight-based PAYT systems featuring QR codes and tracking devices on wheelie bins was strong (as shown in Figure 4-4), an interesting shift in opinion emerged when the proposed system involved switching from wheelie bins to bag systems. The majority of respondents (62.2%) indicated they would not support weight-based PAYT if the system required replacing wheelie bins with bags (Figure 4-5). This change in opinion might highlight the importance of user convenience and perceptions of practicality in waste management systems (i.e. bins versus bag-systems). Only 18.9% of respondents expressed agreement or strong agreement with the statement, indicating that a smaller portion of the population saw potential benefits in a bag-based system. The remaining 18.9% reacted neutrally, which may reflect uncertainty or a lack of strong feelings toward the proposed change.

According to Dahlén and Lagerkvist (2010), residents are more likely to support waste management practices that align with existing habits and infrastructure (in this case wheelie bins), as sudden changes can evoke resistance due to perceived inconvenience. In the context of PAYT systems, Miranda and Aldy (1998) found that public approval is often tied to the usability and practicality of the method employed. In this case, wheelie bins equipped with technology for tracking and weighing may be perceived as more manageable and organised compared to bag-based systems, which can be viewed as cumbersome or less effective.

Figure 4-6 presents responses to the statement “*I would support the implementation of a hybrid PAYT system where a combination of weight or volume, and frequency is used to bill households for waste collection and disposal*”.

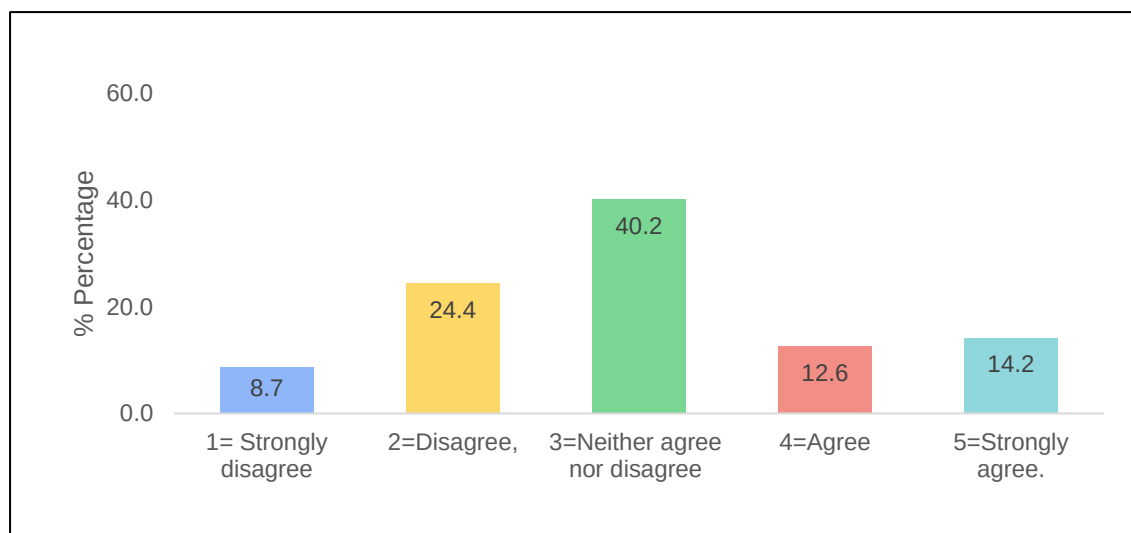


Figure 4-6: Responses towards *I would support the implementation of a hybrid PAYT system where a combination of weight or volume, and frequency is used to bill households for waste collection and disposal (Statement 18)*

The household survey data reveals that a significant proportion of respondents (40.2%) neither agreed nor disagreed with the statement regarding hybrid PAYT systems that use both weight and volume to bill waste generation. This considerable neutral response may, again, indicate uncertainty or a lack of familiarity with how such a system would function in practice. Only 26.8% of respondents agreed or strongly agreed with the statement, suggesting that a smaller segment of the population recognises potential benefits or fairness in a combined billing approach. In contrast, 33.1% of respondents disagreed or strongly disagreed, reflecting a notable level of scepticism or resistance to hybrid systems.

According to Dahlén and Lagerkvist (2010), hybrid PAYT systems are regarded as “*complex and confusing*” and can face public resistance if residents feel uncertain about their operation or believe the system could add undue complexity to waste disposal practices.

4.2.2.1.2 Support towards one-component versus multi-component charges

PAYT charges can be either one-component or multi-component. One-component charges are fully variable, based solely on bin or container volume/weight, with no fixed charge. That means that if households do not dispose of any waste, there is no charge. Under the multi-component charges, there are both are fixed and variable charges. The fixed charges may cover both the basic fee and/or bin rental fee. The fixed fee covers the basic costs of waste management service, while the variable portion is service-related and should be proportional to the weight or volume of the residual waste collected and its disposal (Bilitewski, 2008b; Elia *et al.* 2015). Fixed fees may include general administrative expenses, expenses for the billing system, supervision costs, education and information costs, and other fixed costs (Karagiannidis *et al.*, 2005). The variable portion should offer dynamic incentives to reduce waste generation and should be such that it decreases the total waste charge considerably (Bilitewski, 2008b).

Figure 4-7 provides household respondents’ responses to the statement “*I would support one-component charges for PAYT for waste*”.

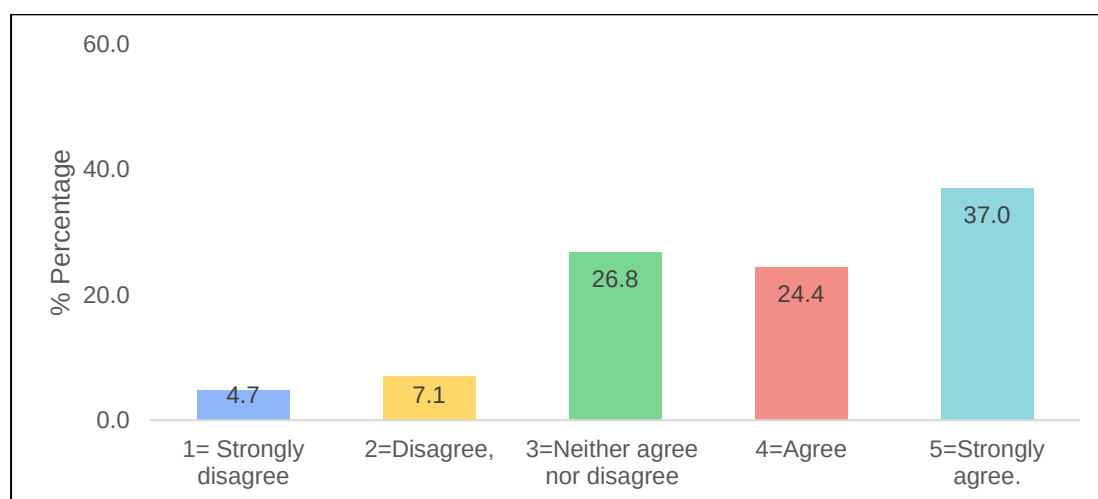


Figure 4-7: Responses towards *I would support one-component charges for PAYT for waste (Statement 19)*

More than 61% of respondents indicated that they would support one-component PAYT charges, with 24.4 % agreeing and 37.0 % strongly agreeing. Approximately 27% of respondents were neutral, while a few either disagreed (7.1%) or strongly disagreed (4.7%).

Figure 4-8 outlines responses to the statement “*I would support multi-component charges for PAYT for waste*”.

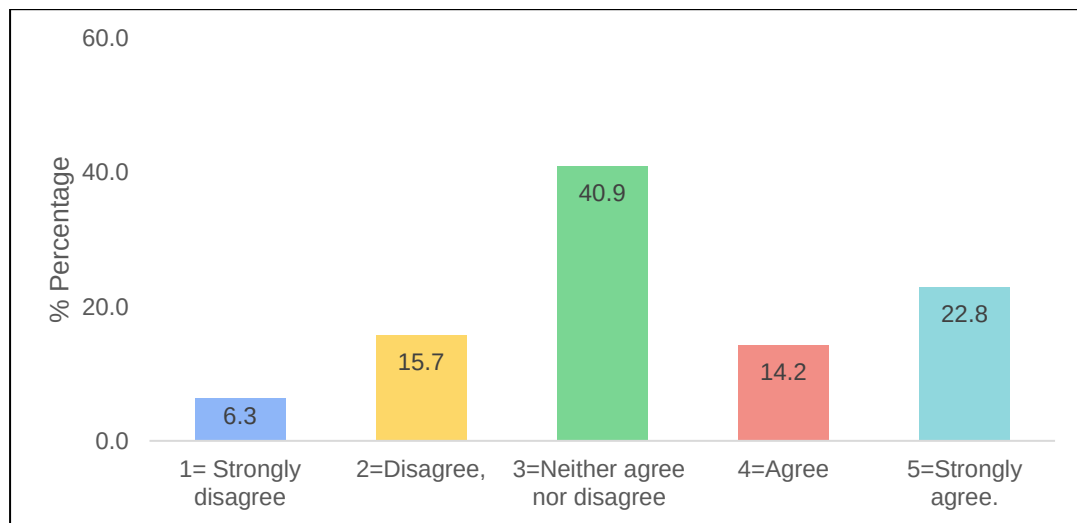


Figure 4-8: Responses towards *I would support multi-component charges for PAYT for waste (Statement 20)*

A significant percentage of respondents (40.9%) reacted neutral to the statement on multi-component charges, while approximately 37 % agreed or strongly agreed to the statement, and approximately 22% disagreed or strongly disagreed to the statement.

In summary, about 61.4% of household respondents supported one-component charge compared to 37% who supported the multi-component charge. Although respondents from this research seemingly preferred the one-component charges, research suggests that multi-component charges are more practical (Karagiannidis *et al.*, 2005; Reichenbach, 2008; Watkins *et al.*, 2012).

4.2.2.2 Perceived ability and readiness of City of Cape Town to successfully apply PAYT system for waste

The successful implementation of a PAYT system for waste management depends heavily on the perceived ability and readiness of municipalities to adopt such a model (Manni & Runhaar, 2014). Households are generally more willing to support systems and buy-in if they perceive the municipality ready and, in a position, to successfully implement a system (Shan *et al.*, 2024).

Figure 4-9 presents responses to the statement “*I believe that the City of Cape Town Metropolitan Municipality would be able to successfully apply a PAYT system for waste*”, while Figure 4-10 depicts responses to the statement “*I believe that the City of Cape Town has the correct waste billing and cost recovery systems in place to enable PAYT implementation*”.

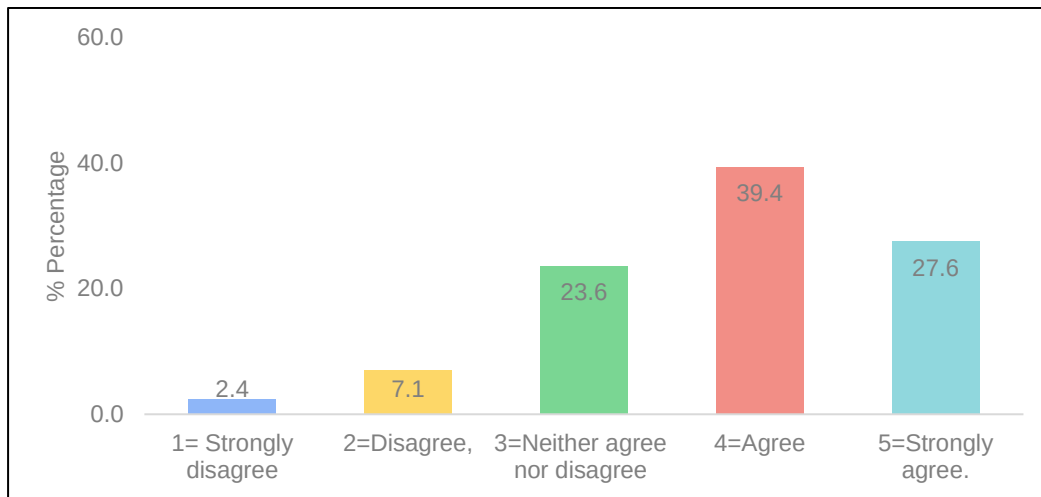


Figure 4-9: Responses towards *I believe that the City of Cape Town Metropolitan Municipality would be able to successfully apply a PAYT system for waste (Statement 3)*

Clearly, the majority of respondents were convinced that the CCT would be able to successfully apply a PAYT system for waste, with 39.4 % of respondents agreeing and 27.6 % strongly agreeing with the statement. Some of the respondents were neutral (23.6%), while a few (9.5%) were not convinced about CCT’s ability to successfully apply PAYT systems for waste.

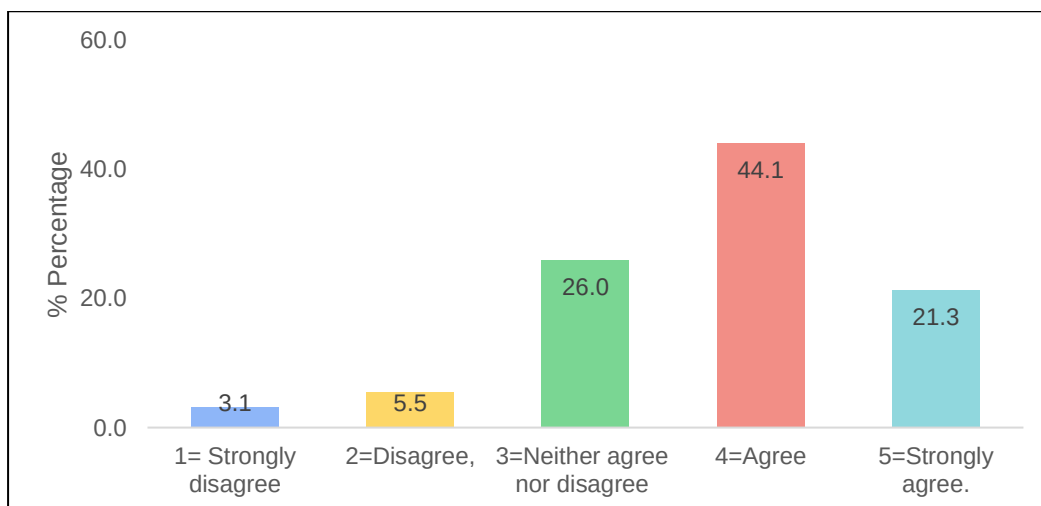


Figure 4-10: Responses towards *I believe that the City of Cape Town has the correct waste billing and cost recovery systems in place to enable PAYT implementation (Statement 4)*

Similarly, most respondents (65.4%) were confident that CCT has the correct billing systems in place to enable PAYT implementation, with 44.1% agreeing and 21.3% strongly agreeing to the statement. Again, about a quarter of the respondents (26%) were uncertain or neutral, while a few respondents (8.6%) either disagreed or strongly disagreed. While the majority of respondents believed that CCT was ready and able to implement PAYT, many respondents from other research studies were not as confident. Kevrekidou (2016) and Emmanouil *et al.*, (2022), with both studies conducted in Greece, indicated that the majority of households in their studies were not confident about their municipalities being able to successfully implement PAYT.

4.2.2.3 Perceived important factors towards implementation of PAYT in the City of Cape Town

The successful implementation of PAYT systems relies on several key factors, including public consultation, education, transparency, and infrastructure support. Public consultation is essential to gauge community concerns and ensure that the proposed system aligns with local needs and values, fostering greater public acceptance (Rogers, 2010). Similarly, education and awareness campaigns are crucial for informing households about how PAYT works, the benefits of waste reduction, and how to effectively manage waste to minimise costs (Dijkgraaf & Gradus, 2004). Clear transparency regarding the pricing model also plays a vital role, as it helps residents understand the charges they will incur and builds trust in the system's fairness and effectiveness. Furthermore, access to recycling infrastructure is a significant consideration, as robust recycling programmes for materials such as paper, cardboard, and plastic can help households reduce their disposable waste, making the PAYT system more successful by reducing the volume or weight of waste collected (Diaz-Farina *et al.*, 2023). These factors collectively support the adoption and long-term success of PAYT as an effective waste management strategy. Figures 4-11 to 4-14 considers household respondents' perspectives of the importance of these factors towards PAYT implementation in CCT.

Figure 4-11 outlines household respondents' responses to the statement "*I believe that public consultation is important before considering policy mechanisms such as PAYT*".

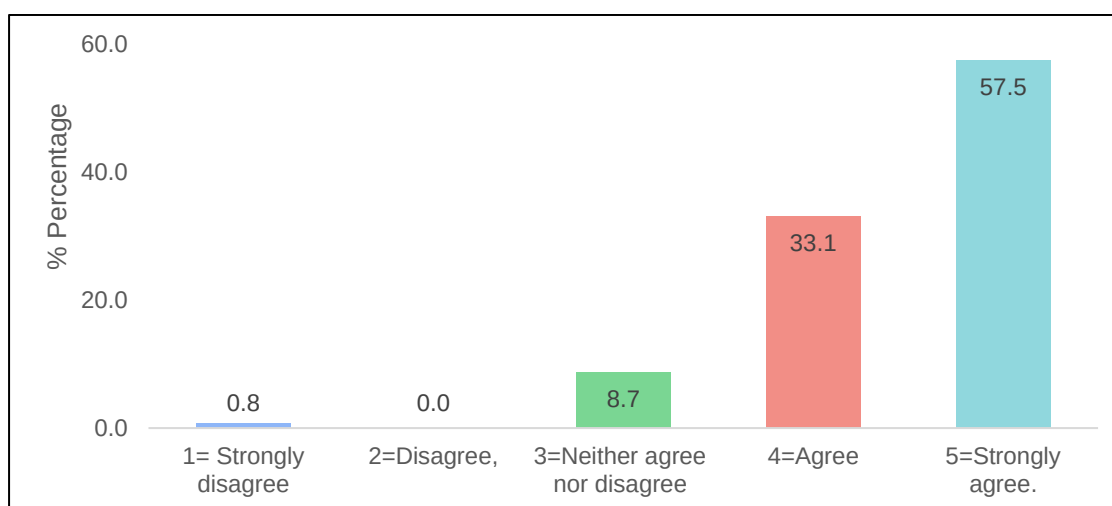


Figure 4-11: Responses towards *I believe that public consultation is important before considering policy mechanisms such as PAYT (Statement 5)*

Noticeably, most respondents (90.6%) saw the importance of public consultation before considering policy mechanisms such as PAYT, with 33.1% agreeing and 57.5 % strongly agreeing. Only 8.7% of respondents reacted neutrally. Only one respondent (0.8%) disagreed with the statement. This overwhelming consensus highlights the value placed on inclusivity in policy development, highlighting that for PAYT systems to succeed, public input is vital in shaping effective and acceptable waste management strategies.

The importance of public consultation and participation in designing and implementing PAYT has been also highlighted in Dunne *et al.* (2008), and by Brown and Johnstone (2014) in similar work. Dunne *et al.* (2008) found that public consultation and participation was a key factor in public acceptance of PAYT in Ireland. Brown and Johnstone (2014) drew similar findings in their study of PAYT as an environmental tax in four OECD countries (Canada, the Netherlands, Sweden, and Switzerland).

Figure 4-12 outlines responses to the statement “*I believe that education and awareness of households are important before considering policy mechanisms such as PAYT*”.

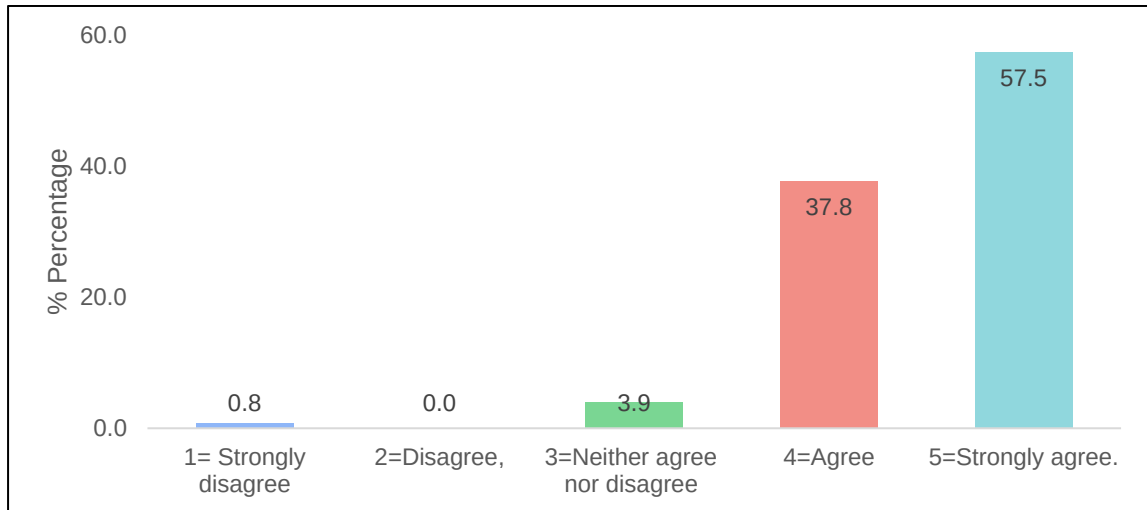


Figure 4-12: Responses towards *I believe that education and awareness of households are important before considering policy mechanisms such as PAYT (Statement 6)*

Similar trends were observed regarding the perceived importance of education and awareness before implementing PAYT systems. Over 95% of respondents either agreed (37.8%) or strongly agreed (57.5%) with the statement, highlighting the widespread belief that educating households is crucial for the successful implementation of PAYT. This strong support emphasises that public education can play a key role in informing citizens about how PAYT works, its benefits, and how to reduce waste in order to minimise costs. Only 3.9% of respondents reacted neutrally, suggesting little to no ambiguity in opinions on the matter. Notably, no respondents disagreed with the statement, reinforcing the consensus that a well-informed public is vital for the success of such policy mechanisms.

Figure 4-13 outlines responses to the statement “*I believe that transparency regarding the pricing model for PAYT is an important factor towards successful implementation*”.

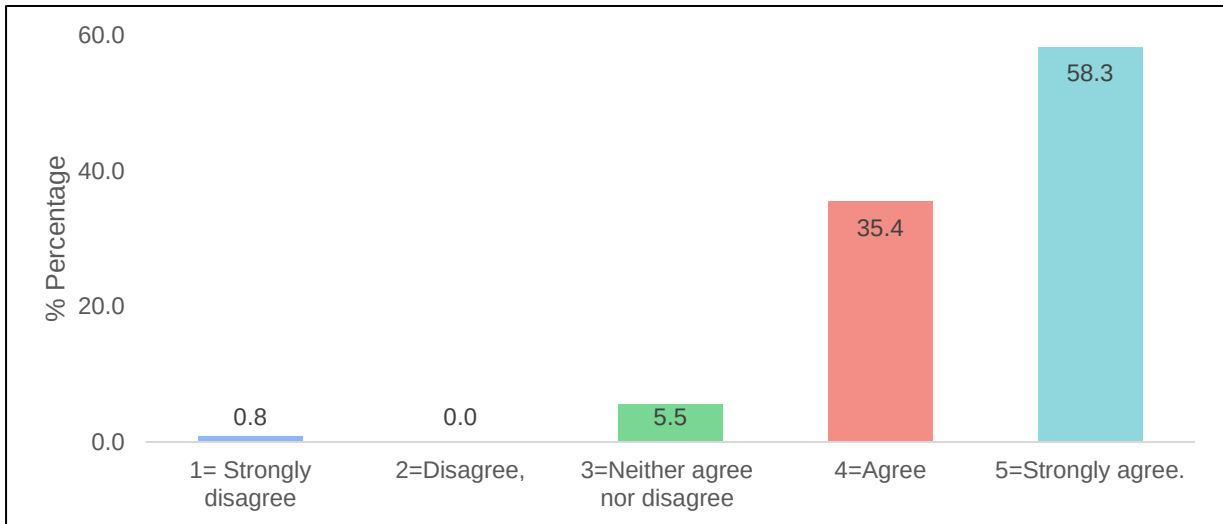


Figure 4-13: Responses towards *I believe that transparency regarding the pricing model for PAYT is an important factor towards successful implementation (Statement 7)*

As far as the perceived importance of transparency regarding the pricing model for PAYT is concerned, 93.7% of respondents agreed or strongly agreed with the statement. Only 5.5% of respondents neither agreed nor disagreed with the statement, and 0.8% strongly disagreed with the statement. These results suggest while the majority of respondents regard transparency as vital, a small segment of the respondents did not regard transparency as an important consideration for PAYT.

Figure 4-14 outlines the household respondents' responses to the statement "*I believe that access to recycling infrastructure is important to reduce volumes/weight of disposable waste in support of PAYT systems*".

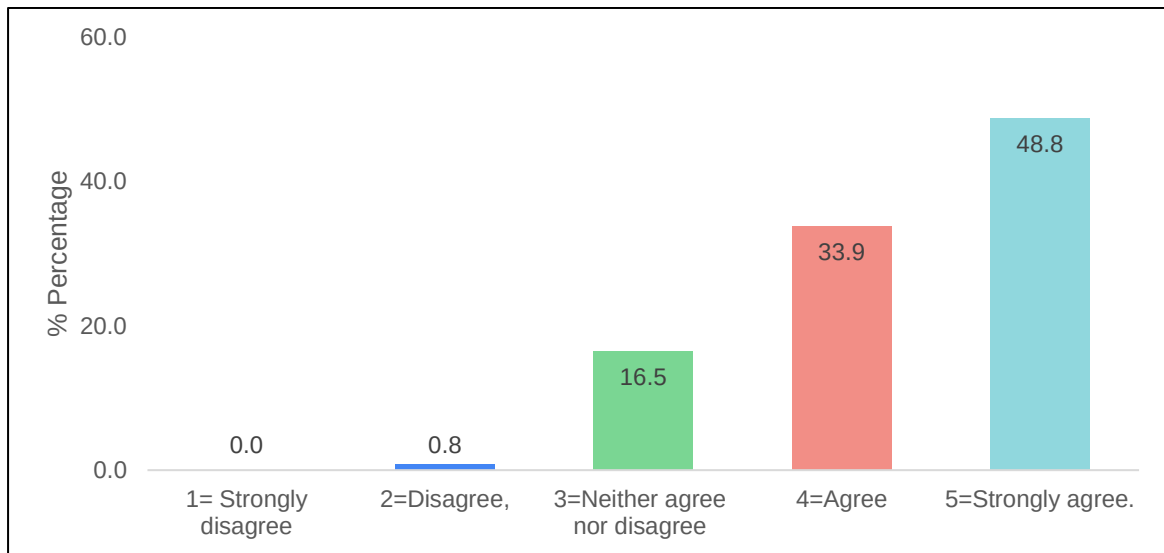


Figure 4-14: Responses towards *I believe that access to recycling infrastructure is important to reduce volumes/weight of disposable waste in support of PAYT systems (Statement 8)*

Approximately 83% of respondents agreed (33.9%) or strongly agreed (48.8%) regarding the importance of access to recycling infrastructure. About 16% of respondents were neutral, while only one respondent (0.8%) disagreed.

The importance of access to recycling infrastructure towards the success of PAYT systems cannot be overstated as households have the opportunity to divert more from disposal, which has billing implications (Beukering *et al.* 2009: 2900; Watkins *et al.*, 2012: 99). Dunne *et al.* (2008: 2831) also concur, as they point out that generally, literature supports the notion that the closer and easier it is to recycle, the higher the rates of recycling and the kerbside recycling collection being the most effective (Watkins *et al.*, 2012: 99).

4.2.2.4 Attitudes towards PAYT and waste management implications

PAYT systems heavily relies on households' attitudes towards waste management and the pricing model itself. Positive attitudes, such as a willingness to reduce waste generation and an understanding of the link between waste disposal and costs, are crucial for the system's effectiveness (Ghimire *et al.*, 2024). If households have positive attitudes and they perceive PAYT as fair, transparent, and beneficial for the environment, they are more likely to engage actively in waste reduction efforts and adopt more sustainable practices (Botetzagias *et al.*, 2020). Conversely, negative attitudes, driven by concerns about increased costs, complexity, or perceived unfairness, may result in resistance, under-participation, or non-compliance, ultimately

hindering the system's success (Zhang *et al.*, 2023). In the context of PAYT challenges, illegal waste dumping is a well-reported concern (Dijkgraaf & Gradus, 2024). Illegal dumping may extend to dumping of one's waste in an open area, or at someone else's premises, or intentionally mixing non-recyclable residual waste with recyclable waste in attempt to reduce PAYT. Furthermore, illegal dumping in the context of PAYT may include what Dijkgraaf and Gradus (2004: 365) calls “*waste tourism*” where household waste is taken to friends, relatives, neighbouring municipalities or even workplaces where there are no PAYT charges.

Figure 4-15 outlines responses towards the statement “*I would not consider illegal dumping of my household waste to reduce my PAYT charges*”.

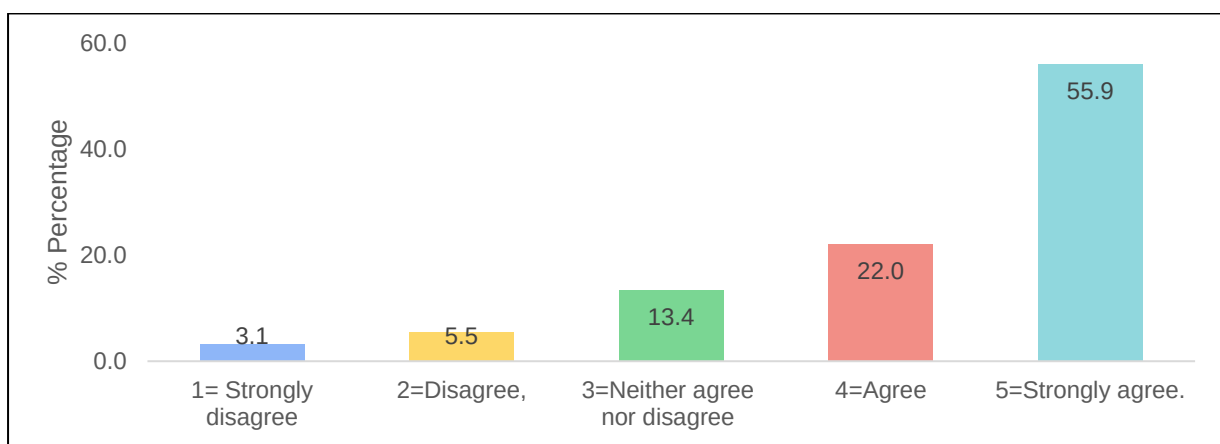


Figure 4-15: Responses towards *I would not consider illegal dumping of my household waste to reduce my PAYT charges* (Statement 9)

Most household respondents (77.9%) indicated that they would not consider the illegal dumping of their waste to reduce PAYT charges. Approximately 13% of respondents reacted neutral to this statement, while 8.6% of respondents disagreed or strongly disagreed. Overall, these responses highlight that a significant number of households would prioritise legal waste disposal over potentially engaging in illegal activities to reduce PAYT costs.

Figure 4-16 outlines responses towards the statement “*I would not consider mixing residual waste with recyclable waste to reduce my PAYT charges*”.

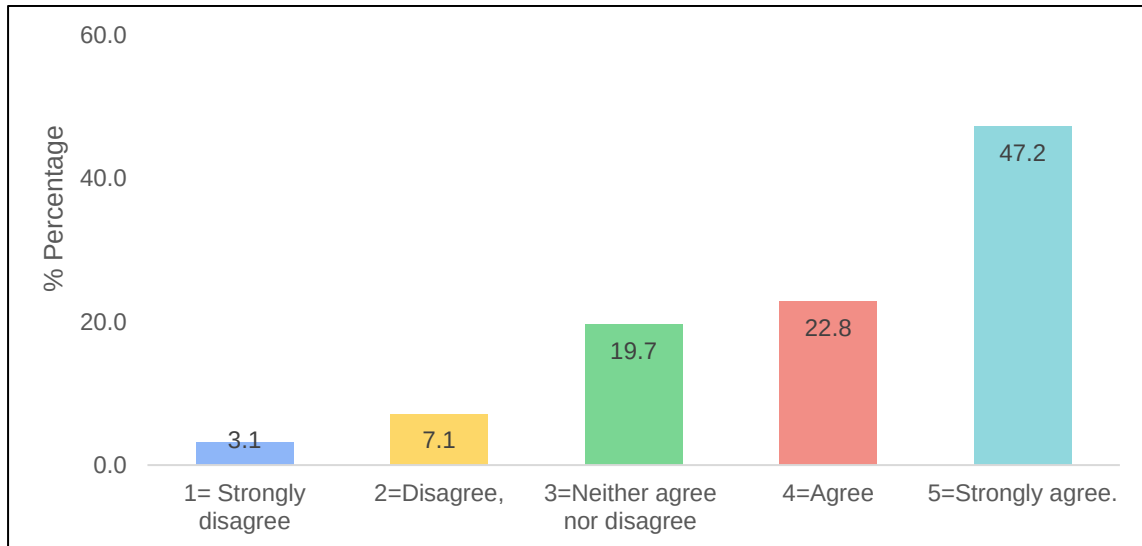


Figure 4-16: Responses towards *I would not consider mixing residual waste with recyclable waste to reduce my PAYT charges (Statement 10)*

Regarding the mixing of waste with recyclables to reduce PAYT charges, a significant portion of respondents (47.2%) strongly agreed, and 22.8% agreed that they would not consider mixing waste in order to lower their charges. This suggests a strong ethical stance against improper waste disposal practices, even when there is a financial incentive to do so. About 20% of respondents reacted neutrally, indicating some level of uncertainty or indifference on the matter. A smaller proportion, 7.1%, disagreed, and 3.1% strongly disagreed with the statement, possibly reflecting concerns about the PAYT system's fairness or a lack of understanding about the benefits of waste separation.

Studies have suggested that the effectiveness of PAYT in promoting recycling depends on the availability of convenient recycling infrastructure and clear communication about the system's rules (Sampson *et al.*, 2015). Overall, these results suggest that most households would prefer to follow proper waste segregation practices, despite the financial incentives to mix waste.

Figure 4-17 presents responses regarding using other households' bins to dispose of residual waste, which also constitutes to illegal waste dumping.

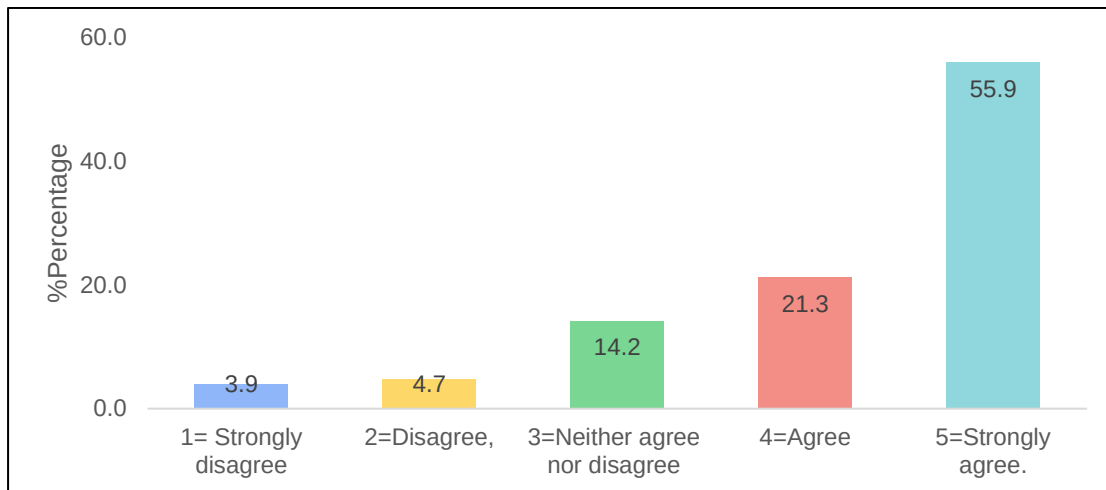


Figure 4-17: Responses towards *I would not consider disposing residual waste in another household's waste bin to reduce my PAYT charges (Statement 11)*

About 77% of respondents indicated that they would not resort to disposing residual waste in another household's waste bin to reduce their PAYT charges, with 14.2% reacting neutral and 8.6% of respondents disagreeing with the statement.

These findings (Figure 4-16 and 4-17) suggest that most households are unlikely to engage in dishonest behaviours to reduce their waste charges, prioritising proper disposal methods over financial incentives. This aligns with broader research indicating that while financial incentives can influence waste disposal practices, ethical considerations and a sense of community responsibility often play a critical role in ensuring compliance with waste management systems (Dijkgraaf & Gradus, 2004).

Figure 4-18 depicts responses to a statement towards “*I would reprimand a non-compliant citizen (i.e. those who illegally dispose of waste to reduce PAYT charges)*”.

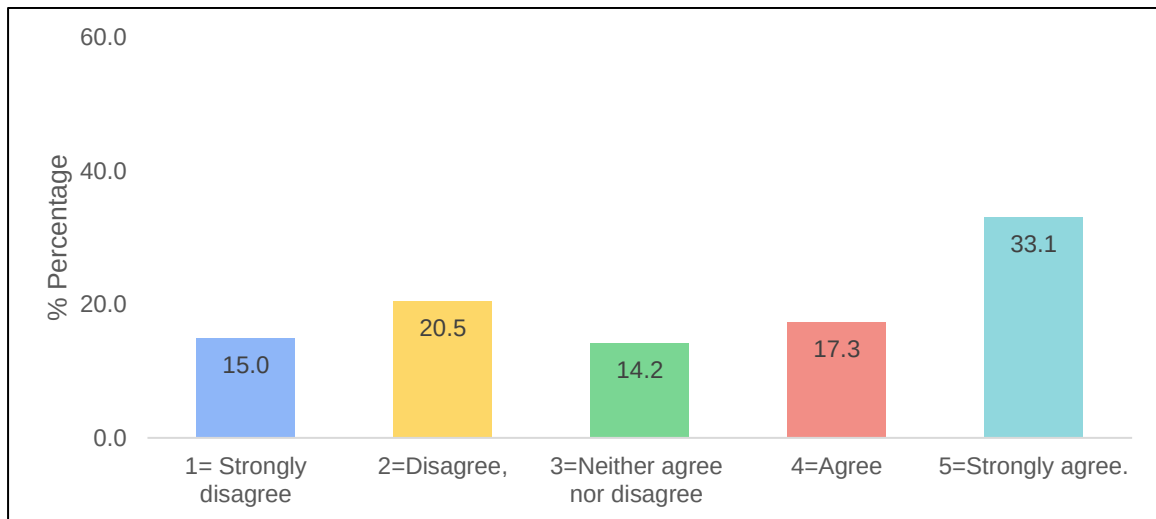


Figure 4-18: Responses towards *I would reprimand a non-compliant citizen (i.e. those who illegally dispose of waste to reduce PAYT charges) (Statement 12)*

Regarding the willingness to reprimand non-compliant citizens in relation to PAYT, the responses were mixed. While 50.4% of respondents agreed that they would reprimand non-compliant individuals (17.3% agreed and 33.1% strongly agreed), a significant proportion (35.5%) disagreed with the idea of confronting offenders (20.5% disagreed, and 15% strongly disagreed). About 14.2% of respondents remained neutral, suggesting some uncertainty or indecision about taking action against non-compliant behaviour.

In comparison, a similar study by Kevrekidou (2016) in Greece found that a vast majority (81.6%) of respondents were more willing to confront PAYT offenders on the spot. This contrast may suggest that while there is a general willingness to address non-compliance in some communities, cultural and contextual factors may influence individuals' readiness to confront those who fail to adhere to waste disposal rules. It also highlights potential variations in attitudes toward civic responsibility and the enforcement of waste management policies across different regions.

Figure 4-19 presents responses on effects of punitive measures for PAYT non-compliance – “*I believe that punitive measures such as fines for unlawful behaviour (i.e. for illegal dumping or disposal of non-recyclable waste in recycling bags/bins) would help with the successful implementation of a PAYT system*”.

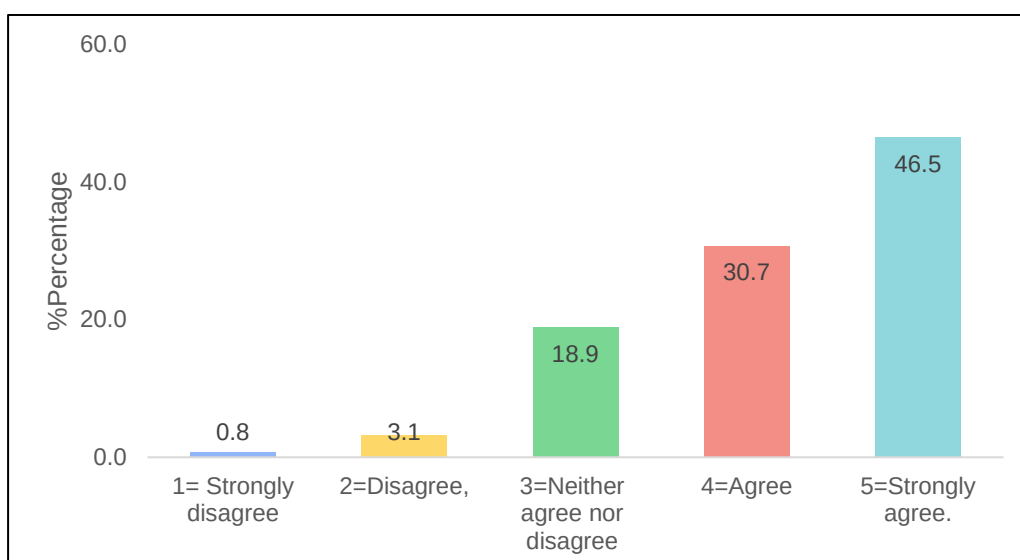


Figure 4-19: Responses towards *I believe that punitive measures such as fines for unlawful behaviour would help with the successful implementation of a PAYT system (Statement 13)*

More than 76% of respondents (46.5% strongly agreed and 30.7% agreed) believed that punitive measures for PAYT should be effective in addressing unlawful behaviour. This suggests broad support for enforcement mechanisms aimed at ensuring compliance with the waste disposal rules. However, a smaller proportion (18.9%) were neutral, and a minority (3.1%) disagreed with the need for punitive measures.

This aligns with findings from a similar study in Greece by Emmanouil *et al.* (2022), where around 85% of respondents unequivocally agreed that imposing fines for non-compliance would be effective in dealing with unlawful behaviour. However, earlier studies by Kevrekidou (2016) in Greece found mixed responses, where most respondents favoured information-based measures such as increased awareness campaigns as a first step, followed by warnings, with fines being viewed as a last resort.

4.2.2.5 Perceived efficiency of different PAYT schemes

As explained earlier in Section 4.2.2.1.1, volume-based schemes are based on the size or volume of the container, and the container may be a bag or a bin, and these vary in size (Agència de Residus de Catalunya, 2010). Weight-based schemes are like volume-based schemes regarding the choice of the container size, however, the container (usually a bin) is weighed upon collection and households billed according to the actual weight of the waste disposed of (Skumatz & Freeman, 2006; Agència de Residus de Catalunya, 2010). Hybrid schemes often use a

combination of volume-based schemes or weighed-based schemes with frequency of collection, and households can choose from various hybrid schemes available from the municipality and are billed accordingly (Skumatz and Freeman, 2006:3; Agència de Residus de Catalunya, 2010).

Figure 4-20 present responses to Statement 14 that required respondents to rank the three different schemes regarding their possible efficiency with 1 being the most efficient and 3 being the least efficient.

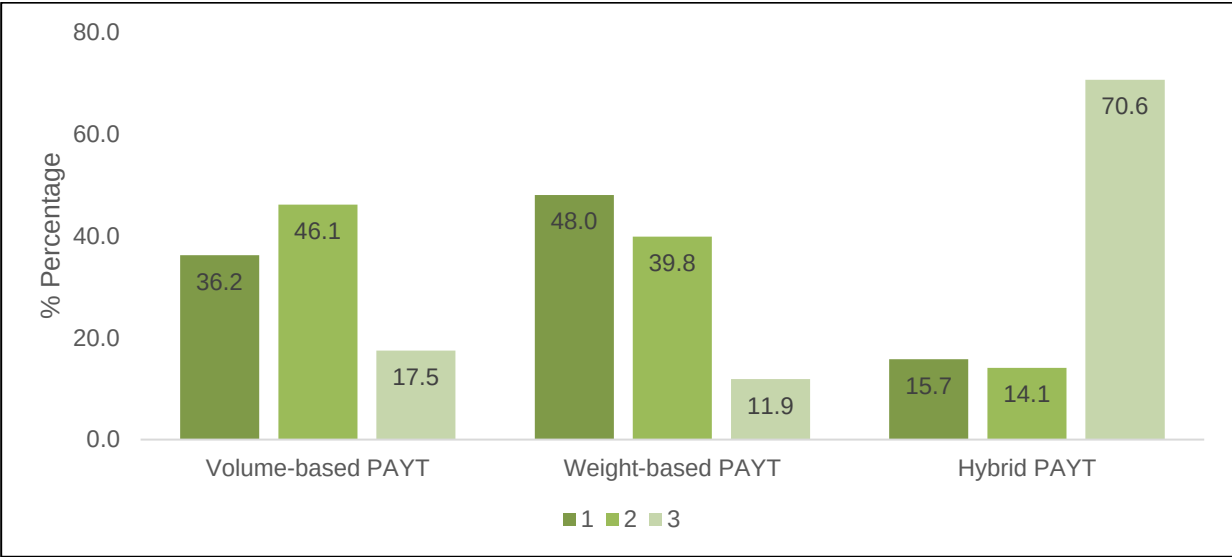


Figure 4-20: Household respondents’ ranking of the three different schemes regarding their possible efficiency with 1 being the most efficient and 3 being the least efficient (Statement 14)

Almost half of the respondents (48%) ranked weight-based PAYT schemes as the most efficient, while 46% considered volume-based PAYT schemes to be the second most efficient. Interestingly, the majority of respondents (70.6%) regarded hybrid PAYT schemes as the least efficient, ranking it third. This suggests a clear preference for more straightforward and direct systems, such as weight-based and volume-based PAYT, over complex hybrid models.

These findings are in line with those of Kevrekidou (2016), who found that most respondents in Greece ranked the weight-based PAYT ‘smart bin’ system as the most preferred waste disposal option. Similarly, Emmanouil *et al.* (2022) also found that a majority of Greek respondents considered the ‘smart bin’ system to be the most efficient. In this system, the user is identified via a prepaid magnetic card, and the bin only opens with the card. A weighing mechanism attached to the bin records the weight of the waste every time it is disposed of. This type of system provides

a highly automated and transparent method of waste tracking, likely appealing to respondents who prioritise efficiency and fairness in the PAYT system.

4.2.3 Opportunities and challenges for PAYT identified by households

The household respondents were also asked the following open-ended questions in the last part of the survey:

- *In your opinion, what are the opportunities for Pay-As-You-Throw (PAYT) for household solid waste management in the City of Cape Town?*
- *In your opinion, what are the challenges for Pay-As-You-Throw (PAYT) for household solid waste management in the City of Cape Town?*

The responses to these questions were thematically analysed as explained in Section 3.7. The perceived opportunities are outlined in Table 4-2 and discussed in the sub-sections to Section 4.2.3.1, while perceived challenges are outlined in Table 4-3 and discussed in the sub-sections to Section 4.2.3.2.

4.2.3.1 Perceived opportunities of PAYT identified by households

Respondents saw several opportunities for PAYT implementation in the CCT. Table 4-2 provides a summary of the perceived opportunities for PAYT implementation in the City of Cape Town, that respondents mentioned.

Table 4-3: Opportunities mentioned by households with regards to PAYT (n = 127)

Theme	Examples of phrases mentioned	Frequency	
		n	%
Increased recycling and reduce waste to landfill	<i>“Better waste management per household”, “this will encourage recycling as well”, “Residents can start composting food waste and yard trimmings to reduce landfill waste”, “Increased Recycling”, “Reduced Landfill Burden” , “less waste to landfill”, “insufficient landfill space”, “ opportunity to reduce waste to landfill”</i>	13	10.2%
Reduce waste generation	<i>“Better waste management and less waste generated per household”, optimise waste reduction”, “Waste avoidance and reduction”, “PAYT incentivises residents to reduce their waste output”, “increased waste generation becoming a problem”</i>	9	7.1%

Theme	Examples of phrases mentioned	Frequency	
		n	%
Cost savings for households	<i>"To be liable for the correct cost", "Better billing per household", "PAYT incentivises residents to reduce their waste output," making it more cost-effective to recycle materials rather than dispose of them", "Promising as people would be eager especially since there will be a benefit attached", "allowing for cost savings rather than being subject to paying a fixed amount even if you had (Null) waste"</i>	6	4.7%
Increased waste awareness	<i>"households will be more aware of waste control", "households will think before they throw", "PAYT will raise awareness and it will keep the area clean"</i>	4	3.1%
Job opportunities	<i>"very good initiative, it would create more job opportunities", "job creation"</i>	2	1.6%

4.2.3.1.1 Increased recycling and reduced waste to landfill

The most frequently mentioned opportunity, identified by thirteen (10.2%) of the household respondents, was the potential of PAYT to increase recycling and divert waste from landfills. Respondents highlighted phrases such as *"opportunity to reduce waste to landfill" and "opportunities for waste reduction and reducing waste to landfill,"* emphasising that *"increased recycling and increased waste diversion from landfills are intertwined; as more waste is source-separated and recycled, less waste is sent to landfills."*

In the United States, Skumatz and Freeman (2006) report that PAYT was responsible for diverting between 4.6 and 8.3 million tonnes of waste from landfills annually. Several studies comparing European municipalities before and after PAYT implementation found that household waste source separation and recycling rates rose to 70% or higher (Reichenbach, 2008), with weight-based PAYT schemes achieving rates as high as 86% (Zeschmar-Lahl et al., 2016). Therefore, the potential for landfill diversion is a realistic benefit of PAYT schemes.

4.2.3.1.2 Reduced waste generation

The second most frequently mentioned theme by respondents was reduced waste generation, with 7.1% (nine respondents) identifying it as a key opportunity. Respondents noted that PAYT incentivises residents to reduce their waste output, using phrases such as *"less waste generated" and "PAYT incentivises residents to reduce their waste output."* One respondent specifically remarked, *"I would reduce the amount of waste generated by my household if PAYT is ever*

implemented in the municipality – otherwise, it will just cost me too much!" This suggests that the financial implications of PAYT may encourage households to reduce their overall waste generation.

Interestingly, waste reduction is sometimes misunderstood as solely increased recycling. However, as Miranda and Aldy (1998) pointed out, following the implementation of PAYT, households undergo a two-stage process in changing their waste behaviours. In Stage 1, households initially increase recycling efforts. Once recycling reaches a saturation point, Stage 2 emerges, where actual source reduction occurs. This stage involves changes in consumption and purchasing habits, such as opting for products with less packaging. The DEA (2016) also highlighted that this shift toward source reduction is critical for the long-term sustainability of waste management systems. However, much of the literature on PAYT systems primarily focuses on increased recycling rates and waste diversion from landfills, with fewer studies addressing the impact of PAYT on actual reductions in waste generation through changes in consumption.

4.2.3.1.3 Cost savings for households

The third most frequently mentioned opportunity (4.7%), identified by six respondents, was cost savings for households. Respondents noted that PAYT could lead to more accurate billing, with phrases such as *"liable for the correct cost"* and *"better billing per household"*. The core principle of PAYT is to provide financial incentives for waste reduction by directly linking the amount of waste generated to the cost of waste collection, encouraging households to dispose of less waste.

In South Africa, much of the source separation of recyclables is currently carried out informally by waste pickers, who benefit directly from selling the recyclable materials they collect (Nahman, 2021). With the implementation of PAYT, both households and waste pickers could benefit - households could save on waste disposal costs by generating less waste, while waste pickers may find more recyclable materials available for collection.

However, as discussed in Section 2.8.1.2, the effect of PAYT on waste costs for households is mixed in the literature. Some studies suggest that PAYT systems lead to cost reductions (MDEP, 2004; Karagiannidis *et al.*, 2008; Morlok *et al.*, 2017), while others report that costs remain unchanged (Frable and Berkshire, 1995, cited in Skumatz, 2008: 2782; Slavik & Pavel, 2013). In contrast, some studies argue that PAYT may actually lead to increased costs for households (Lakhan, 2015). These conflicting findings suggest that the financial outcomes of PAYT may vary depending on local context, waste generation patterns, and how effectively PAYT schemes are implemented.

4.2.3.1.4 Increased waste awareness

Four respondents (3.1%) mentioned that increased waste awareness could be an opportunity arising from the implementation of PAYT, with phrases such as *“households will think before they throw”* and *“PAYT will make people more aware, and keep the area clean.”*

Waste management awareness and education are crucial components for the successful implementation of PAYT, especially during the early stages of the programme (Dunne *et al.*, 2008; Agència de Residus de Catalunya, 2010; Brown & Johnstone, 2014; Zeschmar-Lahl *et al.*, 2016; Emmanouil *et al.*, 2022). Awareness, however, is not an end in itself but rather a means towards achieving successful PAYT implementation. At the same time, it inherently raises societal awareness of waste management and environmental issues.

Sakai *et al.* (2008: 2824) observed that there was an increased waste and environmental awareness in most Japanese municipalities following the implementation of PAYT, which suggests that such systems can have a positive spillover effect in fostering a broader understanding of environmental impacts. Moreover, high environmental awareness is not only important as a tool for PAYT implementation but is also a precondition for the system's success (Zeschmar-Lahl *et al.*, 2016).

In South Africa, littering and illegal dumping are common problems, which are often symptomatic of insufficient public awareness or education, alongside inadequate waste management services (DEA, 2018). In this context, PAYT can serve not only as an efficient waste management tool but also as a general waste and environmental awareness-raising mechanism in urban areas. This increased awareness could contribute to reducing illegal dumping and littering, helping to address two significant challenges facing South Africa's urban waste management systems.

4.2.3.1.5 Create more job opportunities

Two of the respondents (1.6%) regarded job creation as an opportunity related to PAYT. Phrases mentioned were *“job creation”* or *“PAYT is a very good initiative, it would create more job opportunities”*. Regrettably, respondents did not elaborate on the type of job opportunities that could be created and how.

There is not much literature on the impact of PAYT on actual job creation, however, one must look closer into the opportunities created by the waste diverted from landfill. South Africa's 2020 NWMS clearly aims on building a secondary resources economy around the beneficiation of waste as part of the circular economy. Therefore, notwithstanding the informal job sector of waste

pickers, more formal job opportunities can be created especially in beneficiation of household organic waste and WEEE.

4.2.3.2 Perceived challenges of PAYT identified by households

The perceived challenges related to PAYT identified by household respondents are outlined in Table 4-3. Compared to opportunities mentioned (Table 4-2), it seems that household respondents anticipated much more challenges than opportunities for PAYT in the City of Cape Town.

Table 4-4: Challenges mentioned by households with regards to PAYT (n=127)

Theme	Phrases mentioned	Frequency	
		n	%
Illegal waste dumping	<i>“Illegal dumping”, “Illegal dumping of waste”, “people dumping waste illegally and to other people’s bins”, “households might use a different method of disposing of their waste to reduce cost for themselves”, “Disposal of waste in incorrect categories”, “potentially leading to illegal dumping or other negative behaviours”, “Some people may not abide by the rules and it may not take off as planned”</i>	26	20.5%
Increased costs of waste management	<i>“Affordability, for households struggling financially, increased waste costs could be a significant burden”, “Administrative Costs”, “Costs”, “Additional costs”, “the general public would find it difficult to adjust or to plan financially”, “the fees payable, if not done correctly”, “increased costs due the additional equipment”, “increased costs”, “additional costs of equipment needed to implement PAYT”, “it may increase rates”</i>	24	18.9%
Behaviour changes	<i>“The challenge is I have not had an issue, this looks like someone is trying to make some extra cash, I am happy the way things are”, “South Africans are complacent and will try and make this look like a scam”, “Lack of</i>	8	6.3%

Theme	Phrases mentioned	Frequency	
		n	%
	<i>knowledge, people do not fully comprehend the damage waste has on our livelihoods”, “Change of process, the general public would find it difficult to adjust”, People not understanding the PAYT”</i>		
Poverty and inequality and impact on poorer households	<i>“Poverty”, “Costly for poorer households”, “Lower classes don’t have the funds available”, and “ a flat fee for waste collection can be regressive, disproportionately affecting low-income households”; a well-structured PAYT system requires careful consideration to prevent exacerbating existing inequalities”; “if PAYT should be implemented, tenants must each receive a wheelie bin that will have to be locked, then there are the vagrants on Bin Collection Days”,</i>	6	4.7%
Compliance & Enforcement	<i>“People not agreeing to comply to the strategy”, “enforcement”, Enforcement, ensuring compliance with PAYT regulations can be challenging, requiring effective enforcement mechanisms.</i>	3	2.4%
Corruption	<i>“Corruption, there is a risk of corruption in the system, especially if there are opportunities for manipulation of waste weights or billing”,</i>	1	0.8%
Dealing with multi-family buildings	<i>“complexes could be challenging as not all tenants have a wheelie bin allocated to them” if PAYT should be implemented, tenants must each receive a wheelie bin that will have to be locked...”</i>	1	0.8%
Fairness	<i>“this will only be charged on people with subsidy houses it will not be fair like water bills now”</i>	1	0.8%

4.2.3.2.1 Illegal waste dumping

The most frequently mentioned PAYT challenge raised by 26 respondents (20.5%) related to illegal dumping of waste. Respondents mentioned phrases such as *“people dumping waste illegally and to other people’s bins”*, and *“potentially leading to illegal dumping or other negative behaviours”*. One respondent interestingly (and subtly) put it as *“households might use a different method of disposing of their waste to reduce cost for themselves”*.

Literature suggests that illegal dumping and the illegal disposal of waste are significant concerns for households in relation to PAYT systems. Some studies found no evidence of increased illegal waste dumping due to PAYT (Dijkgraaf & Gradus, 2004; Allers & Hoeben, 2010). However, the majority of literature indicates that PAYT carries the risk of increasing illegal waste dumping (Fullerton & Kinnaman, 1996; Miranda & Aldy, 1998; Linderhof *et al.*, 2001; OECD, 2006; Puig-Ventosa, 2008; Dahlén & Lagerkvist, 2010; Bel & Gradus, 2016) (Also refer to Section 2.8.2.1 in Chapter 2).

Given these concerns, it is crucial to be cautious when implementing PAYT systems, particularly in contexts where illegal dumping is already a pressing issue. In South Africa, where illegal dumping remains a significant problem, the potential for PAYT to exacerbate this issue should not be overlooked. Effective monitoring, enforcement, and public awareness campaigns will be essential to mitigate this risk and ensure that PAYT leads to responsible waste management outcomes without contributing to illegal disposal practices.

4.2.3.2.2 Increased costs of waste management

Increased cost of waste management was the second most frequently challenge mentioned, with 24 respondents (18.9%) stating concerns related to *“affordability”*, *“financial burdens”*, *“administrative costs”*, *“fees payable”*, *“increased costs due the additional equipment”*, and *“increased rates”*.

The concerns align with the findings of studies such as those by Zeschmar-Lahl *et al.* (2016), which demonstrated that while PAYT may result in lower overall waste management fees in the long term, the upfront investment required for equipment and system setup cannot be ignored. Research findings by Skumatz, (2008), Dahlén and Lagerkvist, (2010), Lakhan, (2015), as well as Ukkonen and Sahimaa, (2015) consistently point out that the initial investment costs and the increased administrative burden are significant challenges associated with PAYT. These costs often include the installation of weighing devices, the implementation of billing systems, and the ongoing maintenance of these technologies. Despite these challenges, the long-term

sustainability and cost-effectiveness of PAYT schemes are often cited as benefits, particularly in systems where waste reduction is prioritised.

It is important to note that these initial costs can sometimes be offset by the behavioural changes that PAYT encourages, such as reducing waste generation through incentives for waste minimisation. However, these changes may take time to materialise, and during the transition period, households may face higher upfront expenses (Lakhan, 2015).

4.2.3.2.3 Behaviour changes

Eight (6.3%) of the household respondents mentioned phrases related to challenges with behavioural changes. Challenges mentioned included phrases such as *“the general public would find it difficult to adjust”*, *“people might not understand PAYT”*, *“households may not buy-into PAYT and may be reluctant to change”* and *“the public may think it is just a money-making scheme”*.

Ironically, one of the respondents noted: *“The challenge is I have not had an issue with waste, this looks like someone is trying to make some extra cash? I am happy the way things are”*. This statement summarises the concerns, which respondents raised about mistrust, reluctance to change and suspicion that PAYT is a process to make extra money. Waste-related behavioural research indicates that changing behaviour does take time and effort (Udawatta *et al.*, 2015). Some research confirms that while residents may initially resist PAYT implementation, acceptance often increases once the system is in place (Sakai *et al.*, 2008), with positive behavioural changes. However, Lakhan (2015) found that most household respondents surveyed did not change their waste-related behaviour and was unsupportive towards PAYT, even after implementation.

4.2.3.2.4 Poverty and inequality and impact on poorer households

Six (4.7%) of the respondents expressed concerns about poverty, inequality, and the adverse impact of PAYT on poor households. A respondent mentioned that *“a well-structured PAYT system requires careful consideration of poverty and poorer households to prevent exacerbating existing inequalities”*. One respondent questioned *“..there are the vagrants on bin collection days. How will PAYT affect their livelihoods?”*. The concern here is that the informal waste recyclers, i.e., “waste pickers” might not be able to access the bins to collect recyclable materials, and hence their livelihoods might be adversely impacted. The challenge of the poorer households and PAYT is discussed in detail in Section 2.8.2.3. Literature suggests that, just as we do with water and electricity, and even with waste-related rates, indigent households should be supported through discounted rates and/or subsidies.

4.2.3.2.5 Compliance and enforcement

Compliance and enforcement of the PAYT system were mentioned as a challenge by three (2.4%) of the respondents, who raised issues such as *“ensuring compliance with PAYT regulations can be challenging”*, *“PAYT requires effective enforcement mechanisms”*, and *“do we have capacity for enforcement?”*.

Generally, as Nwufo (2010) cited in Oelofse (2018) states - any waste legislation or policy is at best an exercise in futility if they are not effectively enforced. Literature suggests strict enforcement of illegal dumping, littering, and anti-burning rules are factors influencing the success of PAYT (Miranda & Aldy, 1998). Oelofse (2018) points out that poor management of waste across many African countries can be ascribed to poor or no enforcement of environmental and waste legislation. In South Africa, too, littering and illegal waste dumping remains a big challenge (DEFF, 2021a) which indicates poor or no enforcement of environmental and waste legislation enforcement. In such a context, it is not surprising that compliance and enforcement were raised as challenges related to PAYT.

4.2.3.2.6 Dealing with multi-family buildings

Dealing with multi-family housing such as apartment blocks was mentioned by one respondent (0.8%). The respondent stated that *“ complexes could be challenging as not all tenants have a wheelie bin allocated to them. I stay in a complex that consists of 32 units, where about fifteen to sixteen bins are used for all these units, if PAYT should be implemented, tenants must each receive a wheelie bin that will have to be locked to prevent cross-disposal...”*.

Issues of accountability for PAYT charges in multi-family areas are raised in literature (Skumatz & Freeman, 2006; Reichenbach, 2008). The locking of bins (as suggested by this respondent) has been put forward as a possible solution by Reichenbach (2008). However, there are currently various technological solutions such as the chamber system, where the waste container requires the user to be first identified before depositing their waste (Reichenbach, 2008; Elia *et al.* 2015) (also see Section 2.7.2 for more detailed discussion on technical and logistical aspects).

4.2.3.2.7 Fairness and corruption

Lastly, fairness and corruption were each mentioned by one respondent (0.8%). A respondent stated that *“...there is a risk of corruption in the system, especially if there are opportunities for manipulation of waste weights or billing”*, while another participant was more concerned about the fairness of PAYT billing. The participant raised a concern about PAYT charging - *“PAYT will be*

charged for all houses? This [PAYT] will only be charged on people with subsidy houses it will not be fair like water bills now”.

Regarding the latter challenge, government policy (DEA, 2012b) regards refuse removal as a basic service that should be provided to every household regardless of income level, and thus municipalities must provide it free to indigent households, and the costs for that is covered by national government grants. The concern about people corrupting the system is more of issue of trust in government.

4.3 Results of surveys and interviews with municipal waste officials

Section 4.3 provides the results of the municipal waste officials survey and interviews. The section is divided into three sub-sections, where Section 4.3.1 provides the basic socio-demographic profile of the municipal respondents, Section 4.3.2 outlines the results to the structured part of the survey questionnaire, and Section 4.3.3 discusses the opportunities and challenges related to the implementation of PAYT systems, which were identified as part of the open-ended section of the questionnaire, and also integrates results of the municipal officials interviews.

A total of twenty (20) municipal waste officials were targeted, as this was the maximum number of officials approved by CCT to participate in the survey and interviews. The actual number of officials who participated in the survey was ten (10), representing a 50% response rate. Only four officials were willing to participate in follow-up interviews.

4.3.1 Socio-demographic characteristics of the municipal respondents

The municipal officials who participated in the survey were all key personnel within the Urban Waste Management Department at the City of Cape Town. All of the respondents were from the Waste Services Department representing various branches including Waste Services, Integrated Planning and Waste Strategy, Finance and Capital Implementation (CCT 2023). Table 4-5 summarises the basic background information of the ten municipal waste management officials who participated in the research. This information is only provided to give an indication of the representation of respondents. No further associations or correlations are attempted.

Table 4-5: Background information of the municipal respondents (n = 10)

Socio-demographic variable	Frequency	Percentage
Gender		
Female	3	30%

Socio-demographic variable	Frequency	Percentage
Male	6	60%
Prefer not to say	1	10%
Age		
18-39	5	50%
40-49	4	40%
50-59	1	10%
Older than 60	0	0%
Highest level of education		
Grade 12/Matric	1	10%
Tertiary education (undergraduate)	3	30%
Tertiary education (post-graduate)	6	60%
Years of experience in the City of Cape Town		
0-2 years	1	10%
3 -5 years	2	20%
6 -10 years	3	30%
More than 10 years	4	40%

4.3.1.1 Gender

In terms of gender, 60% of respondents were male, 30% were female, while 10% preferred not to disclose their gender.

4.3.1.2 Age

Persons younger than 18 years were purposefully excluded from the survey. The predominant age group of the respondents was between age 18 and 39 years (50%), followed by age group between 40 and 49 years (40%), and then between 50 and 59 years (10%). There was no one older than 60 years participating in the research.

4.3.1.3 Highest level of education

Given the fact that the research focused on persons employed at a high level within the municipality, it was not surprising that 90% of the respondents had a tertiary education, with 60% having post-graduate education, and 30% having an undergraduate education. Only one of the respondents (10%) had only completed matric.

4.3.1.4 Years of experience in the City of Cape Town

Four of the respondents (40%) had more than 10 years of experience in the waste sector working in the CCT, while three (30%) had between 6 to 10 years' experience, two (20%) had between 3 to 5 years' experience, and one (10%) had between 0 to 2 years' experience.

4.3.2 Results of surveys with municipal officials

The results of the survey are presented below in Table 4-6. As explained earlier, a five-point Likert scale was used to rate the respondent's perceptions about PAYT. The questions posed to municipal officials were similar to the questions posed to households, however, there were minor adaptations to few questions to indicate the unique context of municipal official as internal role-players to the CCT (these are indicated with ** in Table 4-6). These officials have first-hand experience of existing waste management systems, as well as potential financial and logistical challenges, and how PAYT would impact on these.

Since much of the background literature has already been dealt with in Section 4.2 where household survey responses were discussed, it will not be repeated here to avoid repetition. Furthermore, Section 4.4 provides an integrated discussion of both households' and municipal officials' survey responses.

Table 4-6: Level of agreement of municipal official respondents (n = 10) to statements posed regarding PAYT in the CCT.

Statement	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Mean
1. I would support the implementation of PAYT as a waste collection system in the City of Cape Town (CCT).	2	0	2	1	5	3.73
2. I believe that the majority of households in the City of Cape Town (CCT) would support the implementation of PAYT as a waste collection system.	1	2	5	1	1	3.13
3. I believe that the City Council of CCT would support the implementation of PAYT as a waste collection system.**	1	1	4	2	2	3.47
4. I do not believe that reliance on landfill revenue by the CCT would be a barrier towards PAYT implementation in the municipality.**	0	3	3	3	1	3.07
5. I believe that the City of Cape Town Metropolitan Municipality would be able to successfully apply a PAYT system for waste.	1	2	2	4	1	3.60
6. I believe that the City of Cape Town has the correct waste billing and cost recovery systems in place to enable PAYT implementation.	0	3	5	2	0	3.00
7. I believe that public consultation is important before considering policy mechanisms such as PAYT.	0	1	0	1	8	4.73
8. I believe that education and awareness of households are important before considering policy mechanisms such as PAYT.	0	1	0	1	8	4.47
9. I believe that transparency regarding the pricing model for PAYT is an important factor towards successful implementation.	0	1	0	1	8	4.53

Statement	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Mean
10. I believe that access to recycling infrastructure (for paper, cardboard, plastic, etc.) is important to reduce volumes/weight of disposable waste (collected by the municipality) in support of PAYT systems.	0	1	0	1	8	4.13
11. I <i>do not believe</i> that CCT households would consider illegal dumping of their waste to reduce PAYT charges	0	4	5	1	0	2.87
12. I <i>do not believe</i> that illegal dumping in the CCT would increase due to PAYT.**	1	3	5	1	0	2.87
13. I <i>do not believe</i> that CCT households would consider mixing residual waste with recyclable waste to reduce PAYT charges.	0	4	2	3	1	3.47
14. I <i>do not believe</i> that CCT households would consider disposing residual waste in another household's waste bin to reduce PAYT charges.	2	4	1	2	1	2.80
15. I believe that citizens would reprimand one another for non-compliant behaviour (i.e. those who illegally dispose of waste to reduce PAYT charges).	2	3	2	2	1	2.60
16. I believe that the municipality has the capacity to enforce punitive measures such as fines for unlawful behaviour (i.e. for illegal dumping or disposal of non-recyclable waste in recycling bags/bins) would help with the successful implementation of a PAYT system.	0	3	2	5	0	3.53
17. Ranking of PAYT schemes (see Section 4.3.2.5)						

Statement	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Mean
18. I would support the implementation of a volume-based PAYT system where charges are based on the volume of waste bins.	2	2	2	3	1	2.87
19. I would support the implementation of a weight-based PAYT system, where waste bins are equipped with identification codes (e.g., barcodes, QR codes) for tracking purposes and are weighed during collection (e.g. vehicles retrofitted with weighing systems).	1	2	3	2	2	3.40
20. I would support the implementation of a weight-based PAYT system, where wheelie bins are replaced by a bag-system.	2	5	2	1	0	2.07
21. I would support the implementation of a hybrid PAYT system where a combination of weight or volume, and frequency is used to bill households for waste collection and disposal.	3	2	1	4	0	2.73
22. PAYT charges can be either one-component or multi-component. One-component charges are fully variable, based solely on bin or container volume/weight, with no fixed charge. That means that if households do not dispose of any waste, there is no charge. I would support one-component charges for PAYT for waste.	1	3	2	3	1	3.00
23. PAYT charges can be either one-component or multi-component. Multi-component charges include fixed costs (e.g., administration, bin rental) and variable costs (e.g., weight-based, volume-based). I would support multi-component charges for PAYT for waste.	2	2	2	3	1	3.07

**Unique questions posed to municipal official respondents.

4.3.2.1 Support towards the implementation of a PAYT system in the City of Cape Town

Figure 4-21 outlines the level of agreement of municipal officials to the statement “*I would support the implementation of PAYT as a waste collection system in the City of Cape Town*”.

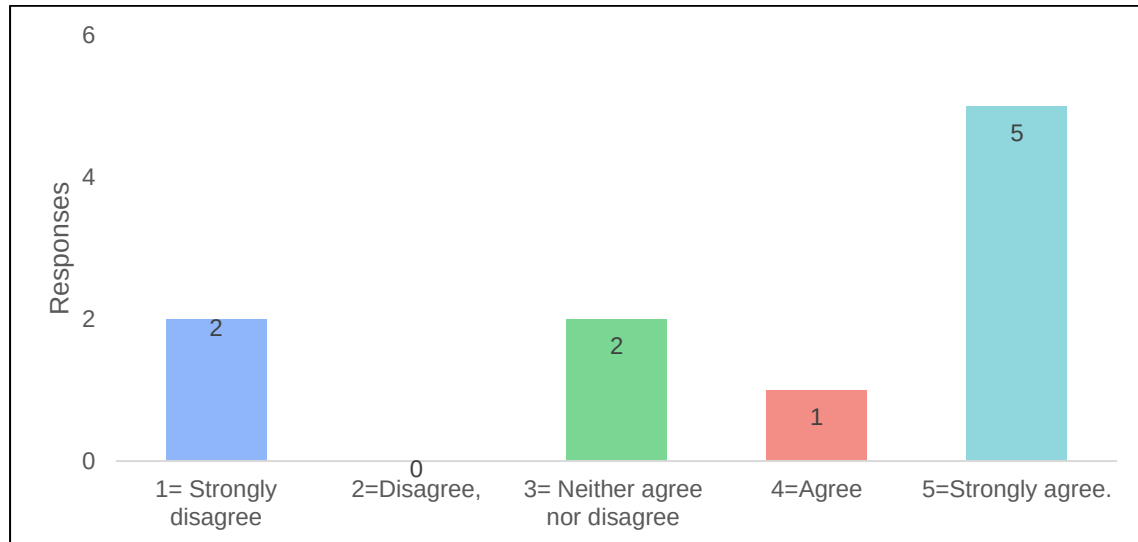


Figure 4-21: Municipal officials’ responses to *I would support the implementation of PAYT as a waste collection system in the City of Cape Town (Statement 1)*

The majority of the municipal respondents (6) supported the implementation of PAYT in the municipality. Two of the respondents were neutral, while the other two did not support PAYT implementation in the CCT (strong disagreement). The general support for PAYT implementation suggests that the waste officials, with the intricate knowledge of CCT waste challenges, might have an appetite to test new waste strategies. In 2022, CCT diverted approximately 20% of waste away from landfill and has landfill capacity constraints with both CCT operational landfills, Coastal Park and Vissershok expected to reach capacity in 2027, and 2036, respectively (CCT, 2023). The implementation of PAYT may offer some relief for these challenges.

Figure 4-22 presents municipal officials’ responses to the statement “*I believe that the majority of households in the City of Cape Town would support the implementation of PAYT as a waste collection system*”.

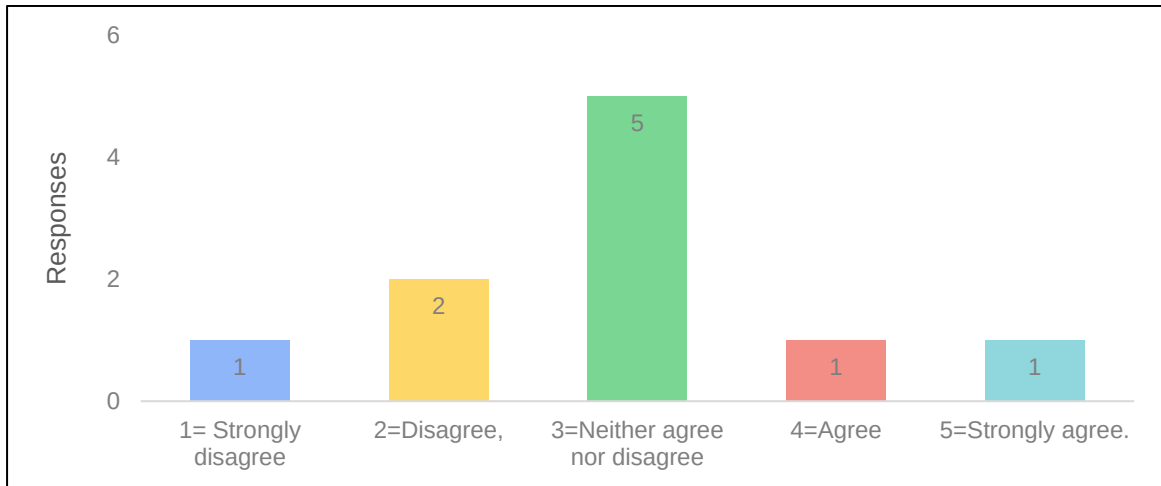


Figure 4-22: Municipal officials' responses to *I believe that the majority of households in the City of Cape Town would support the implementation of PAYT as a waste collection system (Statement 2)*

Interestingly, half of the municipal respondents (5) were neutral regarding this statement, while three disagreed, and only two agreed that they believed the majority of CCT households would support PAYT implementation. When compared to the household survey responses (Figure 4-2), about 51.2% of household respondents were positive that other households would support PAYT implementation. However, it is noteworthy that approximately a third (33.1%) of household respondents were neutral about the statement, similar to the majority of municipal officials.

The support of the City Council is crucial for the successful implementation of PAYT as a waste collection system. As the governing body responsible for municipal waste management, the City Council must ensure that the infrastructure, regulations, and resources needed to implement PAYT are in place. Their backing would also be essential for gaining public acceptance, as they can help educate residents on the benefits of PAYT, address concerns, and ensure that the system operates fairly and effectively. Without their support, the implementation of PAYT could face significant challenges, including resistance from residents and difficulty in achieving widespread compliance. Figure 4-23 presents responses to the statement "*I believe that the City Council would support the implementation of PAYT as a waste collection system*".

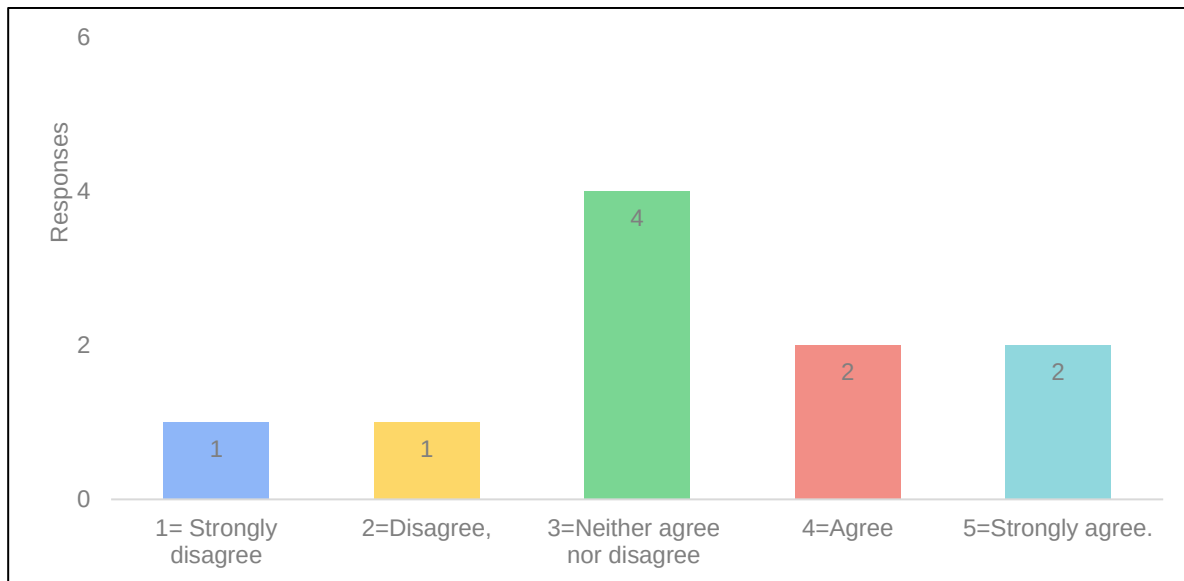


Figure 4-23: Municipal officials' responses to *I believe that the City Council would support the implementation of PAYT as a waste collection system (Statement 3)*

The results were mixed, with four respondents confident that the CCT council would support the PAYT waste strategy, and two respondents not sharing this sentiment, while four respondents were undecided.

Literature points out that one of the greatest challenges with PAYT implementation is municipal council approvals (Skumatz, 2008; Sakai *et al.*, 2008). City councils are sensitive to “*fixing things that are not broken*” and would rather have the traditional flat fee remain (Skumatz, 2008: 2784). Most local municipalities in South Africa are still faced with the basic challenge of providing adequate waste collection services in the first place (DEA, 2018). Although CCT provides weekly collection to 100% of formal households, collections in informal households remain a challenge (CCT, 2023).

4.3.2.1.1 Support towards volume-based versus weight-based PAYT systems

Figures 4-24 to 4-27 outline municipal officials' support towards volume-, weight- and hybrid-based PAYT systems.

Figure 4-24 presents responses of municipal officials to the statement “*I would support the implementation of a volume-based PAYT system where charges are based on the volume of waste bins*”.

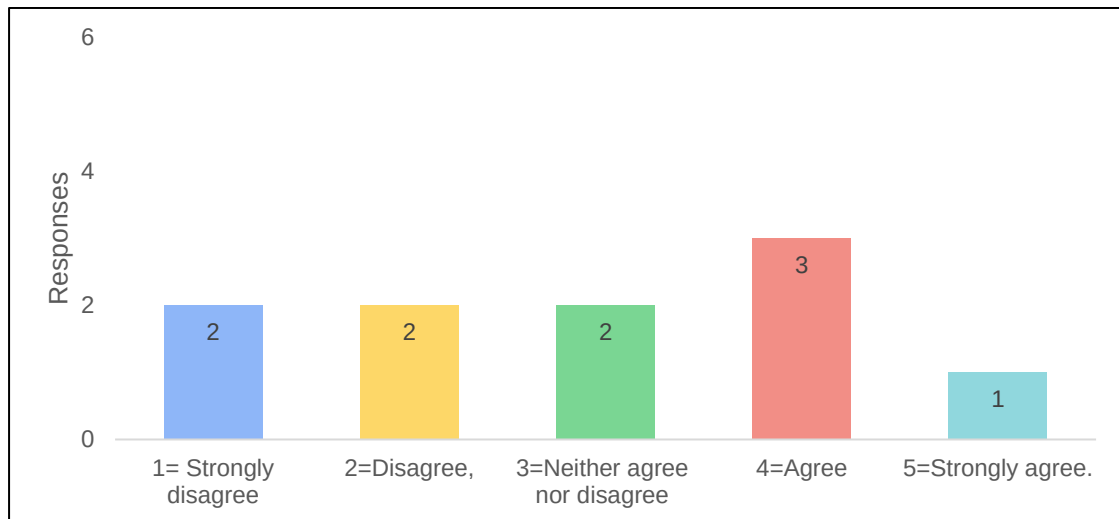


Figure 4-24: Municipal officials' responses to *I would support the implementation of a volume-based PAYT system where charges are based on the volume of waste bins* (Statement 18)

The results were mixed, with four (4) respondents supporting volume-based PAYT, while another four (4) respondents did not support volume-based systems, and two (2) respondents were undecided.

Figure 4-25 shows responses to a statement "*I would support the implementation of a weight-based PAYT system, where waste bins are equipped with identification codes for tracking purposes and are weighed during collection*".

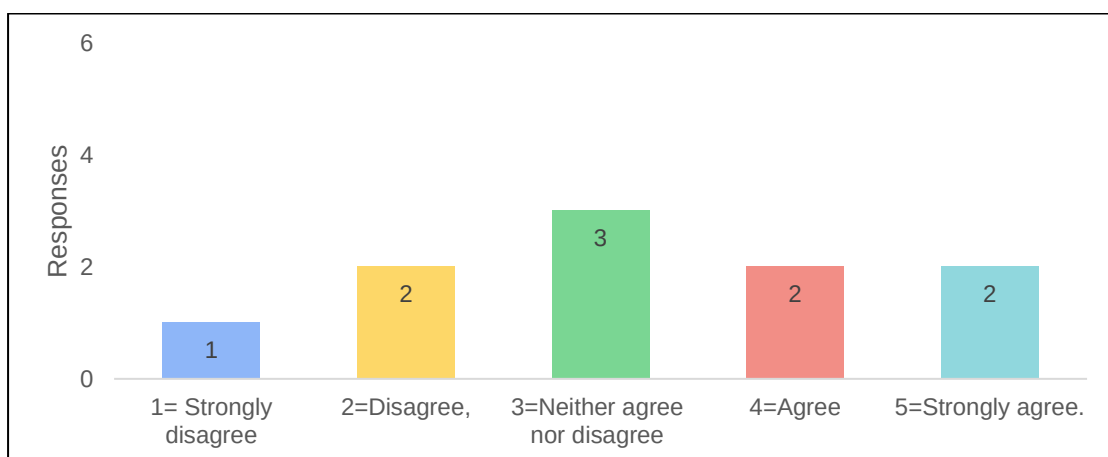


Figure 4-25: Municipal officials' responses to *I would support the implementation of a weight-based PAYT system, where waste bins are equipped with identification codes for tracking purposes and are weighed during collection* (Statement 19)

The results were also mixed towards the support of weight-based systems, with four (4) respondents supporting a weight-based PAYT system, while three (3) respondents did not support it, and three (3) were undecided.

Figure 4-26 shows responses to the statement “*I would support the implementation of a weight-based PAYT system, where wheelie bins are replaced by a bag system*”.

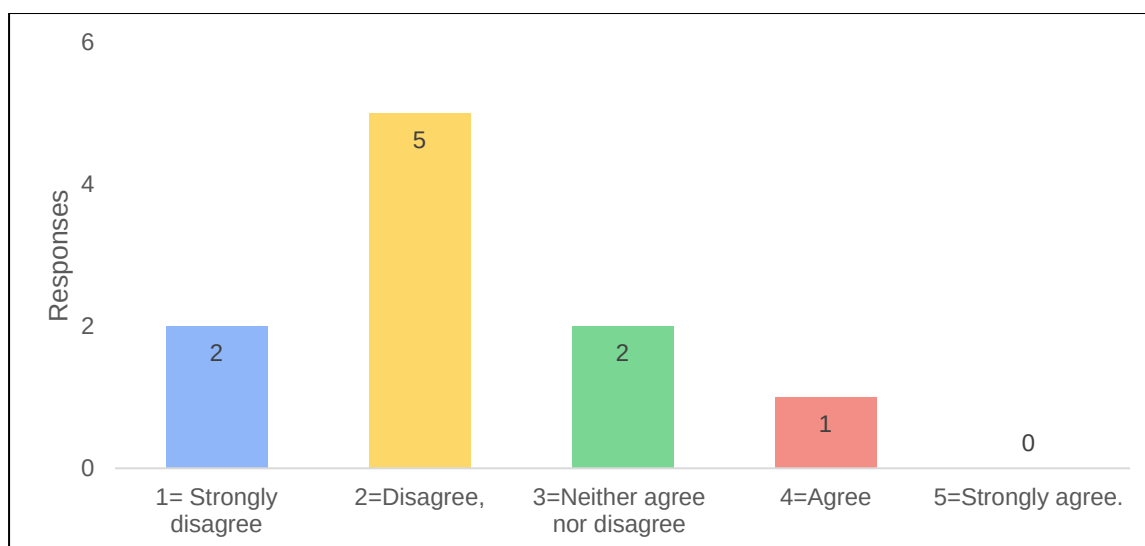


Figure 4-26: Municipal officials’ responses to *I would support the implementation of a weight-based PAYT system, where wheelie bins are replaced by a bag-system* (Statement 20)

There was a stronger level of disagreement towards Statement 20 (than Statement 19), which indicated that municipal officials were even more sceptical towards bag-based systems. The majority of respondents (7) were not supportive of a weight-based system where the current wheelie bins should be replaced by a bag system. Two respondents reacted neutrally, while only one agreed to the statement. Although a PAYT pre-paid bag system offers advantages in terms of low technological complexity, and ease of implementation, it has many drawbacks, such as creating littering and changing the current system where waste is collected in wheelie bins. The research results concur to the findings of Agència de Residus de Catalunya (2010) which states that if there is a specific bin system already in place, the best approach is to integrate PAYT with it.

Figure 4-27 presents responses to the statement “*I would support the implementation of a hybrid PAYT system where a combination of weight or volume, and frequency is used to bill households for waste collection and disposal*”.

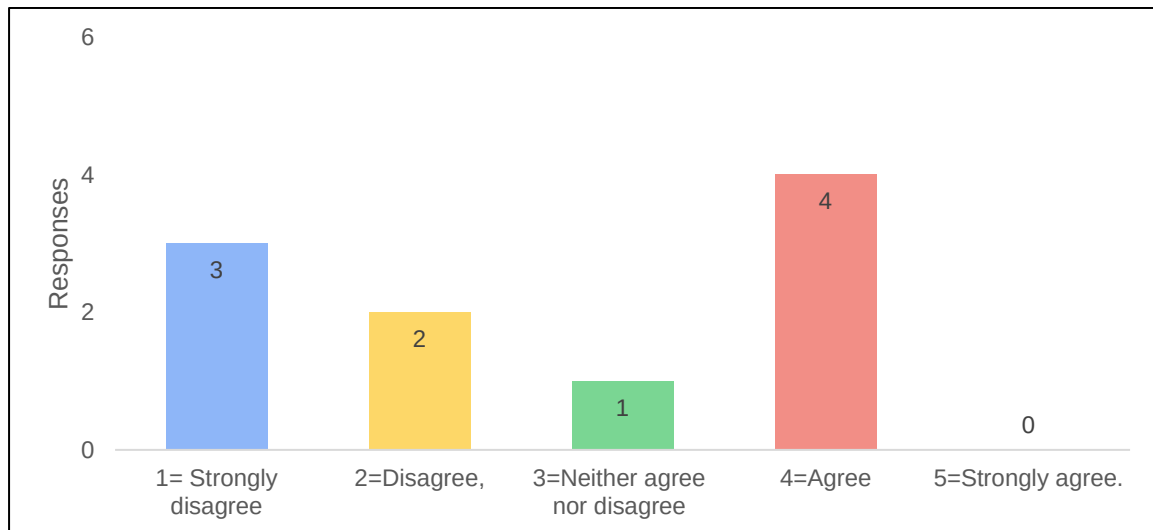


Figure 4-27: Municipal officials' responses to *I would support the implementation of a hybrid PAYT system where a combination of weight or volume, and frequency is used to bill households for waste collection and disposal* (Statement 21)

While half of the respondents (four) agreed that they would support a hybrid PAYT system, one respondent responded neutrally, and three respondents disagreed or strongly disagreed with the statement.

In summary, municipal officials expressed mixed support for different PAYT systems. For volume-based PAYT (Figure 4-24), responses were evenly split, with four in favour, four opposed, and two undecided. Similarly, weight-based PAYT using wheelie bins (Figure 4-25) acquired four supportive responses, three opposed, and three neutral. Opposition was strongest for weight-based PAYT with a bag system (Figure 4-26), with seven respondents against, two neutral, and only one in favour, likely due to concerns about littering and disruptions to existing systems. The hybrid PAYT system, combining weight or volume with frequency-based billing (Figure 4-27), received the most support, with four in favour, three opposed, and one neutral.

The varied responses reflect the inherent complexity of PAYT systems, emphasising the importance of adapting them to existing infrastructure for successful implementation (Also see Sections 2.6.1 and 4.2.2.1.1).

4.3.2.1.2 Support towards one-component versus multi-component charges

Figure 4-28 outlines responses to the statement “*I would support one-component charges for PAYT for waste for waste*”.

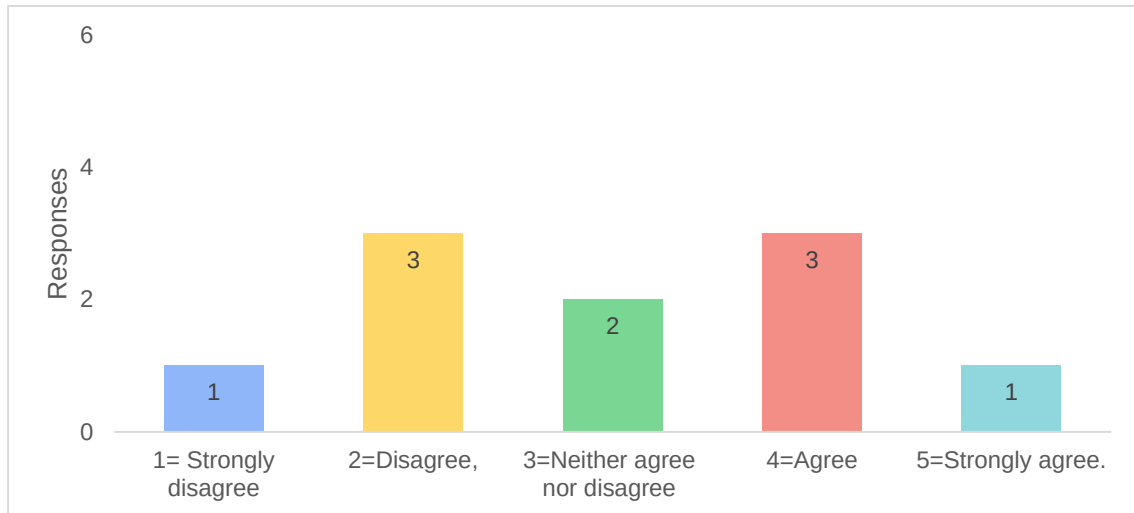


Figure 4-28: Municipal officials' responses to *I would support one-component charges for PAYT for waste (Statement 22)*

Again, no specific trends toward support of a one-component charge system could be established. Responses were mixed, with four municipal officials agreeing, four disagreeing, and two responding neutrally.

Figure 4-29 outlines responses to the statement "*I would support multi-component charges for PAYT for waste*".

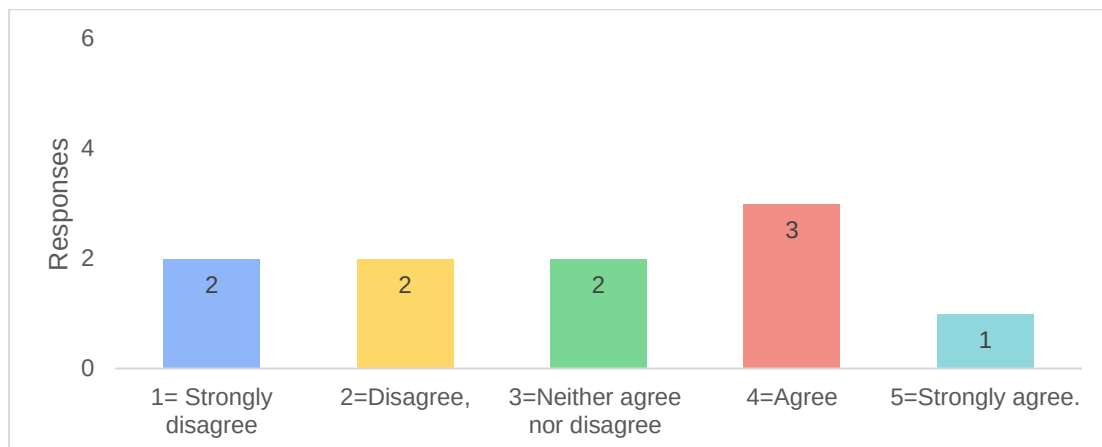


Figure 4-29: Municipal officials' responses to *I would support multi-component charges for PAYT for waste (Statement 23)*

Similarly, the responses were non-conclusive, with four respondents supporting multi-component charges, four being unsupportive towards these charges, and two respondents neither agreeing nor disagreeing.

These inconclusive results suggest a lack of consensus among officials regarding the preferred charging structure for PAYT systems.

4.3.2.2 Perceived ability and readiness of City of Cape Town to successfully apply PAYT system for waste

Figure 4-30 presents municipal officials’ responses to the statement “*I believe that the City of Cape Town Metropolitan Municipality would be able to successfully apply a PAYT system for waste*”.

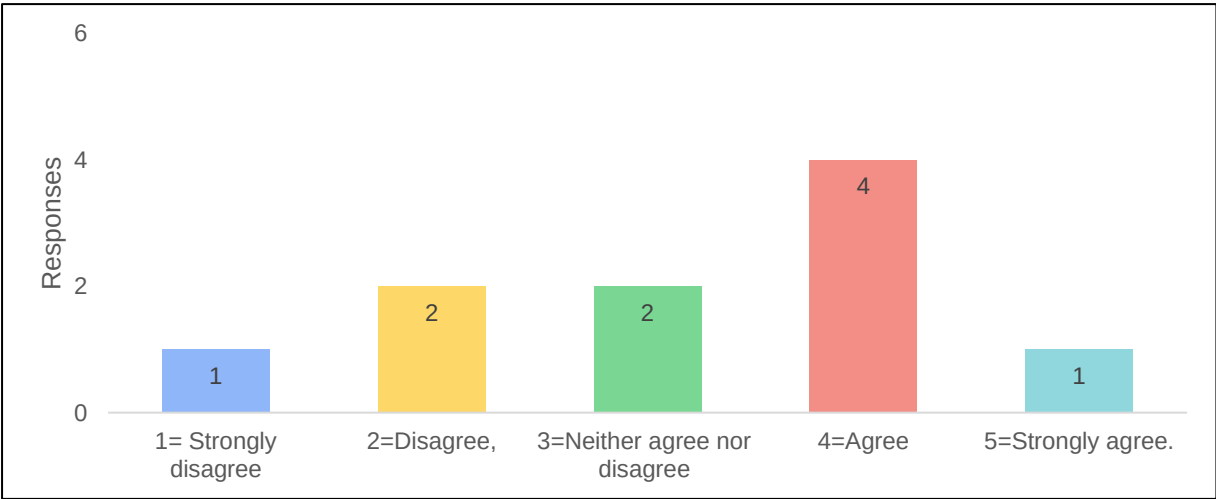


Figure 4-30: Municipal officials’ responses to *I believe that the City of Cape Town Metropolitan Municipality would be able to successfully apply a PAYT system for waste (Statement 5)*

Five of the respondents agreed or strongly agreed that CCT would be able to successfully apply a PAYT system for waste. Three of the respondents were not convinced of CCT’s ability to successfully apply a PAYT system, while two respondents expressed neutral responses.

Figure 4-31 presents responses to “*I believe that the City of Cape Town has the correct waste billing and cost recovery systems in place to enable PAYT implementation*”.

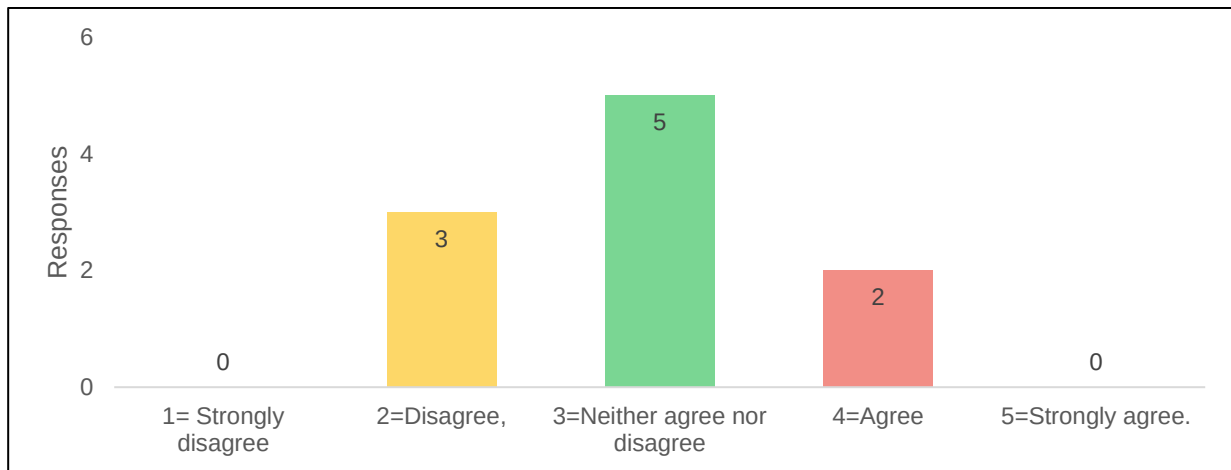


Figure 4-31: Municipal officials' responses to *I believe that the City of Cape Town has the correct waste billing and cost recovery systems in place to enable PAYT implementation (Statement 6)*

Interestingly, half of the participants (5) responded neutrally, while three disagreed and two agreed. It seemed that there were no strong polarised opinions about CCTs billing and cost recovery systems being sufficient to enable PAYT implementation.

Figure 4-32 outlines municipal official's responses to the statement "*I believe that the municipality has the capacity to enforce punitive measures such as fines for unlawful behaviour which would help with the successful implementation of a PAYT system.*"

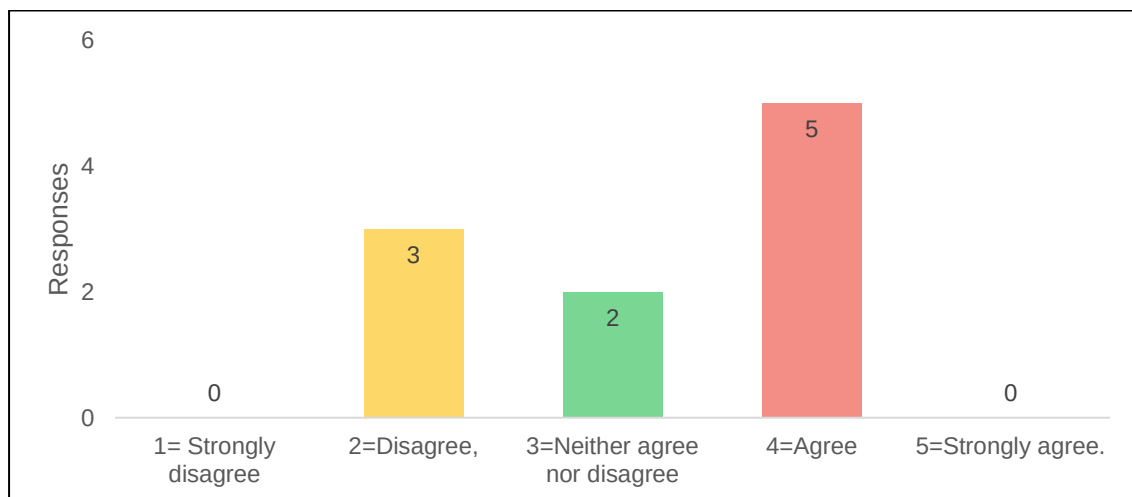


Figure 4-32: Municipal officials' responses to *I believe that the municipality has the capacity to enforce punitive measures such as fines for unlawful behaviour which would help with the successful implementation of a PAYT system (Statement 16)*

Half of the respondents (5) were positive about the CCT’s law enforcement measures and capacity to enforce fines for unlawful behaviour as it related to PAYT systems. Three respondents disagreed with the statement, while two respondents neither agreed nor disagreed.

Literature suggests that effective compliance and enforcement of illegal dumping, littering, and anti-burning rules results in the great success of PAYT (Miranda & Aldy, 1998: 89). However, as mentioned earlier most municipalities in South Africa are struggling with enforcement of environmental and waste legislation (DEFF, 2021a). Comparatively, the CCT is doing relatively well with law enforcement, with municipal officials expressing their belief that punitive measures would be adequate for PAYT implementation.

4.3.2.3 Perceived important factors towards implementation of PAYT in the City of Cape Town

Figures 4-33 to 4-37 outline municipal officials’ perspectives on important factors related to PAYT implementation, such as public consultation, education and awareness, transparency, etc.

Figure 4-33 presents responses to the statement “*I believe that public consultation is important before considering policy mechanisms such as PAYT*”.

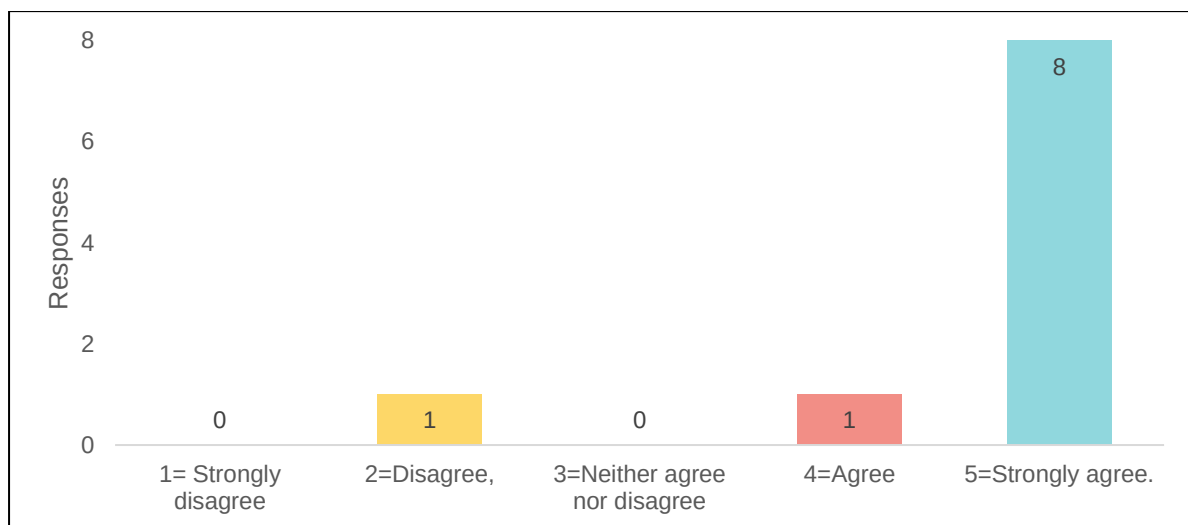


Figure 4-33: Municipal officials’ responses to *I believe that public consultation is important before considering policy mechanisms such as PAYT* (Statement 7)

The majority of respondents (9) were convinced of the importance of both public consultation before implementation of PAYT. Only one respondent disagreed with the statement. Similar studies have found public consultation and participation a key success factors for PAYT

implementation (Brown & Johnstone, 2014; Dunne *et al.* 2008). Oduro-Kwarteng *et al.* (2015) observed that most of the challenges associated with PAYT implementation in Ghana emanated from poor residents' consultation prior to its implementation. Awareness education and consultation are closely linked, hence, Zeschmar-Lahl *et al.* (2016) also point out that awareness raising is a key success factor for PAYT implementation.

Figure 4-34 presents responses to the statement “*I believe that education and awareness of households are important before considering policy mechanisms such as PAYT*”.

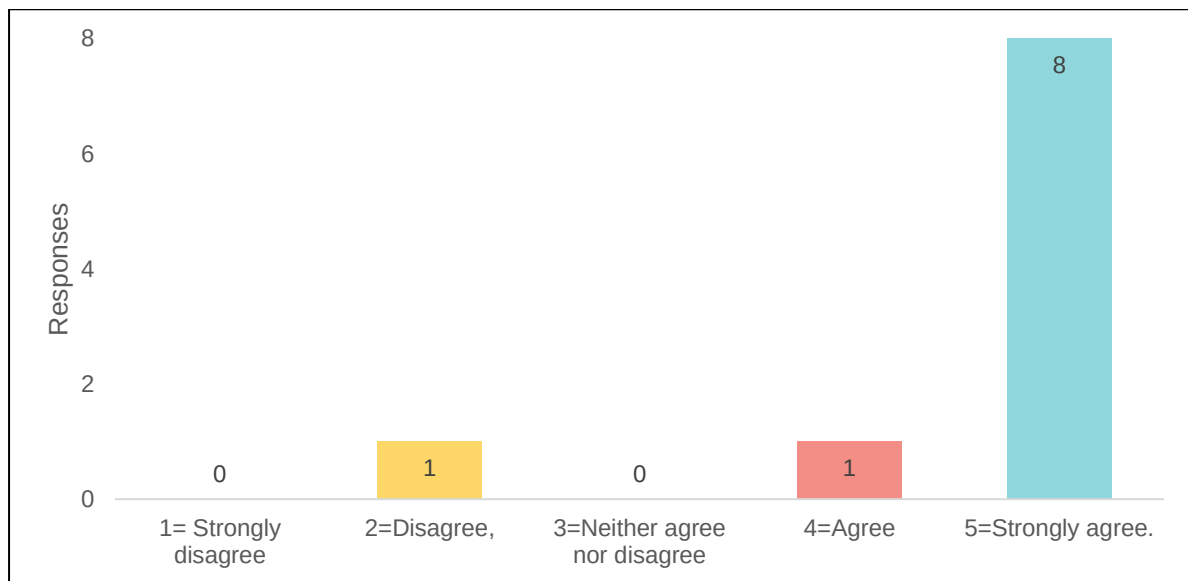


Figure 4-34: Municipal officials’ responses to *I believe that education and awareness of households are important before considering policy mechanisms such as PAYT (Statement 8)*

The responses towards Statement 8 echoed that of Statement 7, with nine respondents agreeing or strongly agreeing that education and awareness of households were important, and one respondent disagreeing.

Figure 4-35 presents responses to the statement “*I believe that transparency regarding the pricing model for PAYT is an important factor towards successful implementation*”. The results were very much similar to findings regarding public consultation, education, and awareness, indicating that these factors are interrelated and regarded as important.

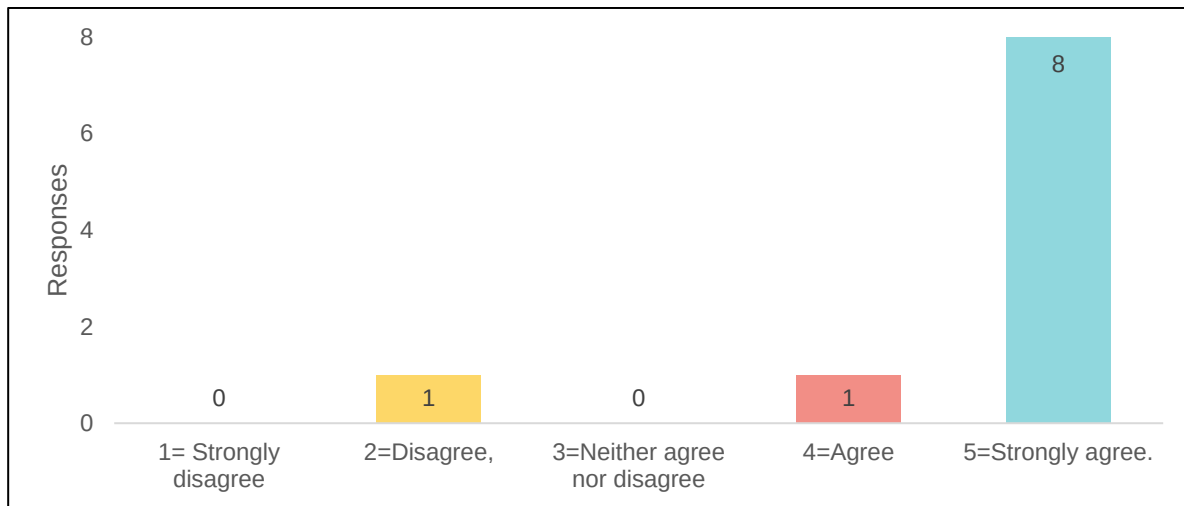


Figure 4-35: Municipal officials' responses to *I believe that transparency regarding the pricing model for PAYT is an important factor towards successful implementation (Statement 9)*

The majority of respondents (9) agreed or strongly agreed that transparency regarding the pricing model is an important factor towards PAYT implementation. Only one respondent disagreed with the statement.

Figure 4-36 presents responses to the statement “*I believe that access to recycling infrastructure is important to reduce volumes/weight of disposable waste in support of PAYT systems*”.

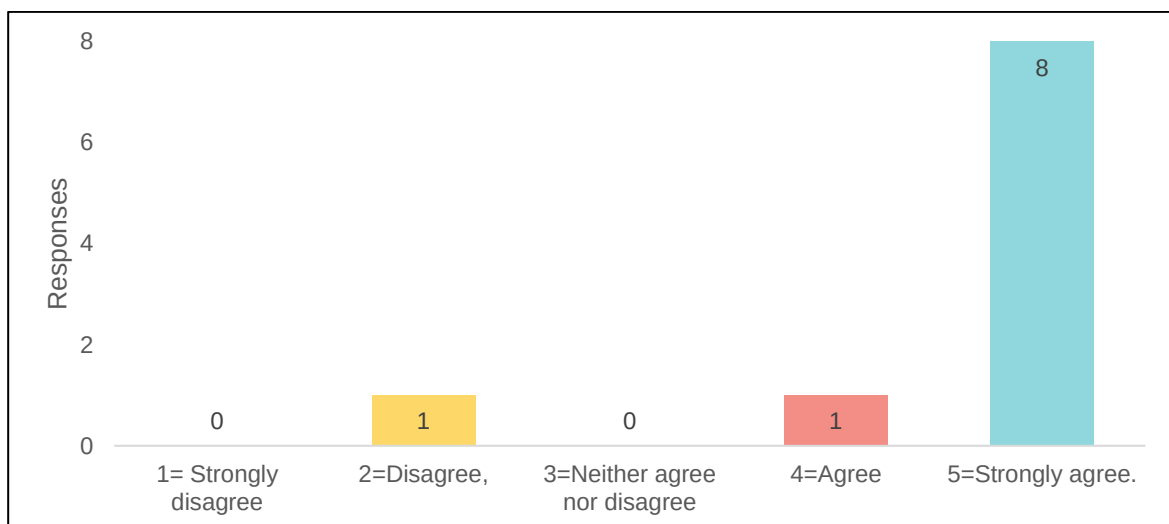


Figure 4-36: Municipal officials' responses to *I believe that access to recycling infrastructure is important to reduce volumes/weight of disposable waste in support of PAYT system (Statement 10)*

Again, almost all respondents (9) agreed to the importance of access to recycling infrastructure for PAYT implementation. One respondent disagreed. The importance of recycling infrastructure cannot be overstated as households divert more waste towards recycling. Most research on PAYT emphasises the presence of comprehensive recycling infrastructure for successful PAYT implementation (Dunne *et al.*, 2008; Beukering *et al.*, 2009; Watkins *et al.*, 2012).

Figure 4-37 presents responses to the statement “*I do not believe that reliance on landfill revenue by the CCT would be a barrier towards PAYT implementation in the municipality*”.

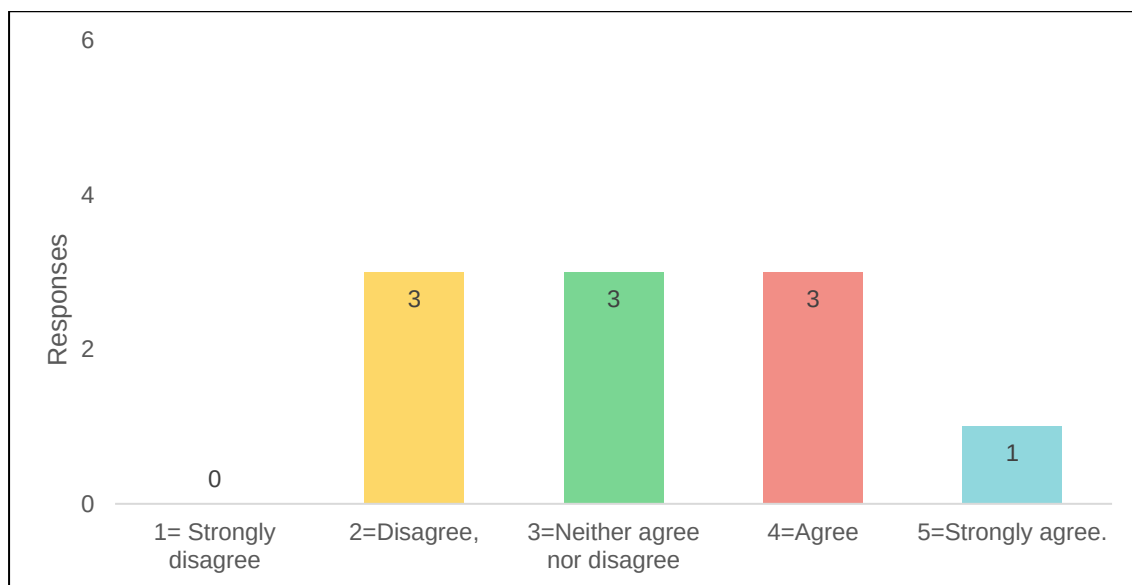


Figure 4-37: Municipal officials’ responses to *I do not believe that reliance on landfill revenue by the CCT would be a barrier towards PAYT implementation in the municipality (Statement 4)*

Half of the (4) respondents agreed that reliance on landfill revenue would not be a barrier to PAYT implementation. However, three respondents thought that it could have an impact, disagreeing with the statement. Three respondents were neutral towards the statement.

There is little published literature regarding this aspect. Dunne *et al.* (2008) raise the matter of landfill revenue reliance; and point out that local authorities and landfill owners in Ireland tend to over-rely on landfill revenue. This distorts the market and incentives for waste reduction, recycling, and diversion. The impact of PAYT on landfill operations could be an area of further research in the future.

4.3.2.4 Attitudes towards PAYT and waste management implications

Figure 4-38 depicts municipal officers' responses to the statement "*I do not believe that CCT households would consider illegal dumping of their waste to reduce PAYT charges*".

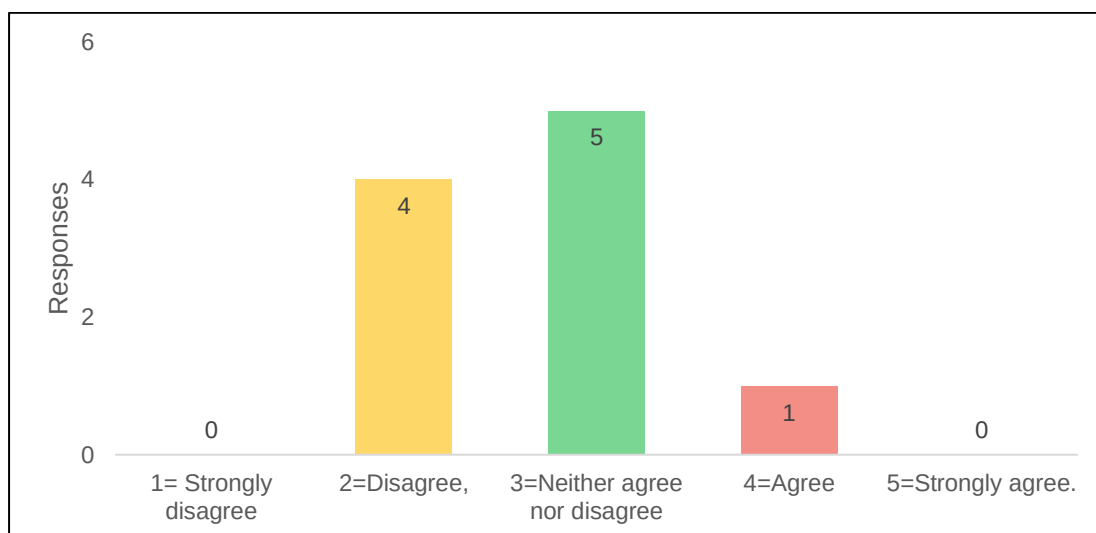


Figure 4-38: Municipal officers' responses to *I do not believe that CCT households would consider illegal dumping of their waste to reduce PAYT charges* (Statement 11)

Municipal officials displayed uncertainty regarding the potential for households to engage in illegal dumping to avoid or reduce PAYT charges. Half of the respondents (5) were neutral on the issue, suggesting uncertainty about households' behaviour. Four respondents disagreed with the statement, indicating they believed illegal dumping might be a consideration for some households, while only one respondent agreed. In contrast, household survey responses (Figure 4-15) showed that the majority (77.9%) were confident they would not resort to illegal dumping to reduce PAYT charges. This comparison highlights a gap between municipal officials' uncertainty and households' reported confidence in maintaining honest behaviour.

Related to Figure 4-38, Figure 4-39 depicts responses to the statement "*I do not believe that illegal dumping in the CCT would increase due to PAYT*".

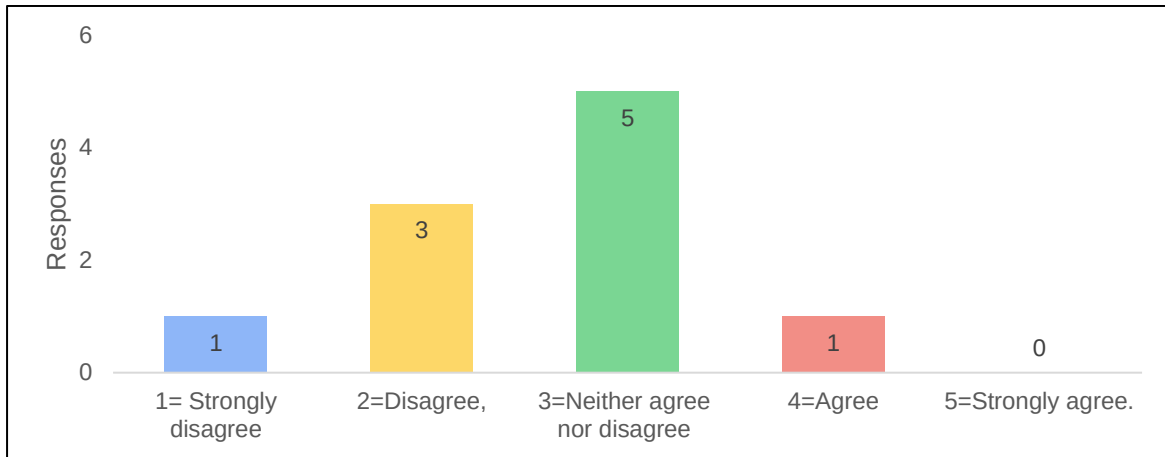


Figure 4-39: Municipal officials' responses to *I do not believe that illegal dumping in the CCT would increase due to PAYT (Statement 12)*

Half of the respondents (5) were uncertain about the impact of PAYT on illegal dumping, as most neither agreed nor disagreed with the statement. Four respondents believed that PAYT might lead to an increase in illegal dumping, while only one disagreed. This uncertainty aligns with findings in the literature, which identify illegal dumping as the primary concern among elected officials and waste managers when considering PAYT implementation (Skumatz, 2008). A comprehensive discussion on the relationship between PAYT and illegal dumping is presented in Sections 4.2.3.2.1.

Figure 4-40 depicts responses to the statement “*I do not believe that CCT households would consider mixing residual waste with recyclable waste to reduce PAYT charges*”.

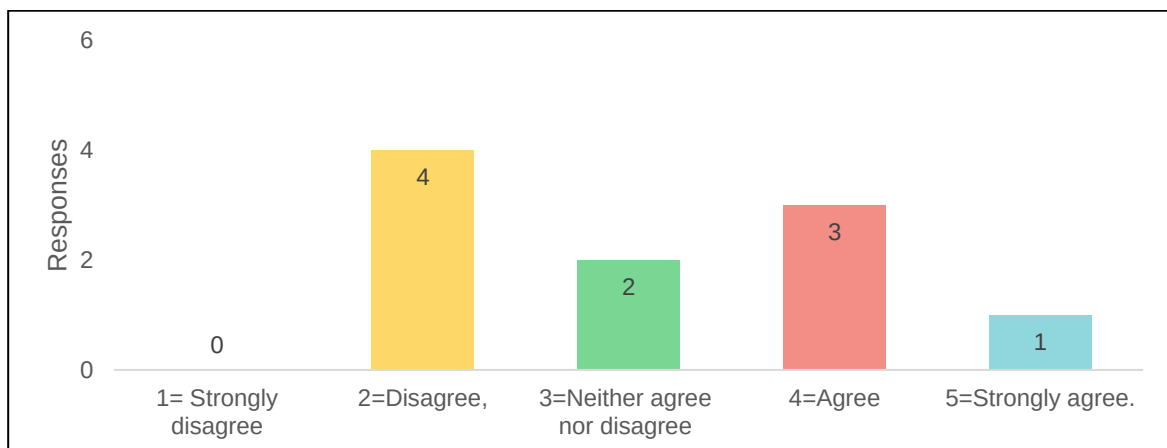


Figure 4-40: Municipal officials' responses to *I do not believe that CCT households would consider mixing residual waste with recyclable waste to reduce PAYT charges (Statement 13)*

The responses to Statement 13 were mixed. Four (4) respondents were not convinced that households would not intentionally contaminate dry recyclables with non-recyclable residual waste to reduce their PAYT charges, while the other (4) believed that households would not practice such form of illegal practices. Two respondents were neutral to this statement.

Figure 4-41 presents responses to the statement “*I do not believe that CCT households would consider disposing of residual waste in another household's waste bin to reduce PAYT charges*”.

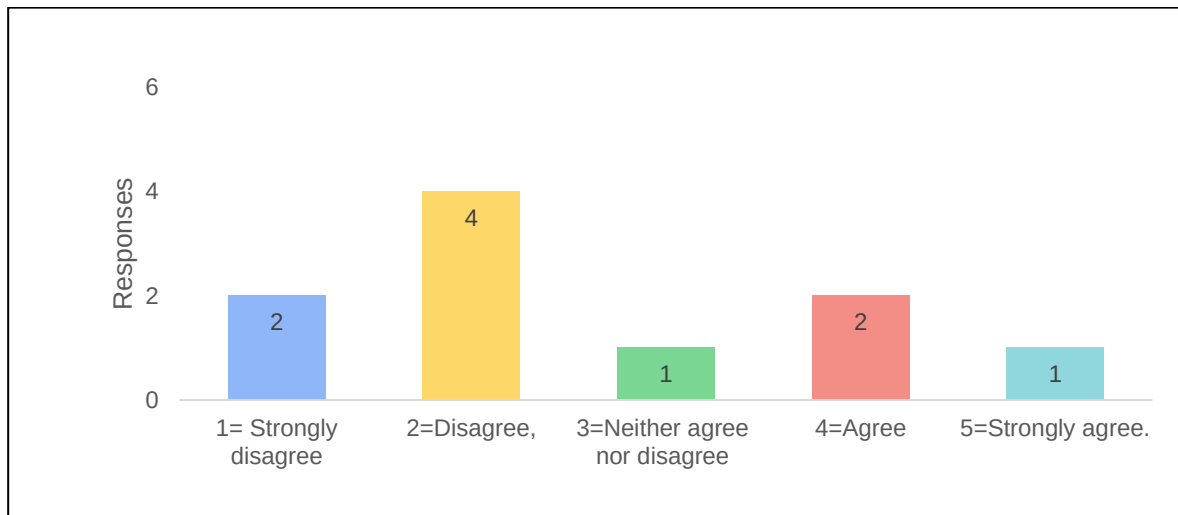


Figure 4-41: Municipal officials’ responses to *I do not believe that CCT households would consider disposing of residual waste in another household's waste bin to reduce PAYT charges (Statement 14)*

Disposing of waste into one’s neighbour's bin is another form of “illegal dumping”, although the costs are not borne by society as with dumping in public spaces. The majority (6) of respondents were not convinced that CCT households would not consider this practice, although three respondents believed households would not resort to such practices. One respondent was unsure/neutral to this statement.

Figure 4-42 depicts responses to the statement “*I believe that citizens would reprimand one another for non-compliant behaviour*”.

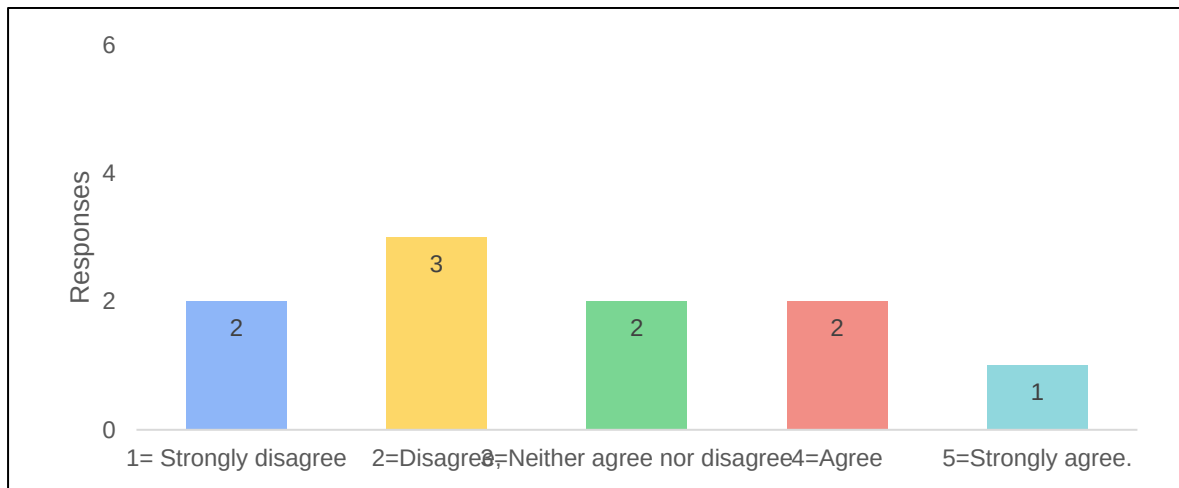


Figure 4-42: Municipal officials' responses to *I believe that citizens would reprimand one another for non-compliant behaviour (Statement 15)*

Responses to Statement 15 showed no definitive trend regarding whether citizens would reprimand one another for non-compliant behaviour. Five respondents disagreed or strongly disagreed with the statement, two remained neutral, and three believed such reprimands might occur. Interestingly, household responses (Figure 4-18) revealed a general hesitancy among citizens to confront or reprimand others for non-compliance, indicating a potential gap between officials' expectations and households' potential behaviour.

4.3.2.5 Perceived efficiency of different PAYT schemes

Figure 4-43 present responses for Statement 17 that required respondents to rate the three different schemes regarding their possible efficiency with 1 being the most efficient and 3 being the least efficient.



Figure 4-43: Municipal official respondents' ranking of the three different schemes regarding their possible efficiency with 1 being the most efficient and 3 being the least efficient (Statement 22)

Most respondents (5) identified weight-based PAYT schemes as the most efficient, followed by volume-based schemes (4), with the hybrid PAYT ranked as the least efficient. Household respondents shared a similar view, favouring weight-based systems for their perceived efficiency.

This aligns with Bel and Gradus (2016), who note that weight-based PAYT achieves the greatest reduction in waste and environmental benefits, despite its higher administrative and operational costs. Literature supports both volume- and weight-based systems, emphasising that their effectiveness depends on the specific context in which they are implemented (Kevrekidou, 2016; Zeschmar-Lahl *et al.*, 2016; Emmanouil *et al.*, 2022).

4.3.3 Opportunities and challenges for PAYT identified by Municipal Waste Officials

The municipal respondents were also asked the following open-ended questions at the end of the survey, which were followed-up and discussed during interviews (with only four of the ten respondents). The open-ended questions posed were:

- In your opinion, what are the opportunities for Pay-As-You-Throw (PAYT) for household solid waste management in the City of Cape Town?
- In your opinion, what are the challenges for Pay-As-You-Throw (PAYT) for household solid waste management in the City of Cape Town?

The responses to these questions were thematically analysed. The perceived opportunities are outlined in Table 4-7 and discussed in the sub-sections of Section 4.3.3.1, while perceived challenges are outlined in Table 4-8 and discussed in the sub-sections of Section 4.3.3.2.

4.3.3.1 Perceived opportunities of PAYT identified by municipal waste officials

Municipal waste officials identified several opportunities associated with PAYT (Table 4-7), including increased recycling, reduced landfill waste, cost savings for households and the municipality, and enhanced waste beneficiation. PAYT also offers potential for innovative waste management strategies, job creation, and improved waste awareness and behaviour change among residents.

Table 4-7: Opportunities mentioned by municipal waste officials with regards to PAYT (n = 10)

Theme	Phrases mentioned	Frequency	
		n	%
Increased recycling and reduced waste to landfill	<i>“Increased recycling and growing the recycling economy, including the recycling of glass bottles”, “Recycling of bottles from households will reduce tailings in MFRs”, “Increased utilisation of waste drop-off centres”, “Increase source separation of waste and waste diversion to landfill”, “Longer lifespan of landfill airspace” “There was increased pressure on the City to divert waste from landfill”</i>	6	60%
Cost savings for households & CCT Municipality	<i>“Opportunity to reduce costs for households while also encouraging behavioural changes”, “Could improve waste collection efficiency, and reduce wear and tear of collection vehicles”, “PAYT could lead to lower waste tariffs”, “Cost savings for waste disposal vehicles from increased collection efficiencies as more materials are diverted through recycling”</i>	4	40%
Increased waste beneficiation	<i>“More household waste beneficiation like home composting and food garden”, “Increased waste beneficiation through waste to energy for high caloric value recycled materials”, “More household</i>	3	30%

Theme	Phrases mentioned	Frequency	
		n	%
	<i>waste beneficiation like home composting and food garden</i>		
New waste management strategies	<i>"PAYT creates an opportunity to test alternative waste management strategies"</i>	2	20%
Create more job opportunities	<i>"Opportunities to bring in smaller entrepreneurs into the recycling economy and create jobs", "May attract more private investment for waste diversion facilities"</i>	2	20%
Increased waste awareness and behaviour changes	<i>"Increased waste awareness and encourage waste behavioural changes", "Opportunity to reduce costs for households while also encouraging behavioural changes"</i>	2	20%

4.3.3.1.1 Increased recycling and reduced waste to landfill

Similar to the responses by household respondents (Section 4.2.3.1.1), increased recycling and reduced waste to landfill was the most mentioned opportunity, stated by six (60%) of the ten municipal officials. Respondents mentioned phrases such as *"increased utilisation of waste drop-off centres"*, *"increased source separation of waste"*, *"increased recycling of waste"* and *waste diversion from landfill*. Slavic and Pavel (2013: 2) succinctly point out that *"there is doubt that PAYT is very effective instruments for increasing household participation in waste separation and in the reduction of waste disposed in landfill"*. A body of literature (Skumatz & Freeman, 2006; Reichenbach, 2008; Zeschmar-Lahl et al., 2016) supports this notion and indicate that PAYT is one of the most effective EIs used to divert household waste from landfill.

Diverting waste from landfills is a key imperative for South Africa's 2020 NWMS. Hence, DEFF (2012a) points out that *"South Africa's strategy for diversion of waste from landfill is based on building a secondary resources economy around the beneficiation of waste as part of the circular economy, this is through among others, the recycling of paper, glass, plastics, metals, tyres, ... to substitute recycled content for virgin materials"*. In this regard, the NWMS sets a target for 5 years, 10 years, and 15 years for 40%, 55%, and 70% reduction of waste disposed in landfills, respectively (DEFF, 2012a). For the country to make any grounds on these ambitious targets, separation of household waste at source is critical. However, source separation is likely to be

costly for municipalities and needs to be incentivised or subsidised (Nahman, 2021) or both. Together with other regulations and instruments, households should be incentivised to separate waste at source through the charging of volumetric tariffs (DEA, 2018b), cited in Nahman (2021: 57).

4.3.3.1.2 Cost savings for households and CCT Municipality

Another key opportunity mentioned by four (40%) of the municipal respondents relates to costs savings for both households and municipalities. Again, this was an opportunity also mentioned by households (Section 4.2.3.1.3). However, some households were also concerned about cost (See 4.2.3.2.2). Municipal officials mentioned *“opportunities to reduce costs for households while also encouraging behavioural changes”*, that PAYT *“could improve waste collection efficiency, and reduce wear and tear of collection vehicles, which could save many”*, and that *“PAYT could lead to lower waste tariffs”*. The responses indicated that participants believed that households could benefit from reduced waste costs, while municipalities could also benefit from reduced operational and maintenance expenses.

As discussed earlier, literature, however, points to mixed opinions regarding PAYT and cost savings. Some studies suggest that PAYT may decrease waste-related costs, or that it may stay the same (CWMI, 2000; Karagiannidis *et al.*, 2008; Skumatz, 2008; Slavik & Pavel, 2013). Beukering *et al.* (2009: 2900) point out that PAYT *“does not increase the overall cost of waste collection for municipalities”*, while others argue that PAYT has no real cost saving benefits for any of the role players involved (Dahlén & Lagerkvist, 2010; Lakhan, 2015).

4.3.3.1.3 Increased waste beneficiation

The opportunity for increased waste beneficiation was mentioned by three (30%) of the municipal waste officials. One respondent stated that *“more household waste beneficiation like home composting for food garden might be encouraged by PAYT systems”*, while another respondent said that *“increased waste beneficiation through waste to energy for high caloric value recycled materials present an opportunity”*. The thinking is that with PAYT, households have the incentive to separate food waste and organic waste from the disposable waste streams, and that these wastes could then be used for beneficiation.

According to Oelofse *et al.* (2018), the value of MSW generated in African cities is US\$8.0 billion per year, and only about 4% is recovered. In Africa, opportunities to advance waste as a secondary resource are largely untapped (Oelofse *et al.*, 2018). Thus, increased waste beneficiation of construction and demolition waste, industrial waste, WEE, and organic waste are key focus areas of the 2020 NWMS aimed at driving the “Zero waste going to landfill” long-term

goal. Therefore, PAYT will be a critical enabler for household source separation and advancing waste as a resource.

4.3.3.1.4 New waste management strategies

Two (20%) of the respondents identified an opportunity for the CCT to test new waste strategies. The one respondent highlighted that *"PAYT creates an opportunity to test alternative waste management strategies"*, while the second respondent noted that *"There were opportunities and appetite for new waste strategies by City of Cape Town officials"*. South Africa has relied heavily on the traditional, command-and-control approach for waste management. In fact, Oelofse (2021) argues that South Africa has seen a surge of waste regulation since the NEMWA was promulgated in 2008. But this has not been translated to much success with all the current waste challenges including littering and illegal dumping, low levels of separation at source, inconsistent waste collection, etc. PAYT offers an opportunity to test new strategies and apply innovative techniques, to supplement existing waste management approaches, such as command-and-control.

4.3.3.1.5 Create more job opportunities

Two (20%) of the respondents mentioned job creation as an opportunity related to PAYT. Respondents mentioned that *"PAYT may create new opportunities including job creation"* and that *"opportunities to bring in smaller entrepreneurs into the recycling economy and create jobs, may attract more private investment for waste diversion facilities"*. Household respondents also saw job creation opportunities with PAYT implementation (Section 4.2.3.1.5).

Oelofse *et al.*, (2018:107) concur that the secondary goods economy can create social opportunities including *"job creation, poverty alleviation, enterprise development, entrepreneurship, and women's empowerment"*. Waste collection and sorting of secondary resources is labour intensive and can create many direct jobs (Oelofse *et al.*, 2018). Furthermore, Oelofse *et al.* (2018) are in agreement with the respondents as they also see an opportunity for small and medium-sized enterprises (SMEs) to partner with the local authorities in the collection, reuse, recycling and recovery of various source separated various waste stream, where an enabling environment is created.

4.3.3.1.6 Increased waste awareness and behavioural changes

Finally, two respondents (20%) identified opportunity related to increased waste awareness and behavioural changes. Respondents mentioned phrases such as *"increased waste awareness and encourage waste behavioural changes"*, and *"opportunity to encourage behavioural changes"*.

Similarly, household respondents saw PAYT as a good opportunity for waste awareness raising, as discussed in Section 4.2.3.1.4.

4.3.3.2 Perceived challenges of PAYT identified by municipal waste officials

The challenges of PAYT perceived by municipal waste officers are outlined in Table 4-8 and discussed in the sub-sections below. Perceived challenges related to cost, technical challenges, inequality and impacts on poor households, illegal dumping and impacts on landfill sites, and concerns regarding a lack of support and buy-in from households. A similar trend to household responses was observed, where more challenges were mentioned than opportunities.

Table 4-8: Challenges mentioned by municipal waste officials with regards to PAYT (n = 10)

Theme	Phrases mentioned	Frequency	
		n	%
Increased costs of waste management	<i>“Will require placement of glass bottle banks”, “Waste disposal tariffs may need to increase to ensure the sustainability of landfill operations”, PAYT is a complex system and requires significant investment to implement”, “Additional costs for PAYT equipment”, “Costs of recycling”, “Technical challenges with recycling of different materials and costs involved”, The true costs of recycling vs landfilling</i>	7	70%
Technical challenges with PAYT implementation	<i>“Technical challenges with recycling of different materials”, PAYT is a complex system and requires significant investment to implement, “Complexities of actually weighing PAYT”, “Technical challenges with recycling of different materials”, PAYT may be very difficult to implement on a mega scale such as in large metros</i>	5	50%
Poverty, unemployment and inequality	<i>“Poverty and unemployment and poor people sharing households might have a detrimental impact on poor households”, “Many households do</i>	5	50%

Theme	Phrases mentioned	Frequency	
		n	%
and impact on poorer households	<i>not have gardens to increase beneficiation, thus PAYT may prejudice some households”, “Poverty and inequality”, “Cross-subsidisation of poor households by more affluent households”, “Many poor people share informal households and PAYT might have a detrimental impact on poor households”</i>		
Illegal waste dumping	<i>“Illegal waste dumping, including using neighbours bins to dump waste, and lack of enforcement resources by the City”, Illegal dumping might also cause disputes within communities”, “Illegal waste dumping”,</i>	3	30%
Getting buy-in from all stakeholders	<i>“Getting a buy-in from all stakeholders”, City council approval, the council is focused on providing basic services to everyone, especially informal households, and not making changes to the current waste strategy</i>	3	30%
Impact on landfill operations	<i>It would affect the cashflow of landfill operations and management and overall waste department revenue</i>	2	20%
Secondary goods economy	<i>Challenges with the recycling economy in terms of the market for the materials and also the value and pricing of recycled materials</i>	1	10%

4.3.3.2.1 Increase costs of waste management

The most frequent PAYT challenge mentioned by seven (70%) of the ten municipal respondents was concern about PAYT increasing the overall costs of waste management in the CCT. Concerns such as “waste disposal tariffs may need to increase to ensure the sustainability of landfill operations”, “PAYT is a complex system and requires significant investment to implement”,

and “additional costs for PAYT equipment” were mentioned. Similarly, this was the second most mentioned challenge perceived by household respondents (Section 4.2.3.2.2).

Although some studies suggest that PAYT does not lead to an increase to overall waste management costs (Karagiannidis *et al.*, 2008; Skumatz, 2008; Beukering *et al.*, 2009; Slavik & Pavel, 2013), it is generally accepted that PAYT implementation does bring additional costs of equipment and administration initially, and also additional maintenance costs of weighing devices (Dahlén & Lagerkvist, 2010; Lakhan, 2015; Ukkonen & Sahimaa, 2015). Furthermore, although capital investments for new additional equipment can be funded separately, usually by central governments, it is the operational costs that are mostly higher than capital costs and often the most challenging to sustain (Kaza *et al.*, 2018).

4.3.3.2.2 Technical challenges with PAYT implementation

Five (50%) of the ten municipal officials were concerned about technical challenges related to PAYT implementation. One of the respondents indicated that “*PAYT is a complex system and requires significant investment to implement. I anticipate various technical challenges*”. Another respondent was concerned about the “*complexities of actually weighing waste to implement PAYT*”.

The level of complexity of PAYT can vary greatly depending on the type of scheme implemented (see Table 2-1). Generally, weight-based schemes require more technical equipment and staff, and may, therefore, be more expensive, but “*it can be justified by their better results*” (Zeschmar-Lahl *et al.*, 2016: 99). Elia *et al.* (2015: 189) concurs that “*designing PAYT systems in MSWM is a complex issue*”. Thus, Agència de Residus de Catalunya (2010) suggests that the first step in implementing PAYT is to carry out a technical study to assess the initial situation and evaluate various implementation options.

4.3.3.2.3 Poverty, unemployment and inequality and impact on poorer households

Poverty, unemployment, inequality, and the impact of PAYT on poorer households were also identified as challenges by five (50%) of the ten respondents. One of the respondents raised his concerns - “*Poverty and unemployment and poor people sharing households might have a detrimental impact on poor households*”, while another mentioned “*poverty and inequality always come into play with economic instruments*”. Household respondents also raised the same concern (Section 4.2.3.2.4).

Drawing from the phrases mentioned by municipal officials, several concerns are evident. Firstly, poor households may have higher household sizes due to people sharing and backyard living,

hence generating higher waste volumes than affluent households. Secondly, poor households may struggle to pay the PAYT charge, as discussed under Sections 2.8.2.3 and 4.2.3.2.4.

4.3.3.2.4 Illegal waste dumping

Illegal waste dumping is one of the challenges mentioned by three (30%) municipal respondents, although not the biggest. Issues such as *“illegal dumping will increase”*, *“households may end up using neighbours’ bins to dump waste”*, and *“illegal dumping might cause disputes within communities”* were mentioned. Household respondents also raised the concern.

The discussion on illegal waste dumping has been covered in Sections 2.8.2.1 and 4.2.3.2.1 and will not be repeated here.

4.3.3.2.5 Getting buy-in from all stakeholders

Three (30%) of the respondents were concerned about getting support and buy-in from all stakeholders. Respondents highlighted concerns regarding: *“Getting buy-in from all stakeholders might be impossible”*, and *“Will council support this? City council approval and support is important, since the council is focused on providing basic services to everyone, especially informal households, and not making changes to the current waste strategy”*.

Literature suggests that besides resistance from households, City councils are often not so keen or willing to adopt PAYT (Skumatz, 2008; Sakai et al., 2008). Oelofse (2021: 10) argues that South African municipalities often perceive moving waste up the waste management hierarchy (such as implementing source separation) as an *“unfunded mandate”*. Schedule 5 of the Constitution, Part B lists *“refuse removal, refuse dumps and solid waste disposal”* as a function of local government. Hence, municipalities are reluctant to implement source separation initiatives, which they do not regard to explicitly form part of their Constitutional duties (Oelofse, 2021). Therefore, new waste strategies that are aimed at moving waste up the waste management hierarchy needs both financial and political support from national governments and buy-in from both local governments and households.

4.3.3.2.6 Impact on landfill operations

Two respondents (20%) also mentioned challenges relating to PAYT impact on landfill operations. A respondent stated that *“It [PAYT] would affect the cash flow of landfill operations and management and overall waste department revenue”*. The concern raised is twofold - one, the financial impact of PAYT on landfill operations, i.e., their financial sustainability; and two - the overall impact on municipal revenue is questioned. Similar findings have been raised by Dunne et al. (2008) following mandatory implementation of PAYT scheme in Ireland. They found that

local authorities and landfill owners tend to rely on landfill revenue and seek to “*keep this revenue stream*”. Unfortunately, this distorts the market and incentives for waste diversion (Dunne *et al.* 2008: 2832).

4.3.3.2.7 Secondary goods economy

Lastly, one respondent mentioned (10%) challenges relating to the secondary goods economy and fluctuating recycling markets. This respondent was concerned about “*Challenges with the recycling economy in terms of the market for the materials and also the value and pricing of recycled materials*”. The argument is that the prices offered for secondary goods are low, and the market for these goods fluctuating more often, which then impacts on the sustainability secondary goods economy. This would ultimately have a negative impact on source separation for recycling purposes.

Similar concerns were raised by Slavic and Pavel (2013: 17) in their research of PAYT impact in the Czech Republic, as they point out that “*prices of separated materials have decreased to near zero due to the crisis on the secondary raw material market*”. Dunne *et al.* (2008) point out similar concerns in Ireland about fluctuating recycling markets.

4.4 Discussion: Integration of household and municipal official survey findings

This research aimed to investigate stakeholder perceptions of PAYT as a fiscal instrument for managing household solid waste in the City of Cape Town Metropolitan Municipality. The study examined various aspects, including support for PAYT implementation, perceptions of the City’s ability and readiness to implement PAYT, factors critical to its successful adoption, household attitudes toward PAYT and its implications for waste management, perceived efficiency of different PAYT schemes, and opportunities and challenges associated with PAYT. The following sections present the combined findings from household and municipal official surveys (detailed individually in Sections 4.2 and 4.3) alongside relevant literature discussed in Chapter 2.

4.4.1 Support towards PAYT implementation

In general, both municipal and household respondents generally supported the implementation of PAYT as a waste collection system in the City of Cape Town (CCT). However, they expressed uncertainty about whether the broader population of Cape Town households and the City Council would support such a system. The literature highlights that gaining public acceptance and support for PAYT is a key challenge. Nevertheless, studies suggest that once PAYT is implemented, it often becomes popular with citizens (Skumatz, 2008; Brown & Johnstone, 2014).

Although Cape Town residents have not experienced PAYT for solid waste management, most formal households currently pay a fixed monthly waste tariff (R166.26, excluding VAT). This indicates that the principle of user charges is already familiar to them. Consequently, the general support for PAYT expressed by some Cape Town households may reflect an understanding of its potential benefits, such as reducing waste management costs and tariffs over time.

Among household respondents, the majority preferred a one-component charge pricing model, while municipal officials expressed mixed views. Evidence suggests that the multi-component pricing model is more practical, as it better ensures the financial sustainability of the overall waste management system (Bilitewski, 2008b). Public understanding and transparency regarding the pricing model are critical for PAYT's success. Therefore, efforts should focus on enhancing public awareness of actual waste management costs through transparency and meaningful public participation.

4.4.2 Perceptions about ability and readiness of CCT to implement PAYT

When asked about the readiness of the City of Cape Town (CCT) to implement PAYT, most household respondents and municipal officials believed that CCT could successfully apply the system. However, there was uncertainty regarding whether the CCT had the necessary “*correct waste billing and cost recovery systems*” in place to support PAYT implementation. The National Pricing Strategy for Waste Management (NPSWM) (DEA, 2016) emphasises that for any South African municipality to implement EIs like volumetric tariffs, robust financial and administrative systems, including accurate billing and cost recovery mechanisms, must be established.

It may be necessary to further investigate what constitutes the correct waste billing and cost recovery systems referenced in the NPSWM. According to Kaza *et al.* (2018), joint billing of waste fees with property or utility taxes is an indicator of a mature waste management system. The CCT already employs joint billing for waste services along with property taxes and other utilities, which could be interpreted as evidence of a sound billing framework.

Cost recovery, defined as the practice of charging consumers the full or nearly full cost of providing services like water, electricity, and waste management (McDonald, 2002), remains a challenge for many municipalities. Globally, local authorities often struggle to fully recover the costs of waste services through user fees alone, necessitating subsidies or grants from central governments (Kaza *et al.*, 2018). In Africa, poor cost recovery is a persistent issue, often attributed to poverty, weak economies, low incomes, and limited public awareness or education (Richter, 2018).

In this context, the CCT funds its waste management services through a mix of user fees, equitable share allocations, infrastructure grants from the national government, and property rates (CCT, 2023). While full cost recovery has not been achieved, CCT has partial systems in place to recover costs and accurate billing mechanisms. In principle, despite broader socio-economic challenges, the CCT appears relatively well-positioned to implement PAYT, supported by its existing financial and administrative structures.

4.4.3 Perceived important factors towards PAYT implementation

Respondents were uncertain about how the broader Cape Town population would perceive PAYT and whether they would support such a system for waste management. This underscores the importance of public participation and consultation in policymaking. Key factors for the successful implementation of PAYT include education, awareness, public participation, transparency, and access to recycling infrastructure. Before adopting PAYT as a waste management strategy, a participatory process must be undertaken (Agència de Residus de Catalunya, 2010). This goes beyond merely raising awareness about policy mechanics, likely impacts, and rationale; it involves public officials working closely with residents to co-create policies (Homsy & Hart, 2021).

The critical role of education and awareness in PAYT's success cannot be overstated. PAYT has not yet been implemented in South Africa, and it is reasonable to infer that residents remain largely uninformed about the concept. Respondents unanimously highlighted the importance of awareness, education, and transparency in securing public support. As Zeschmar-Lahl *et al.* (2016:157) highlight, *“If the citizens are aware and convinced of the system, they will actively support it.”* Studies have shown that extensive public awareness campaigns significantly enhance the acceptance of PAYT systems (Dunne *et al.*, 2008; Agència de Residus de Catalunya, 2010; Brown & Johnstone, 2014; Emmanouil *et al.*, 2022).

Although awareness-raising and public participation are interconnected, they are distinct processes. Awareness campaigns involve one-way communication, where municipalities provide or collect information through platforms such as billboards, newspapers, websites, or roadshows. In contrast, public participation entails involving citizens in decision-making, policymaking, and governance (Vivier *et al.*, 2015). For PAYT implementation, the pre-implementation participatory process should focus on citizen engagement in decision-making rather than solely raising awareness. This two-way communication creates a dialogue between authorities and the public, fostering support for the programme (Dunne *et al.*, 2008). Nevertheless, such participatory processes inherently raise awareness about PAYT, which must be reinforced through ongoing public awareness campaigns post-implementation.

For PAYT to be effective, comprehensive recycling infrastructure must be available to facilitate source-separated waste. Offering incentives or disincentives to reduce waste disposal necessitates creating an enabling environment for waste separation and recycling. These factors are essential for the long-term success of PAYT.

4.4.4 Attitudes towards PAYT and waste management implications

The successful implementation of PAYT heavily depends on household attitudes towards waste management. Positive attitudes - such as a willingness to separate waste at the household level, awareness of the negative impacts of waste on health and the environment, perception of policy fairness and effectiveness, transparency, and understanding of the pricing model - can significantly enhance PAYT acceptability (Zhang *et al.*, 2023). Conversely, negative attitudes, often rooted in a lack of understanding of waste management costs, concerns about increased household expenses, insufficient public participation in policymaking, and potential non-compliance, can hinder PAYT's success (Zhang *et al.*, 2023).

A major concern surrounding PAYT is non-compliance, particularly in the form of illegal waste dumping, which manifests in various ways. This includes deliberately mixing non-recyclable residual waste with recyclable or bio-waste, disposing of waste in others' bins or public spaces, or even transporting waste to workplaces or schools. When assessing perceptions of illegal dumping, most household and municipal respondents indicated they would not engage in dishonest waste disposal practices. However, many expressed uncertainties about the behaviour of others in this regard.

The majority of respondents (77.9%) would not consider illegal dumping of household waste, and a similar proportion (77%) rejected disposing of residual waste in others' bins. These findings reflect an ethical commitment to proper waste management, consistent with literature suggesting that ethical considerations often outweigh financial incentives in determining waste behaviour (Dijkgraaf & Gradus, 2004). Furthermore, a strong stance against mixing residual and recyclable waste (70% agreeing they would not do so) suggests that many households are inclined to comply with source separation rules if adequately supported by infrastructure and education. However, the presence of neutral opinions (8–20% across behaviours) indicates potential areas of non-compliance that could undermine PAYT's success. Although there is ongoing debate about whether PAYT increases illegal dumping (Botetzagias *et al.*, 2020), it remains a key challenge associated with PAYT implementation.

Household willingness to confront or reprimand non-compliant citizens was more divided. While 50 % expressed readiness to reprimand offenders, 36% opposed taking such action, reflecting a

hesitancy to engage in direct confrontations. This contrasts with findings in other contexts, such as Greece, where community enforcement attitudes were stronger (Kevrekidou, 2016). Cultural factors, perceptions of personal responsibility, and the social acceptability of confrontation likely influence these differences.

The strong support (76%) for punitive measures, including fines for unlawful behaviour, underscores the perceived importance of enforcement mechanisms in ensuring PAYT compliance. This aligns with findings from other studies, such as Emmanouil *et al.* (2022), which emphasise fines as an effective deterrent to illegal behaviours. These findings reinforce the importance of a comprehensive strategy for PAYT implementation, combining public education, recycling infrastructure, and enforcement mechanisms. The general willingness to comply with PAYT rules indicates strong potential for success, but the observed pockets of neutrality or non-compliance suggest a need for tailored interventions.

4.4.5 Perceived efficiency of different PAYT schemes

The study explored three main PAYT schemes - volume-based, weight-based, and hybrid - asking respondents to assess their efficiency. Most respondents supported the implementation of a weight-based scheme, ranking it as the most efficient. This preference aligns with evidence that weight-based systems, when coupled with effective waste infrastructure and a population with high environmental awareness, tend to achieve the best environmental results, such as higher recycling rates and reduced residual waste (Zeschmar-Lahl *et al.*, 2016). Respondents likely associated the word "efficiency" with these environmental benefits, as weight-based schemes offer strong incentives for households to reduce waste. However, the concept of "efficiency" extends beyond environmental outcomes, encompassing operational costs and system sustainability. While weight-based PAYT schemes provide significant waste reduction incentives, they also require more technical infrastructure, such as advanced weighing systems, which can make them more expensive than volume-based systems (EPA, 2016; Zeschmar-Lahl *et al.*, 2016). Additionally, collection efficiencies can vary depending on where the weighing system is implemented, with bin-integrated systems being more efficient than vehicle-mounted systems (Agència de Residus de Catalunya, 2010).

Beyond environmental efficiency, the economic impact of PAYT schemes remains a key concern. The overall cost-effectiveness of PAYT schemes is a subject of debate. Some studies suggest that PAYT can improve or maintain economic efficiency by reducing waste and promoting recycling (Karagiannidis *et al.*, 2008; Skumatz, 2008), while others have found the opposite, citing increased operational costs (Dahlén & Lagerkvist, 2010; Ukkonen & Sahimaa, 2015). Slavik and Pavel (2013) argue that the assumption that PAYT leads to improved economic efficiency

overlooks factors such as the falling prices of secondary raw materials and the continuing low costs of landfilling in many regions due to insufficient landfill taxes or regulations. This issue is particularly pertinent for developing countries like South Africa, where landfilling remains the least expensive waste disposal option. However, these arguments fail to account for the environmental and social costs associated with landfilling, which can be substantial. The impact of PAYT on municipal waste management costs needs careful examination, as the benefits in terms of waste reduction must be weighed against the costs of implementing and maintaining these systems. Additionally, externalities such as environmental degradation and social impacts should be factored into the costing of PAYT systems, making the analysis of their cost-effectiveness more complex.

Thus, while weight-based PAYT systems may appear to offer the most significant incentives for waste reduction and recycling, their economic viability is not guaranteed, especially in regions where landfilling remains economically attractive. A comprehensive evaluation of PAYT's broader economic impact, including both direct and indirect costs, is essential for assessing its long-term sustainability in different contexts.

4.4.6 Perceived opportunities and challenges of PAYT

The survey and follow-up interviews revealed several key opportunities for implementing PAYT systems. Significant benefits identified by respondents related to the potential for PAYT to increase waste recycling, reduce landfill usage, and raise public awareness about waste management. There is broad consensus in the literature that PAYT is effective in enhancing recycling rates and diverting waste from landfills (Slavik & Pavel, 2013).

Furthermore, respondents indicated that they believed that PAYT could potentially lead to cost savings for households, as they would pay for waste disposal based on the amount of waste they generate. Research in developed countries suggests that households can save on disposal fees when waste is minimised (Skumatz, 2008; Beukering *et al.*, 2009; Morlok *et al.*, 2017). However, Lakhani (2015) counters this by pointing out that municipal waste management costs can rise by up to 8 percent in areas where PAYT is implemented, primarily due to the additional resources required for its operation. If the costs to municipalities increase, these costs are likely to be passed onto households through higher waste tariffs. This highlights the need for further research into the operational and economic efficiencies of PAYT, particularly in developing countries where waste management services are less developed.

Another opportunity identified was the potential for increased waste beneficiation, especially through home composting. In sub-Saharan Africa, where organic waste like food scraps and yard

waste constitutes a large portion of municipal solid waste, PAYT could provide a strong incentive for households to compost these materials (Yonli & Godfrey, 2018). Composting not only diverts waste from landfills but also creates a valuable product that can be used to improve soil quality or sold for income generation.

Despite these opportunities, several challenges associated with PAYT were identified, with illegal waste dumping being the biggest concern among both householders and municipal respondents. Some studies indicate that PAYT could exacerbate illegal dumping, especially in the early stages of implementation (Skumatz, 2008). However, the evidence is mixed, with some research showing no link between PAYT and increased illegal dumping (Dijkgraaf & Gradus, 2004; Allers & Hoebe, 2010; Dahlén & Lagerkvist, 2010), while other studies acknowledge that illegal dumping may be a short-term issue. Research suggests that most illegally dumped waste consists of bulky items like furniture and appliances, which might not be adequately addressed by a PAYT system without complementary initiatives (Skumatz & Freeman, 2006). The CCT found that the most common illegally dumped materials are bulky household items and construction debris (CCT, 2023). Therefore, local authorities could complement PAYT with programmes designed to handle these types of waste. In South Africa, illegal dumping is already a significant problem, driven by inadequate waste collection services and low levels of public awareness (DEA, 2018). There is concern that PAYT could worsen this issue, particularly if municipalities lack the resources to address it. However, South Korea has seen a reduction in illegal dumping after implementing PAYT, partly due to incentives for reporting illegal waste activities, which could serve as a model for other countries (OECD, 2006).

The additional costs associated with implementing PAYT were a common concern. Many respondents feared that PAYT would lead to substantial increases in waste tariffs. This concern is not unfounded, as local authorities and landfill operators often rely on landfill fees for revenue, which can be undermined by reduced landfill use (Dunne et al., 2008). In the Netherlands, for example, the introduction of waste diversion programmes led to significant financial strain on landfill operators, who faced difficulties in meeting closure and aftercare obligations due to reduced revenue (Scharff, 2014). This highlights the need to carefully assess the financial impact of PAYT on all stakeholders, including households, waste contractors, and landfill operators, before implementation.

Several other challenges were also identified, including poverty, unemployment, inequality, and cross-subsidisation of poor households. In South Africa, where a significant portion of the population lives in poverty, municipalities are required to provide free basic waste services to indigent households, funded through central government grants and cross-subsidisation from paying customers (CCT, 2023). PAYT pricing models must take these socio-economic factors

into account to avoid exacerbating inequality. PAYT has been predominantly implemented in single-family homes and small apartment complexes where the users can be identified. However, where user(s) cannot be easily identified, such as in informal settlements, it is very difficult to attribute waste generation to individual households. However, cities can develop tailored solutions for such residents. Some respondents expressed concerns about the sustainability of the recycling economy, given that prices for recycled materials can fluctuate, potentially threatening the viability of recycling operations. This is particularly problematic in developing countries like South Africa, which rely on exporting recyclables to markets like China. The ban on certain waste imports by China since 2018 has posed challenges to the global recycling industry, but it also presents an opportunity for African countries to develop regional markets for recycling (Oelofse *et al.*, 2018).

Finally, while PAYT has been widely implemented in smaller municipalities (in developed countries), its adoption in larger cities, such as those with populations over 100 000, presents additional challenges. Larger cities must make significant efforts to gain buy-in from residents and address challenges like illegal dumping and the complexities of billing multi-family units (Sakai *et al.*, 2008). Despite these challenges, some large cities, such as those in Japan and the US, have successfully implemented PAYT. A pilot programme in Cape Town, which has a population of over 4.7 million, could provide valuable insights for scaling up PAYT in larger urban contexts. In summary, while PAYT offers numerous opportunities to improve waste management practices, particularly in terms of recycling and waste diversion, its implementation must be carefully planned to address the associated economic, social, and logistical challenges. This includes ensuring that the system does not exacerbate existing inequalities or lead to higher waste management costs, while also tackling illegal dumping and ensuring the sustainability of the recycling economy.

4.5 Chapter summary

This chapter presented and discussed the findings from the survey of CCT households, as well as the surveys and interviews with key officials from the CCT Urban Waste Management Department. Section 4.2 focused on the results of the household surveys, while Section 4.3 examined the perspectives of municipal waste management officials. The research findings indicate strong support for the implementation of PAYT as a new waste management strategy, both among municipal officials and households. Respondents identified several challenges and opportunities associated with PAYT, which will need to be addressed in the planning and implementation phases. Chapter 5 will conclude the research, offering a summary of the key findings and providing recommendations for the way forward.

CHAPTER 5 CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

Pay-as-you-throw (PAYT) is considered one of the most effective economic instruments (EIs) that can be used to move household waste up the waste management hierarchy, and also reduce waste to landfill. This research aimed to explore the perceptions of stakeholders namely, households and municipal waste officials, regarding PAYT as a fiscal instrument for household solid waste management in the City of Cape Town Metropolitan Municipality (CCT).

The findings of the research are based on survey questionnaire responses of 127 households, and ten municipal waste officials. The survey questionnaire mostly consisted of structured statements regarding different aspects of PAYT, where respondents used a 5-point Likert scale to indicate their levels of agreement with these statements. The last part of the questionnaire consisted of two open-ended questions, where respondents had to identify opportunities and challenges for PAYT implementation in the CCT.

This chapter concludes the dissertation, with Section 5.2 providing conclusions and Section 5.3 providing recommendations for PAYT implementation, and recommendations for future research.

5.2 Conclusions

The sub-sections below provide conclusions of the research about stakeholder perceptions of PAYT as a fiscal instrument for household solid waste in the CCT.

5.2.1 Perceptions about PAYT support, implementation and waste management implications

The research findings indicate strong support towards the implementation of a PAYT waste management system in Cape Town, with over 76% of household respondents agreeing or strongly agreeing with the proposal. This indicates a general willingness among residents to adopt more sustainable waste practices, particularly for weight-based PAYT systems (68%), which were favoured for their fairness and transparency. However, the shift to bag-based systems faced significant opposition (62.2%), due to concerns about practicality and convenience. Support for hybrid and multi-component billing systems was more divided, with many respondents uncertain about the complexity of these models.

Among municipal officials, while the majority (6 out of 10) expressed support for PAYT, there was less confidence in widespread household endorsement, with many officials remaining neutral or

sceptical. This uncertainty reflects concerns about the City Council's support for PAYT, which could hinder successful implementation. Regarding PAYT models, responses were mixed, with some favouring volume-based systems, while others supported weight-based approaches, particularly those using wheelie bins. Opposition was stronger for bag-based systems, with concerns over littering and disruptions to current infrastructure. The hybrid PAYT system, which combines weight or volume with frequency-based billing, garnered the most support among officials but still faced some opposition.

The literature indicates that securing buy-in and support from both households and local authorities is a significant challenge for the implementation of PAYT systems, especially in large cities (Sakai *et al.*, 2008). However, studies also suggest that once PAYT is implemented, it tends to gain popularity among residents, with public resistance decreasing as households experience the system's benefits (Skumatz, 2008; Brown & Johnstone, 2014). While the CCT is not planning to implement PAYT in the near future, the results of this study suggest that households may be receptive to such a system.

It is important to note, however, that the study's non-representative sample limits the generalisability of these findings to the broader population. Future research could benefit from using a more representative sample that includes diverse demographic sectors and income groups (see Section 5.3.2).

5.2.2 Perceptions about CCT's readiness and important factors towards PAYT implementation

In this study, the majority of household respondents expressed confidence in the CCT's ability to implement PAYT, with 39.4% agreeing and 27.6% strongly agreeing. Furthermore, 65.4% believed that CCT had the appropriate billing and cost recovery systems in place for successful implementation. While these results suggest optimism in Cape Town, some respondents remained uncertain, highlighting the need for further assurance about municipal readiness.

Among municipal officials, responses were mixed but generally positive. Five out of ten officials agreed or strongly agreed that CCT could successfully implement PAYT. However, responses about the sufficiency of CCT's billing infrastructure were less certain, with half expressing neutrality and others divided in their opinions. Additionally, when asked about the municipality's capacity to enforce fines for unlawful behaviour, half of the officials expressed confidence in CCT's ability to implement and enforce punitive measures. This aligns with research indicating that effective enforcement is key to the success of PAYT systems (Miranda & Aldy, 1998), though many South African municipalities still face challenges in this area (DEFF, 2021a). In comparison,

CCT appears relatively well-equipped to handle enforcement, but continued attention is needed to ensure that systems are fully capable of supporting PAYT.

Although the majority of household respondents and municipal officials believed that the CCT was ready to successfully implement PAYT, there are number of important factors that need to be considered first. Key important factors for PAYT implementation that the respondents agreed upon included public participation and consultation, education and awareness, transparency and access to comprehensive recycling infrastructure.

Households overwhelmingly supported the idea of public consultation (90.6%) before implementing PAYT, highlighting the need for inclusivity and public participation in policy development. This is consistent with existing literature that stresses the role of public consultation in fostering acceptance of PAYT systems (Dunne *et al.*, 2008; Brown & Johnstone, 2014). While local authorities are responsible for waste policy making at the local level, sustainable waste management strategies require integration and participation of all stakeholders. This not only create synergies, but also *“fosters greater comprehension of and support for the measures implemented, raising the probability of successful policy outcomes”* (Diaz-Farina *et al.*, 2023: 3). Therefore, a co-created PAYT policy does not only increase the efficiency of the PAYT system, but also raises the probability of acceptance and successful implementation, and also serves as means for awareness and education.

Both households and municipal officials recognised the importance of education and awareness, with over 95% of respondents agreeing that educating the public on PAYT systems is crucial for success. This reflects a shared understanding that informing citizens about the system's mechanics, benefits, and cost-reduction strategies is vital for its effective adoption.

Transparency in the pricing model for PAYT was also seen as a critical factor for successful implementation, with 93.7% of respondents agreeing that clear and transparent pricing would aid in public acceptance. Both household and municipal officials stressed the need for openness in pricing to build trust and avoid confusion.

Access to recycling infrastructure was another key factor identified, with 83% of respondents agreeing that accessible recycling facilities are crucial to reducing disposable waste. This supports the notion that improving recycling infrastructure is essential to the success of PAYT systems, as it encourages waste diversion and reduces overall disposal volumes, which are critical for the functionality of PAYT systems (Beukering *et al.*, 2009; Watkins *et al.*, 2012). While CCT has some recycling infrastructure in place, it may not be sufficient for PAYT implementation. CCT has identified that illegal dumping mainly consists of bulky household items and building

rubble (CCT, 2023). Therefore, the focus should be on managing bulk waste and improving source separation and recycling of organic waste, which makes up 57% of municipal solid waste. This would help create the conditions needed for effective PAYT implementation.

5.2.3 Perceptions about attitude regarding PAYT

The findings from both household and municipal responses indicate differing perspectives on the potential for unethical waste disposal practices under a PAYT system, with households generally showing a strong commitment to legal and ethical disposal methods, while municipal officers express more uncertainty.

Households overwhelmingly (77.9%) indicated they would not resort to illegal dumping to reduce PAYT charges, with similar attitudes towards mixing residual waste with recyclables (47.2% opposed this practice) and using other households' waste bins (77% would not engage in this). These results demonstrate that most households prioritise ethical waste disposal, despite the financial incentives to act otherwise. A majority also supported the idea of punitive measures, such as fines, to enforce compliance, with 76% agreeing that fines would be effective in reducing unlawful behaviour.

Municipal officers, however, were less confident in households' commitment to proper waste disposal. Their responses were more mixed, with many expressing uncertainties about the potential for illegal dumping or the mixing of waste to reduce charges. For example, while half of municipal officials were neutral on whether PAYT would increase illegal dumping, some believed it could. Additionally, municipal officers were split on whether households would engage in waste mixing or dispose of waste in another household's bin. This uncertainty may reflect concerns based on prior experiences or research indicating that financial incentives can sometimes lead to non-compliant behaviour.

In terms of addressing non-compliant behaviour, municipal officials and households had contrasting views. While a significant portion of households expressed a willingness to reprimand non-compliant individuals (50.4%), municipal officers were more divided, with some questioning whether such reprimands would occur in practice.

In conclusion, the findings suggest that while households generally show a strong preference for ethical waste disposal practices, municipal officers are more cautious and uncertain about the potential for non-compliance. This highlights a potential gap between official concerns and the confidence households have in adhering to waste disposal rules.

5.2.4 Perceptions about various PAYT schemes and pricing model

Household respondents favoured weight-based PAYT schemes as the most efficient (48%), followed by volume-based schemes (46%). Conversely, hybrid schemes were ranked as the least efficient by 70.6% of respondents, indicating a preference for simpler, more direct systems. These preferences were mirrored by municipal officials, with most ranking weight-based PAYT systems as the most efficient, followed by volume-based schemes, while hybrid models were seen as the least efficient.

These findings align with existing literature, which highlights the environmental effectiveness of weight-based PAYT systems, despite higher operational costs (Agència de Residus de Catalunya, 2010: 19-21). Both household and municipal respondents preferred the clarity and directness of weight-based and volume-based systems over the complexity of hybrid models, suggesting that simplicity and ease of implementation play crucial roles in the perceived efficiency and acceptance of PAYT systems.

The proposal to replace the current wheelie bins with bags for a bag-based PAYT system was not supported by respondents. As noted in the literature, the choice of PAYT system is closely linked to the type of container used for waste collection, and if a specific bin is already in place, it should remain. Instead, an automatic identification system can be added to the existing 240L wheelie bins. This suggests that if the CCT decides to implement a PAYT system, it could opt for a weight-based model while retaining the current wheelie bins and retrofitting them with user identification technology.

Regarding the pricing model, household respondents overwhelmingly preferred a single-component charge, where they would not incur any costs if they did not dispose of waste during a given month. However, experience and literature suggest that multi-component charges are more sustainable and effective in protecting the waste management system's long-term viability system (Reichenbach, 2008; Watkins *et al.*, 2012). The preference for a single-component charge may reflect a lack of understanding about the true costs of waste disposal, emphasising the need for better education on the financial and environmental impacts of waste management systems.

In conclusion, the findings suggest that while households favour simpler and more flexible systems, such as single-component pricing and retaining current bins, the effectiveness and sustainability of a PAYT system would be better supported by multi-component charges and an adapted approach to waste collection infrastructure.

5.2.5 Perceived opportunities and challenges of PAYT

The survey highlighted both opportunities and challenges for implementing PAYT in the CCT. A key opportunity identified is the potential to increase waste recycling and divert waste from landfills, which is well-documented in the literature (Noehammer & Byer, 1997; Dahlén *et al.*, 2007). Given that CCT currently diverts only about 20% of municipal solid waste from landfill (CCT, 2023), PAYT could be an effective policy tool to significantly enhance this diversion. Other opportunities include increased waste beneficiation through technologies like composting, particularly considering that organic waste constitutes a large portion of MSW in sub-Saharan Africa (Yonli & Godfrey, 2018).

Respondents also suggested that PAYT could lead to cost savings for households by charging based on waste generation, as seen in developed countries (Skumatz, 2008; Beukering *et al.*, 2009). However, concerns exist about potential increases in municipal waste management costs, which could raise household tariffs (Lakhan, 2015), emphasising the need for further research into PAYT's economic impact. Additionally, PAYT could encourage composting, particularly of organic waste, in sub-Saharan Africa, providing both environmental benefits and economic opportunities (Yonli & Godfrey, 2018).

However, several challenges emerged from the survey. Respondents expressed concerns about the potential increase in illegal dumping, higher waste costs, and tariffs, as well as the impact on the sustainability of landfill operations. The risk of illegal dumping is a significant worry for waste managers and elected officials (Linderhof *et al.*, 2001; OECD, 2006), and while households generally reported they would not engage in dishonest behaviour, both municipal officials and households were concerned about others doing so. Additionally, there were concerns regarding the sustainability of the secondary goods economy and the reliance on the export of recyclables, which could undermine the long-term viability of recycling efforts (Dunne *et al.*, 2008; Oelofse *et al.*, 2018). The impact of PAYT on landfill operations, especially in the context of South Africa's long-term zero waste goals, warrants careful consideration. Experiences from the Netherlands suggest that PAYT can negatively affect landfill operations, and lessons from these studies can inform South Africa's approach to waste management (Scharff, 2014).

In conclusion, while PAYT presents significant opportunities for improving waste management in CCT, these opportunities must be carefully balanced with the challenges identified, particularly regarding illegal dumping, waste costs, and the sustainability of the secondary goods economy.

5.3 Recommendations

Section 5.3.1 below presents the recommendations regarding the implementation of PAYT in the CCT, while Section 5.3.2 makes suggestions for future research.

5.3.1 Recommendations for PAYT implementation in the CCT

Urban waste management in South Africa faces significant challenges, including low levels of waste separation at source, insufficient recycling infrastructure and culture, and backlogs in waste service delivery (DEFF, 2021a). Successful waste reduction strategies depend on source separation, which is heavily influenced by the *"willingness and good practices among residents"* as well as market incentives for the parties involved (DEFF, 2021a: 14). While these challenges pose barriers, they also create opportunities for implementing alternative waste management strategies such as PAYT.

The following recommendations are made regarding potential PAYT implementation in CCT or other South African municipalities:

- **Enhancing source separation and recycling:** The effectiveness of PAYT depends significantly on the presence of a robust recycling infrastructure, including door-to-door or kerbside collection services for recyclables. The goal is to create an environment where households are incentivised to separate and recycle waste. While the CCT has made strides in implementing recycling infrastructure and waste billing systems, its current setup does not fully support the implementation of PAYT. Research shows that successful PAYT systems are often linked to comprehensive recycling infrastructures that incentivise both waste separation and recycling (Watkins *et al.*, 2012). South Africa's EPR regulations, introduced in 2020, further strengthen the potential for enhanced recycling. These regulations require producers to take responsibility for their products' end-of-life management, including targets for collection and recycling. Collaboration between producers, Producer Responsibility Organisations (PROs), and local authorities can reduce the financial burden of recycling on municipalities and enable a more efficient focus on organic waste diversion (DEFF, 2021b).
- **Piloting PAYT:** The implementation of PAYT in large municipalities is challenging, but literature indicates that many cities in the US, Europe, Japan, and China have successfully adopted unit-based pricing (Morlok *et al.*, 2017). With the CCT's population of approximately 4.76 million, a pilot PAYT programme would be an ideal approach to test its effectiveness. However, such pilot programmes should be implemented after significant investments in recycling infrastructure, particularly the separation of organic waste, to

ensure the success of PAYT (Beukering *et al.*, 2009). Of the three PAYT models explored, most respondents supported implementing a weight-based scheme. The CCT has adopted the 240 L wheelie bin, therefore, if PAYT is implemented, the current bin should continue to be used, and an automatic identification system can be added to it. Therefore, a weight-based PAYT scheme where the current 240 wheelie bins are fitted with identification tags, and collection vehicles fitted with weighing devices should be considered. Furthermore, most respondents rejected the replacement of 210 L wheelie bins with bags to implement PAYT.

- **Progressive investment in PAYT equipment and technologies:** Although the CCT has not yet adopted PAYT, there are opportunities for progressive investment in PAYT technology. As fleet and equipment replacements occur, CCT can integrate PAYT-enabling technologies. For example, new waste bins issued to households could be fitted with permanent user identification, and new collection vehicles could be equipped with weighing devices to track waste (Skumatz, 2008). This gradual approach can help CCT prepare for future PAYT implementation without disrupting current waste management operations.
- **Implications for informal households and backyard dwellers:** Although the CCT provides a weekly service to 100% formal households, collections and services in high-density areas including informal households and backyard dwellers remain a challenge (CCT, 2023). However, the CCT plans to roll out an additional 240L refuse containers to backyarders residing on formal private properties, and also develop an Informal Settlement Waste Management Strategy (CCT, 2023). CCT can integrate PAYT into these initiatives, for instance, CCT can issue bar-coded bins to backyarders, while informal households can be issued with at least two prepaid color-coded bags, one for dry recyclables, and another for disposal of residual waste.
- **Enhancing broader understanding of waste management costs:** Many household respondents preferred the one-component charge pricing model, which is simpler but may indicate a lack of understanding of the full costs of waste management. Municipal officials had mixed opinions on this matter, reflecting the complexity of pricing structures. Similar to utilities like water and electricity, waste management involves both fixed and variable costs, and there is a need for public education on this issue. Efforts should be made to raise awareness that waste management costs, like other essential services, include both fixed infrastructure costs and costs that vary based on service usage (Sakai *et al.*, 2008). This understanding is crucial for gaining broader public support for PAYT systems and ensuring their long-term sustainability.

5.3.2 Recommendations for further research

PAYT strategies are widely applied in developed countries, however, for developing nations, there are very few countries that have adopted unit-based pricing. In light of this, there is very limited research on PAYT from the developing country context. Therefore, key recommendations for further research include:

- **Researching a broader and more representative sample to explore stakeholders' perceptions of PAYT:** It must be noted that this research on stakeholder perceptions of PAYT is an initial study, which was limited to two stakeholder groups (households and municipal officials) in the City of Cape Town only. The PAYT concept is relatively new to South Africa, with many municipalities exploring this concept, but not implementing it yet. Furthermore, this study did not use a representative sample and cannot be generalised to the larger population in the City of Cape Town, or other municipalities in South Africa. Future research can incorporate a representative sample across various different demographic sectors and income groups for households. The research should also include informal settlements, especially since these are the areas faced with environmental degradation due to excessive illegal waste dumping. The survey should also be extended to other stakeholders such as waste industry role players, authorities, landfill operators or owners, etc.
- **Researching a broader spatial scope:** It is recommended that this research is replicated in other municipalities and provinces in South Africa. Since research on PAYT is limited in the developing country context, performing similar studies in other African municipalities may also be beneficial.
- **Researching specific financial aspects within the PAYT system:** This research was performed in the context of environmental management. Since PAYT is an economic instrument, that largely relies on financial aspects, it might be useful to do a more in-depth economic study on PAYT implementation researching the financial and socio-economic considerations for successful PAYT.
- **Researching behavioural aspects of PAYT implementation by households:** Since participation in systems such as PAYT is dependent on household behaviour, research that focuses on behavioural aspects are recommended. A framework commonly applied for behavioural research within the waste management context, is the Theory of Planned Behaviour. This framework considers intention, subjective norms, and attitudes toward changing behaviour.

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ANNEXURE A: HOUSEHOLD SURVEY

Household survey questionnaire

You are being invited to participate in a research study conducted by Ndafika Baleni, Student Number, 26324253 under the supervision of Prof. Claudine Roos, an Associate Professor in environmental management at the North-West University. The study is entitled “Exploring stakeholder perceptions of Pay-As-You-Throw (PAYT) for household solid waste management in the City of Cape Town” and aims to explore stakeholder perceptions of PAYT as a fiscal instrument for household solid waste management in the City of Cape Town Metropolitan Municipality. You were selected as a possible participant in this study because you are a City of Cape Metropolitan household with access to the internet. The research will form part of a master’s dissertation which will be submitted in partial fulfilment of the requirements for the degree Magister of Environmental Management at the North-West University.

Confidentiality

Your responses from this survey will be anonymous and be kept as confidential as possible. No individual identities will be used in any reports or publications resulting from the study. The information obtained through the survey will be used exclusively for this study and for no other purpose.

Compensation

No compensation can be offered for participation in the research.

Withdrawal

Your participation in this research is voluntary, and you may withdraw from the survey at any time and do not have to provide a reason.

Ethical clearance

This research has obtained ethical clearance, ethics number, NWU-1211-24-A9 from the Faculty of Natural and Agricultural Sciences Ethics Committee. If you have any concerns or questions in this regard, please contact Prof. Roelof Burger (roelof.burger@nwu.ac.za).

Contact details of researcher

If you have any questions or concerns about the research, please feel free to contact , Ndafika Baleni at 063 407 3131 or ndafbaleni@gmail.com or Prof. Claudine Roos, at (018) 299 1477 or claudine.roos@nwu.ac.za.

SURVEY CONSENT

The survey will take less **than 20 minutes** to complete.

I hereby give consent to participate in the research study and further confirm that I am older than 18 years of age and hereby volunteer to take part in the study.

- I agree to participate in the study.
- I disagree and do not wish to participate in the study.

Exit or next

SCREEN

Survey questionnaire

Please note that in the survey a household consists of one or more persons, family or non-family members living in the same dwelling on a regular basis.

Section A- Basic information of the respondent

1. **What is your age?**
 1. 18-39
 2. 40-49
 3. 50-59
 4. 60 or more
2. **What gender do you identify as?**
 1. Male
 2. Female
 3. Prefer not to say.
3. **What is the highest level of education that you have completed?**
 1. No formal education
 2. Primary education
 3. Secondary education (Grade 12/Matric)
 4. Tertiary education (undergraduate)
 5. Tertiary education (post-graduate)
4. **What is your current employment status?**
 1. Unemployed
 2. Self-employed
 3. Company employee
 4. Civil servant
5. **Which of these ranges best reflects the approximate combined current annual income of everyone in the household, after tax? *Please include income from all sources, including wages, government pensions, benefits, rental, and investments.***
 1. R0- R108 500 pa
 2. R108 501 to R236 900 pa
 3. R236 901 to R495 400 pa
 4. R495 401 to R995 500 pa
 5. R995 501 to R1 882 200 pa
 6. Over R1 882 200 pa

Section B : Perceptions of Pay-as-you-throw (PAYT)

In this section, you will be asked to indicate your level of agreement to specific statements related to PAYT in the City of Cape Town, where **1 = Strongly disagree**, **2 = Disagree**, **3 = Neither agree nor disagree (neutral)**, **4 = Agree**, and **5 = Strongly agree**.

PAYT also known as “unit-based pricing”, “variable rate pricing” or “volumetric tariffs” is a system in which residents pay for municipal solid waste management services per unit of waste disposed of rather than solely through a fixed flat fee. This is similar to how South Africans pay for other utilities such as water and electricity, for example. PAYT enables the residents to pay for the actual amount of waste that they dispose of.

6. **I would support the implementation of PAYT as a waste collection system in the City of Cape Town (CoCT).**

1. Strongly disagree.
 2. Disagree
 3. Neither agree nor disagree
 4. Agree
 5. Strongly agree.
- 7. I believe that the majority of households in the CoCT would support the implementation of PAYT as a waste collection system.**
1. Strongly disagree.
 2. Disagree
 3. Neither agree nor disagree
 4. Agree
 5. Strongly agree.
- 8. I believe that the City of Cape Town Metropolitan Municipality would be able to successfully apply a PAYT system for waste.**
1. Strongly disagree.
 2. Disagree
 3. Neither agree nor disagree
 4. Agree
 5. Strongly agree.
- 9. I believe that the City of Cape Town has the correct waste billing and cost recovery systems in place to enable PAYT implementation.**
1. Strongly disagree.
 2. Disagree
 3. Neither agree nor disagree
 4. Agree
 5. Strongly agree.
- 10. I believe that public consultation is important before considering policy mechanisms such as PAYT.**
1. Strongly disagree.
 2. Disagree
 3. Neither agree nor disagree
 4. Agree
 5. Strongly agree.
- 11. I believe that education and awareness of households are important before considering policy mechanisms such as PAYT.**
1. Strongly disagree.
 2. Disagree
 3. Neither agree nor disagree
 4. Agree
 5. Strongly agree.
- 12. I believe that transparency regarding the pricing model for PAYT is an important factor towards successful implementation.**
1. Strongly disagree.
 2. Disagree
 3. Neither agree nor disagree
 4. Agree
 5. Strongly agree.

- 13. I believe that access to recycling infrastructure (for paper, cardboard, plastic, etc.) is important to reduce volumes/weight of disposable waste (collected by the municipality) in support of PAYT systems.**
1. Strongly disagree.
 2. Disagree
 3. Neither agree nor disagree
 4. Agree
 5. Strongly agree.
- 14. I would not consider illegal dumping of my household waste to reduce my PAYT charges.**
1. Strongly disagree.
 2. Disagree
 3. Neither agree nor disagree
 4. Agree
 5. Strongly agree.
- 15. I would not consider mixing residual waste with recyclable waste to reduce my PAYT charges.**
1. Strongly disagree.
 2. Disagree
 3. Neither agree nor disagree
 4. Agree
 5. Strongly agree.
- 16. I would not consider disposing residual waste in another household's waste bin to reduce my PAYT charges.**
1. Strongly disagree.
 2. Disagree
 3. Neither agree nor disagree
 4. Agree
 5. Strongly agree.
- 17. I would reprimand a citizen a non-compliant citizen (i.e. those who illegally dispose of waste to reduce PAYT charges).**
1. Strongly disagree.
 2. Disagree
 3. Neither agree nor disagree
 4. Agree
 5. Strongly agree.
- 18. I believe that punitive measures such as fines for unlawful behaviour (i.e. for illegal dumping or disposal of non-recyclable waste in recycling bags/bins) would help with the successful implementation of a PAYT system.**
1. Strongly disagree.
 2. Disagree
 3. Neither agree nor disagree
 4. Agree
 5. Strongly agree.
- 19. PAYT systems can be generally categorised as volume-based schemes, weight-based schemes, or hybrid schemes.**
- **Volume-based schemes** are based on the size or volume of the container, and the container may be a bag or a bin, and these vary in size, and the cost of the container incorporates the costs of waste collection, transportation, and disposal.

- **Weight-based schemes** are like volume-based schemes regarding the choice of the container size; however, the container (usually a bin) is weighed upon collection and households billed according to the actual weight of the waste disposed of.
- **Hybrid schemes** often use a combination of volume-based schemes or weighed-based schemes with frequency of collection, and households can choose from various hybrid schemes available from the municipality and are billed accordingly.

Please rate the three different schemes regarding their possible efficiency with 1 being the most efficient and 3 being the least efficient.

	1	2	3
Volume-based PAYT			
Weight-based PAYT			
Hybrid PAYT			

20. I would support the implementation of a volume based PAYT system where charges are based on the volume of waste bins.

1. Strongly disagree.
2. Disagree
3. Neither agree nor disagree
4. Agree
5. Strongly agree.

21. I would support the implementation of a weight based PAYT system, where waste bins are equipped with identification codes (e.g., barcodes, QR codes) for tracking purposes and are weighed during collection (e.g. vehicles retrofitted with weighing systems).

1. Strongly disagree.
2. Disagree
3. Neither agree nor disagree
4. Agree
5. Strongly agree.

22. I would support the implementation of a weight-based PAYT system, where wheelie bins are replaced by a bag-system.

1. Strongly disagree.
2. Disagree
3. Neither agree nor disagree
4. Agree
5. Strongly agree.

23. I would support the implementation of a hybrid PAYT system where a combination of weight or volume, and frequency is used to bill households for waste collection and disposal.

1. Strongly disagree.
2. Disagree
3. Neither agree nor disagree
4. Agree
5. Strongly agree.

24. PAYT charges can be either one-component or multi-component. One-component charges are fully variable, based solely on bin or container volume/weight, with no fixed charge. That means that if households do not dispose of any waste, there is no charge. I would support one-component charges for PAYT for waste.

1. Strongly disagree.
2. Disagree
3. Neither agree nor disagree
4. Agree
5. Strongly agree.

25. PAYT charges can be either one-component or multi-component. Multi-component charges include fixed costs (e.g., administration, bin rental) and variable costs (e.g., weight-based, volume-based). I would support multi-component charges for PAYT for waste.

1. Strongly disagree.
2. Disagree
3. Neither agree nor disagree
4. Agree
5. Strongly agree.

Section C: Opportunities and challenges for Perceptions of Pay-as-you-throw (PAYT) for household solid waste management in the City of Cape Town

26. In your opinion, what are the opportunities for Pay-As-You-Throw (PAYT) for household solid waste management in the City of Cape Town?

Text

27. In your opinion, what are the challenges for Pay-As-You-Throw (PAYT) for household solid waste management in the City of Cape Town? *

Text

You have reached the end of the survey and thank you for your time and support for this study.

If you have any questions or concerns about the research, please feel free to contact the researcher, Ndafika Baleni at 063 407 3131 or ndafbaleni@gmail.com or his supervisor, Prof. Claudine Roos, at (018) 299 1477 or claudine.roos@nwu.ac.za.

ANNEXURE B: MUNICIPAL OFFICIAL SURVEY

Municipal personnel survey questionnaire

You are being invited to participate in a research study conducted by Ndafika Baleni, Student Number, 26324253 under the supervision of Prof. Claudine Roos, an Associate Professor in environmental management at the North-West University. The study is entitled “Exploring stakeholder perceptions of Pay-As-You-Throw (PAYT) for household solid waste management in the City of Cape Town”. The study aims to explore stakeholder perceptions of PAYT as a fiscal instrument for household solid waste management in the City of Cape Town Metropolitan Municipality. •You were selected as a possible participant in this study because you are employed by the City of Cape Metropolitan in the following departments, Waste Services, Finance (budget), and Environmental Management departments. The research will form part of a master’s dissertation which will be submitted in partial fulfilment of the requirements for the degree Magister of Environmental Management at the North-West University.

Confidentiality

Your responses from this survey will be anonymous and be kept as confidential as possible. No individual identities will be used in any reports or publications resulting from the study. The information obtained through the survey will be used exclusively for this study and for no other purpose.

Compensation

No compensation can be offered for participation in the research.

Withdrawal

Your participation in this research is voluntary, and you may withdraw from the survey at any time and do not have to provide a reason.

Ethical clearance

This research has obtained ethical clearance, ethics number, NWU-1211-24-A9 from the Faculty of Natural and Agricultural Sciences Ethics Committee. If you have any concerns or questions in this regard, please contact Prof. Roelof Burger (roelof.burger@nwu.ac.za).

Contact details of the researcher

If you have any questions or concerns about the research, please feel free to contact, Ndafika Baleni at 063 407 3131 or ndafbaleni@gmail.com or Prof. Claudine Roos, at (018) 299 1477 or claudine.roos@nwu.ac.za.

SURVEY CONSENT

The survey will take less **than 20 minutes** to complete.

I hereby give consent to participate in the research study and further confirm that I am older than 18 years of age and hereby volunteer to take part in the study.

- I agree to participate in the study.
- I disagree and do not wish to participate in the study.

Exit or next

SCREEN

Survey questionnaire

Section A- Basic information of the respondent

1. **What is your age?**
 1. 18-39
 2. 40-49
 3. 50-59
 4. 60 or more
2. **What gender do you identify as?**
 1. Male
 2. Female
 3. Prefer not to say.
3. **What is the highest level of education that you have completed?**
 1. No formal education
 2. Primary education
 3. Secondary education (Grade 12/Matric)
 4. Tertiary education (undergraduate)
 5. Tertiary education (post-graduate)
4. **How many years have you been working for the City of Cape Town?**
 1. 0 to 2 years
 2. 3 to 5 years
 3. 6 to 10 years
 4. More than 10 years
5. **Which department at the City of Cape Town do you currently work for?**
 1. Finance Department
 2. Environmental Management Department
 3. Waste Services Department
 4. Other Department

Section 2: Perceptions of Pay-as-you-throw (PAYT)

In this section, you will be asked to indicate your level of agreement to specific statements related to PAYT in the City of Cape Town, where **1 = Strongly disagree**, **2 = Disagree**, **3 = Neither agree nor disagree (neutral)**, **4 = Agree**, and **5 = Strongly agree**.

PAYT also known as “unit-based pricing”, “variable rate pricing” or “volumetric tariffs” is a system in which residents pay for municipal solid waste management services per unit of waste disposed of rather than solely through a fixed flat fee. This is similar to how South Africans pay for other utilities such as water and electricity, for example. PAYT enables the residents to pay for the actual amount of waste that they dispose of.

6. **. I would support the implementation of PAYT as a waste collection system in the City of Cape Town (CoCT).**
 1. Strongly disagree.
 2. Disagree
 3. Neither agree nor disagree
 4. Agree
 5. Strongly agree.

7. **I believe that the majority of households in the City of Cape Town would support the implementation of PAYT as a waste collection system.**
 6. Strongly disagree.
 7. Disagree
 8. Neither agree nor disagree
 9. Agree
 10. Strongly agree.
8. **I believe that the City Council of CCT would support the implementation of PAYT as a waste collection system.**
 1. Strongly disagree.
 2. Disagree
 3. Neither agree nor disagree
 4. Agree
 5. Strongly agree
9. **I do not believe that reliance on landfill revenue by the CoCT would be a barrier to PAYT implementation in the municipality.**
 1. Strongly disagree.
 2. Disagree
 3. Neither agree nor disagree
 4. Agree
 5. Strongly agree.
10. **I believe that the City of Cape Town Metropolitan Municipality would be able to successfully apply a PAYT system for waste.**
 6. Strongly disagree.
 7. Disagree
 8. Neither agree nor disagree
 9. Agree
 10. Strongly agree.
11. **I believe that the City of Cape Town has the correct waste billing and cost recovery systems in place to enable PAYT implementation.**
 1. Strongly disagree.
 2. Disagree
 3. Neither agree nor disagree
 4. Agree
 5. Strongly agree.
12. **I believe that public consultation is important before considering policy mechanisms such as PAYT.**
 1. Strongly disagree.
 2. Disagree
 3. Neither agree nor disagree
 4. Agree
 5. Strongly agree.
13. **I believe that education and awareness of households are important before considering policy mechanisms such as PAYT.**
 1. Strongly disagree.
 2. Disagree
 3. Neither agree nor disagree
 4. Agree
 5. Strongly agree.

14. I believe that transparency regarding the pricing model for PAYT is an important factor in successful implementation.

1. Strongly disagree.
2. Disagree
3. Neither agree nor disagree
4. Agree
5. Strongly agree.

15. I believe that access to recycling infrastructure (for paper, cardboard, plastic, etc.) is important to reduce volumes/weight of disposable waste (collected by the municipality) in support of PAYT systems.

1. Strongly disagree.
2. Disagree
3. Neither agree nor disagree
4. Agree
5. Strongly agree.

16. I do not believe that CoCT households would consider illegal dumping their waste to reduce PAYT charges.

1. Strongly disagree.
2. Disagree
3. Neither agree nor disagree
4. Agree
5. Strongly agree.

17. I do not believe that illegal dumping in the CCT would increase due to PAYT.

6. Strongly disagree.
7. Disagree
8. Neither agree nor disagree
9. Agree
10. Strongly agree.

18. I do not believe that CoCT households would consider mixing residual waste with recyclable waste to reduce PAYT charges.

1. Strongly disagree.
2. Disagree
3. Neither agree nor disagree
4. Agree
5. Strongly agree.

19. I do not believe that CoCT households would consider disposing of residual waste in another household's waste bin to reduce PAYT charges.

1. Strongly disagree.
2. Disagree
3. Neither agree nor disagree
4. Agree
5. Strongly agree.

20. I believe that citizens would reprimand one another for non-compliant behaviour (i.e. those who illegally dispose of waste to reduce PAYT charges.

1. Strongly disagree.
2. Disagree
3. Neither agree nor disagree
4. Agree
5. Strongly agree.

21. I believe that the municipality has the capacity to enforce punitive measures such as fines for unlawful behaviour (i.e. for illegal dumping or disposal of non-recyclable waste in recycling bags/bins) would help with the successful implementation of a PAYT system.

1. Strongly disagree.
2. Disagree
3. Neither agree nor disagree
4. Agree
5. Strongly agree.

22. PAYT systems can be generally categorised as volume-based schemes, weight-based schemes, or hybrid schemes.

- **Volume-based schemes** are based on the size or volume of the container, and the container may be a bag or a bin, and these vary in size, and the cost of the container incorporates the costs of waste collection, transportation, and disposal.
- **Weight-based schemes** are like volume-based schemes regarding the choice of the container size; however, the container (usually a bin) is weighed upon collection, and households are billed according to the actual weight of the waste disposed of.
- **Hybrid schemes** often use a combination of volume-based schemes or weighed-based schemes with the frequency of collection, and households can choose from various hybrid schemes available from the municipality and are billed accordingly.

Please rate the three different schemes regarding their possible efficiency with 1 being the most efficient and 3 being the least efficient.

	1	2	3
Volume-based PAYT			
Weight-based PAYT			
Hybrid PAYT			

23. I would support the implementation of a volume-based PAYT system where charges are based on the volume of waste bins.

6. Strongly disagree.
7. Disagree
8. Neither agree nor disagree
9. Agree
10. Strongly agree.

24. I would support the implementation of a weight-based PAYT system, where waste bins are equipped with identification codes (e.g., barcodes, QR codes) for tracking purposes and are weighed during collection (e.g. vehicles retrofitted with weighing systems).

6. Strongly disagree.
7. Disagree
8. Neither agree nor disagree
9. Agree
10. Strongly agree.

25. I would support the implementation of a weight-based PAYT system, where wheelie bins are replaced by a bag system.

6. Strongly disagree.
7. Disagree

- 8. Neither agree nor disagree
 - 9. Agree
 - 10. Strongly agree.
- 26. I would support the implementation of a hybrid PAYT system where a combination of weight volume, and frequency is used to bill households for waste collection and disposal.**
- 6. Strongly disagree.
 - 7. Disagree
 - 8. Neither agree nor disagree
 - 9. Agree
 - 10. Strongly agree.
- 27. PAYT charges can be either one-component or multi-component. One-component charges are fully variable, based solely on bin or container volume/weight, with no fixed charge. That means that if households do not dispose of any waste, there is no charge. I would support one-component charges for PAYT for waste.**
- 6. Strongly disagree.
 - 7. Disagree
 - 8. Neither agree nor disagree
 - 9. Agree
 - 10. Strongly agree.
- 28. PAYT charges can be either one-component or multi-component. Multi-component charges include fixed costs (e.g., administration, bin rental) and variable costs (e.g., weight-based, volume-based). I would support multi-component charges for PAYT for waste.**
- 6. Strongly disagree.
 - 7. Disagree
 - 8. Neither agree nor disagree
 - 9. Agree
 - 10. Strongly agree.

Section C: Opportunities and challenges for Perceptions of Pay-as-you-throw (PAYT) for household solid waste management in the City of Cape Town

- 29. In your opinion, what are the opportunities for Pay-As-You-Throw (PAYT) for household solid waste management in the City of Cape Town?**

Text

- 30. In your opinion, what are the challenges for Pay-As-You-Throw (PAYT) for household solid waste management in the City of Cape Town? ***

Text

You have reached the end of the survey and thank you for your time and support for this study. Please click submit below to submit your responses.

>>Submit

ANNEXURE C: INVITATION TO PARTICIPATE IN THE RESEARCH WITH QR CODE

Good day,

You are invited to participate in a research study on *“Exploring stakeholder perceptions of Pay-As-You-Throw (PAYT) for household solid waste management in the City of Cape Town”* conducted by Ndafika Baleni (student number: 26324253) under the supervision of Prof. Claudine Roos. The research will form part of a dissertation which will be submitted in partial fulfilment of the requirements for the degree Magister of Environmental Management with a Specialisation in Waste Management at e North-West University. Please see further background information about the project, the anonymity of research participants, and the right to withdraw from the research in the introduction to the survey.

The study aims to explore stakeholder perceptions of Pay-As-You-Throw (PAYT) as a fiscal (financial) instrument for household solid waste management in the City of Cape Town Metropolitan Municipality (CoCT).

You were selected as a possible participant in this study because you are a City of Cape Metropolitan household with access to the internet. It will not take longer than 5 minutes to complete the survey.

Please scan the QR code below to complete the survey.



Please remember to click the “submit” button after completing the survey.

ANNEXURE D: RESEARCH APPROVAL REQUEST



CITY OF CAPE TOWN
ISIXEKO SASEKAPA
STAD KAAPSTAD

Date : 19 June 2024
To : Director: Policy & Strategy
Reference : PSRR-1134 (ORP- hybrid)

Research Approval Request

In terms of the City of Cape Town System of Delegations (June 2023) - Part 35, No 2 Subsection 2, 3 and 4 "Research;

- (2) To consider any request for the commissioning of an organizational wide (excluding directorate specific) research report in the City and to approve or refuse such a request.
- (3) To grant authority to external parties that wish to conduct research within the City of Cape Town and/or publish the results thereof.
- (4) In consultation with the relevant Executive Director, grant permission to employees of the City of Cape Town to conduct research, surveys etc. related to their studies, within the relevant directorate.

The Director: Policy & Strategy is hereby requested to consider, in terms of sub-section 3, the request received from

Name	: Ndafika Baleni
Designation	: Masters candidate
Affiliation	: North-West University
Research Title	: "Exploring stakeholder perceptions of Pay-As-You-Throw (PAYT) for household solid waste management in the City of Cape Town"

Taking into account the recommendations below:

Recommendations

The City via the Director: Policy & Strategy grant permission to Ndafika Baleni, Masters candidate at North-West University, to undertake research subject to the following conditions:

General conditions

- Engagement is limited to the scope and scale of the study, and restricted to the participants' professional input;
- Additional CCT respondents or data to be identified and line approval sought via an addendum to initial (approved) request;
- Clear acknowledgement in the research report that the analysis generated from City data does not constitute official CCT policy;
- Clear acknowledgement in the research report that views of the CCT officials are not interpreted as official CCT policy where interviews are granted;
- Interviews and/or participation from CCT staff are not to interfere with staff assigned work and tasks;

POPIA compliance

- The researcher to familiarise him/herself with and ensure POPIA compliance, which is to be strictly and fully adhered to;

Limitations

- Approval is subject to staff capacity (time and resource availability) and the willingness of City officials to participate in the research, on a voluntary basis;
- The use of direct quotations in the report to be agreed in advance and in writing by the respondent concerned, and any text for direct quotation/s must be verified and signed off ahead of any publication of the report;
- City officials and their inputs, including any quotations, are to be anonymised, and referenced by the functional role, and not by name or designation in the City;
- The City logo and brand, not be used in the research publication unless with the City's consent;

Future obligations

CIVIC CENTRE IZIKO LEENKONZO ZOLUNTU BURGERSENTRUM
12 HERTZOG BOULEVARD CAPE TOWN 8001 PRIVATE BAG X9181 CAPE TOWN 8000
www.capetown.gov.za

Making progress possible. Together.

- The City, will have no current and/or future obligation to either fund, avail resources, or to partner with the researcher or another party/entity partaking in the research as a whole or partially. This also includes any findings or recommendation for implementation;	
CCT Engagements - For the Waste Services Department, the identification of officials for surveys and interviews is to be advised by Tsogghfa Leite via Tsogghfa.Leite@capetown.gov.za; - Urban Waste Management requires that Themba Mbasa and/or Mawande Myti be included as participants; - Researcher has approval to implement a survey and undertake one follow-up interview with a maximum of 20 CCT Waste officials; - Surveys are to be capped at 20 minutes per survey and interviews to be capped at 30 minutes per interview; - The request for the distribution of the survey link to Cape Town households is declined; - All applicants to be available to share a presentation on request by the CCT line department, on a shared platform;	
Sharing of research products - Pre final analysis of the data to be shared with the Waste Services Department such as a findings report and/or presentation, via the designated contact person(s) for information; - The final draft of the academic paper and any other related future publications to be submitted to the Waste Services Department and the Research Branch, for information; - Submission of the completed research report to the Policy and Strategy Director, and the Manager: Research, Policy and Strategy, within 3 months of completion of the research report;	
Validity of Approval - If approved, the approval is effective from date of signature/acceptance of the recommendations by the researcher, and is valid for three years, only if: a) The scope and scale has not been amended; b) The primary researcher(s) has not changed;	
Delegated authority: Approved ☒ Comment: Note that distribution of survey to households is not approved: _____ Not Approved ☐ Comment: _____ Hugh Cole: Dir. Policy & Strategy: Hugh Cole Digitally signed by Hugh Cole Date: 2024.06.19 16:19:48 +02'00' Acceptance by Applicant: I, NDAFIKA BALEM confirm that I agree to abide by the conditions as stipulated above. Applicant:  Date: 20 JUNE 2024	
CCT departments: No interviews or data to be provided without proof of acceptance of the conditions under which the research permission is granted. Kindly return signed copy to Aaishah.Petersen@capetown.gov.za	