Technical Guidance

Pay As You Throw System Implementation

Brazil

Elaborated by: Consortium, ECOGESTUS - Resíduos, Estudos e Soluções Lda.; ARS ambiente; ENT Environment & management

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ABOUT

About Clean Air Task Force

Clean Air Task Force (CATF) is a global nonprofit organization working to safeguard against the worst impacts of climate change by catalysing the rapid development and deployment of low-carbon energy and other climate protection technologies. With 25 years of internationally recognized expertise on climate policy and a fierce commitment to exploring all potential solutions, CATF is a pragmatic, non-ideological advocacy group with the bold ideas needed to address climate change. CATF has offices in Boston, Washington D.C., and Brussels, with staff working virtually around the world. For more information, visit www.catf.us.

About ECOGESTUS, ARS, ENT and THINKCities Consulting

ECOGESTUS, headquartered in Portugal, is a company specializing in environmental and waste management, operating through multidisciplinary teams with consolidated experience since 2005. We develop sustainable technical solutions, tailored to the specificities of each territory, integrating expertise in the areas of engineering, biology, architecture, and planning, with a strong foundation in fieldwork.

We collaborate with municipalities, private companies, NGOs, and international organizations, both in Portugal and internationally, with projects developed in Africa, namely in Mozambique, São Tomé and Príncipe, the Democratic Republic of Congo, and Nigeria. Our solutions promote efficiency in resource management, the circular economy, the inclusion of local communities, and the environmental and socioeconomic enhancement of territories.

ARS Ambiente is an environmental consulting and engineering company with over 20 years of experience in integrated waste management and the circular economy. It supports public and private entities in the planning, development, and implementation of technical, economic, and regulatory solutions focused on the sustainable management of waste.

The company has a multidisciplinary team specializing in selective collection projects, defining and waste tariffs, preparing and monitoring bidding processes, planning waste management systems, and developing projects for treatment facilities and plants. ARS Ambiente also offers technical and legal consulting, ensuring regulatory compliance and supporting strategic decision-making.

ENT – Environment & Management is a socio-economic initiative operating through a consultancy and a foundation, with proven experience in the development, analysis, and management of environmental policies. The organization has a highly qualified multidisciplinary team capable of responding to complex technical challenges in the areas of sustainability, circular economy, and environmental management.

ENT is strongly involved in Research and Development (R&D) projects, ensuring an evidence-based approach, with results published in leading publications and at technical and scientific events.

THINKCities Consulting provides advice and strategic guidance to cities, towns and communities focused on sustainability and climate resilience. We work directly with municipal decision makers and municipal service departments as well as with the international donor community and other organizations and firms that support urban sustainability efforts.

PROJECT TEAM

Clean Air Task Force

Paula García Holley, Latin America Policy Senior Manager, Methane Pollution Prevention Team

Kait Siegel, Director Waste Methane, Methane Pollution Prevention Team

Chris Godlove, THINKCities Consulting

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Consortium – Technical Authors

João Vaz – ECOGESTUS – Resíduos, Estudos e Soluções

Ignasi Puig – ENT Environment & Management

Maria Calaf – ENT Environment & Management

Michele Giavini – ARS Ambiente

Abbreviations and Acronyms

AD – Anaerobic Digestion
APP – Application (mobile or web-based)
ARS – ARS Ambiente Srl
BAYT – Benefit As You Throw
BRL – Brazilian Real
CATF – Clean Air Task Force
CH_4 – Methane
CO_2 – Carbon Dioxide
DtD / Door-to-Door – Door-to-Door (collection system)
DIFTAR – Differentiated Tariff (Dutch PAYT system; "Gedifferentieerde Tarieven")
ECOGESTUS – ECOGESTUS – Resíduos, Estudos e Soluções Lda.
ENT – ENT Environment & Management
EPR – Extended Producer Responsibility
EU – European Union
GHG – Greenhouse Gas
GIS – Geographic Information System
GIZ – Deutsche Gesellschaft für Internationale Zusammenarbeit (German Development Cooperation)
HF – High Frequency (RFID technology)
IBGE – Instituto Brasileiro de Geografia e Estatística (Brazilian Institute of Geography and Statistics)
ICT – Information and Communication Technology
ID – Identification
IPTU – The Urban Property Tax
KAYT – Know As You Throw
LF – Low Frequency
LGPD – Lei Geral de Proteção de Dados (Brazilian General Data Protection Law)
LIFE – EU LIFE Programme (EU funding instrument for environment and climate)
LP – Light Packaging
MBT – Mechanical-Biological Treatment
MMA – Ministério do Meio Ambiente e Mudança do Clima (Brazilian Ministry of Environment and Climate Change)
MNCR – Movimento Nacional dos Catadores de Materiais Recicláveis (National Movement of Waste Pickers)
MOPA – Monitoria Participativa (Participatory Monitoring Platform)
MSW – Municipal Solid Waste
NFC – Near Field Communication
NGO – Non-Governmental Organization
OECD – Organisation for Economic Co-operation and Development
PAYT – Pay As You Throw
PET – Polyethylene Terephthalate
PLANARES – Plano Nacional de Resíduos Sólidos (National Solid Waste Plan)
PLANARO – Plano Nacional de Redução e Reciclagem de Resíduos Orgânicos Urbanos (National Plan for the Reduction and Recycling of Municipal Organic Waste Plan – under formal approval)
PNRS – Política Nacional de Resíduos Sólidos (National Solid Waste Policy – Law No. 12.305/2010)
QR (Code) – Quick Response Code
Residual waste – nonrecyclable waste
RFID – Radio Frequency Identification Device
RW – Residual Waste
SaaS – Software as a Service
SAYT – Save As You Throw,
SEEG – Sistema de Estimativas de Emissões e Remoções de Gases de Efeito Estufa (Brazil's Greenhouse Gas Emissions and Removals Estimation System)
SME – Small and Medium-sized Enterprise
TCL – Taxa de Coleta de Lixo (Municipal Waste Collection Fee)
TCRS – Taxa de Coleta de Resíduos Sólidos (Municipal Solid Waste Collection Fee – alternative denomination)
ToR – Terms of Reference
TTC – Transforming Tanzania Cities (Programme)
UHF – Ultra-High Frequency (RFID technology)
UN – United Nations
UNICATADORES – União Nacional das Cooperativas de Catadores (National Union of Waste Pickers Cooperatives)
UNEP – United Nations Environment Programme
USD – United States Dollar
VA – Variable Component (of the waste fee, contextual usage)
WasteMAP – Waste Methane Assessment Platform
WRAP - Waste and Resources Action Programme

Short Glossary:

PAYT - Pay As You Throw A waste fee system in which users pay according to the amount and type of waste they generate, rather than a flat rate. By linking cost directly to waste production, PAYT operationalises the polluter-pays principle and creates financial incentives for waste reduction and source separation.

SAYT — Save As You Throw A variant of PAYT that emphasises savings rather than charges. Instead of paying more for generating more waste, users receive discounts, rebates, or credits when they reduce residual waste or increase separate collection. SAYT is particularly effective in contexts where punitive mechanisms face low social acceptance.

KAYT — Know As You Throw An information-based approach in which users receive regular feedback on their own waste generation patterns — through apps, SMS, or public dashboards — compared to neighbourhood averages. KAYT does not involve direct charges or rewards; its behavioural lever is transparency and social comparison. It is often used as a preparatory step before introducing full PAYT schemes.

Residual Waste (RW) The fraction of municipal solid waste that remains after all separate collection streams — organic waste, recyclables (paper, cardboard, glass, plastics, metals), and other recoverable fractions — have been diverted. Residual waste cannot be further sorted or recovered under current conditions and is typically sent to landfill, incineration, or other final disposal. In PAYT systems, residual waste is always the primary charged fraction, as reducing it is the central environmental and behavioural objective of the scheme.

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1 Executive Summary

1.1 Context and rationale

Brazil's municipal solid waste sector remains constrained by high reliance on landfills and open dumpsites, low coverage of separate collection (only 36% of the population), and weak cost recovery (only ~8% of municipalities are financially self-sufficient on waste fees).

Organic waste makes up about 45% of MSW and is a relevant source of methane emissions — a greenhouse gas with over 80 times the warming potential of CO_2 over 20 years, so PAYT systems can be used to increase separate organic collection.

PAYT (Pay-As-You-Throw) schemes link waste service charges to the amount and type of waste each user generates, applying the polluter-pays principle and creating direct incentives for reduction, source separation and organic diversion.

This guidance translates international experience into a practical roadmap for Brazil, aligned with PNRS, PLANARES, the forthcoming PLANARO and the Basic Sanitation Legal Framework (Law No. 14.026/2020).

1.2 PAYT models and complementary instruments

Two main families of PAYT exist: container-identification systems (door-to-door collection with RFID-tagged bins or prepaid/postpaid bags) and user-identification systems (locked containers with access control.

Residual waste is always the primary charged fraction; organic waste should generally not be charged at household level thus incentivizing its separate collection as long as proper waste treatment (composting, digestion) is available.

Complementary approaches — information feedback, using nudging elements, are especially relevant lever in Brazilian and Global South contexts.

1.3 Key enabling conditions for Brazil

PAYT is usually the last step in the path towards an advanced waste management scheme. Some preconditions apply as follows:

- Organic waste collection first
- Dedicated waste fee, charge must be visible, and oriented to full cost recovery.
- Integration of waste pickers (“catadores”) cooperatives providing community trust, sorting quality and social legitimacy.
- PAYT should be designed so that cooperatives benefit from improved separation outcomes
- Fit technology to capacity: start low-tech (volume based, stickers) and migrate to RFID or locked containers only after system maturity allows it

1.4 International lessons and expected results

Case studies show consistent outcomes when preconditions are met: Parma, in Italy, cut residual waste by 47% and reached >80% separate collection; Bergamo gained 5 points of separate collection with a low-tech KAYT bag system; Santa Cruz–Galápagos (EC), the first Latin American PAYT, raised cost recovery from 45% to >80% in one year; Dar es Salaam (TZ) increased identified users and revenue coverage; Argentona (Catalunya, Spain) reached 87.6% separate collection with prepaid bags. Across contexts, expected trends include declining total and residual waste, rising organic and recyclable capture, and significant methane emission reductions.

1.5 Strategic recommendations for Brazil

Brazil is well positioned to lead South–South PAYT innovation thanks to PNRS, PLANARES and the forthcoming PLANARO, combined with strong cooperative networks and access to climate finance.

The incremental cost of implementing medium-technology PAYT systems is estimated, in Europe, at approximately €5 (29 BRL) per capita per year — a modest share of total waste management costs, though one that requires careful calibration in the Brazilian context where waste disposal (Landfill, Dumpsites) remains inexpensive and organic waste treatment is only available in a few places.

Priority next steps: (i) identify candidate pilot municipalities based on objective readiness criteria; (ii) build capacity through ENAP and a national PAYT learning platform, enhancing previous activities in this field; (iii) run feasibility and equity impact assessments; (iv) launch co-designed demonstration projects with cooperatives and service operators; (v) start with simple, transparent models, door-to-door (tag/frequency-based) coupled with social safeguards for low-income households and informal settlements.

PAYT pilots would close a major global evidence gap and establish Brazil as a regional benchmark for inclusive, climate-aligned waste governance.

2 Introduction

Brazil's solid waste sector stands at a critical intersection of environmental, social, and fiscal challenges. Municipal solid waste management remains marked by high dependence on landfilling and open dumpsites, limited coverage of separate collection systems, and structural difficulties in achieving full cost recovery for urban cleaning services. At the same time, organic waste represents the largest fraction (approximately 45%[1] of municipal solid waste in Brazil) and is an important source of methane emissions, a greenhouse gas with a global warming potential more than 80 times higher than carbon dioxide over a 20-year period.[2] Reducing methane emissions from waste is therefore both a climate imperative and an opportunity to strengthen circular economy practices.

Pay-As-You-Throw (PAYT) systems emerge as a strategic economic and governance instrument. PAYT links the cost of waste services to the amount and type of waste generated, creating direct incentives for waste reduction, source separation, recycling, and organic waste diversion. International experience shows that, when properly designed and supported, PAYT can significantly reduce residual waste (RW).

In Brazil, PAYT must fit into existing policy frameworks, including the National Solid Waste Policy (Política Nacional de Resíduos Sólidos – PNRS), the National Solid Waste Plan (Plano Nacional de Resíduos Sólidos – PLANARES), the forthcoming National Plan for the Reduction and Recycling of Municipal Organic Waste (PLANARO), and the Basic Sanitation Legal Framework (Law No. 11.445/2007). These instruments already establish the principles of waste hierarchy, shared responsibility, cost recovery, and methane reduction.

PAYT is also a behavioral and social policy tool. By providing clear feedback and, when combined with separate collection of organic waste, composting, and complementary approaches such as Save-As-You-Throw (SAYT) and Know-As-You-Throw (KAYT), PAYT can contribute directly to improved recycling performance and social inclusion, particularly through the integration of waste pickers and cooperatives.

Purpose and scope of this guidance

The objective of this technical guidance is to provide decision-makers, municipal practitioners, and stakeholders with a structured, practical, and context-sensitive overview of PAYT systems and their potential application in Brazil. The document draws on international experience, behavioral science, legal and economic analysis, and South–South case studies, with a particular emphasis on the role of organic waste management as a prerequisite for effective PAYT implementation.

The report is organized as follows:

- Chapters 2–3 introduce the PAYT concept and frame it as a tool for behavioral change, environmental justice, and methane reduction in the Brazilian context.
- Chapters 4–5 examine the regulatory framework and international experience,

[1] Ministério do Meio Ambiente. (2025). Plano setorial de mitigação e adaptação à mudança do clima para a consolidação de uma economia de baixa emissão de gases de efeito estufa no setor de resíduos sólidos e efluentes domésticos [Sectoral plan for climate change mitigation and adaptation toward a low-emission economy in the solid waste and domestic effluents sector]. Governo Federal do Brasil. https://www.gov.br/mma/pt-br/centrais-de-conteudo/publicacoes/mudanca-do-clima/plano-setorial-residuos-solidos-efluentes-domesticos.pdf

[2] Unless otherwise stated, numerical values in this document follow the U.S. numerical convention (comma as the thousands separator and dot as the decimal separator).

highlighting lessons relevant to Brazil and other Global South contexts.

- Chapters 6–9 provide a detailed technical overview of PAYT system types, available technologies, and fee design options, including the treatment of different waste fractions.
- Chapters 10–12 address legal, institutional, and economic aspects of PAYT implementation, including cost recovery and investment considerations.
- Chapters 13–15 analyze expected impacts on waste flows, greenhouse gas emissions, communication strategies, enforcement, and complementary economic instruments such as landfill taxes and feebate schemes.
- Chapters 16–18 focus on South–South learning, implementation pathways, and concrete recommendations for piloting and scaling PAYT in Brazil.

The Annexes present detailed case studies, technical references, and supporting tools to assist municipalities in feasibility assessment and stakeholder engagement. By linking economic incentives, behavioral insights, and organic waste management, this guidance positions PAYT not merely as a pricing mechanism, but as a lever for systemic transformation of municipal solid waste management in Brazil.

3 What is PAYT

Waste charges paid by households and commercial activities are crucial to ensure sufficient and stable funding for the collection and treatment services provided by local authorities.

Pay-As-You-Throw (PAYT) schemes are a subset of waste charges in which users pay according to the estimated amount and type of waste they produce. PAYT promotes fairness and responsibility and creating incentives to reduce waste and increase separate collection. This, in turn, leads to higher recycling and composting rates and, therefore, lower volumes sent to final disposal and reduced methane emissions.

This mechanism is grounded in the polluter-pays principle: those who generate more waste, or generate it less responsibly, bear a larger share of the service cost. By directly linking cost to the quantity and type of waste produced, PAYT turns a legal principle into a tangible, everyday financial incentive for users.

Beyond PAYT, complementary approaches apply the same behavioral logic through other means: SAYT (Save As You Throw) rewards waste reduction through discounts rather than additional charges; KAYT (Know As You Throw) informs users about their own generation patterns, without any direct charge or reward; and BAYT (Benefit As You Throw) offers tangible benefits — such as credits or vouchers — to those who reduce or better separate their waste. These approaches are detailed in section 5.3.

PAYT is not merely a waste management strategy; it is a governance tool that can drive systemic transformation in Brazilian municipalities by increasing awareness and motivating those willing to adopt more sustainable waste practices.

The objective of this guide is to provide an overall view of PAYT schemes and how they can be implemented in Brazil. First, it highlights the importance of behavioral change, as individuals perceive a direct connection between their daily waste habits and financial consequences. Second, it assesses the conditions required to implement PAYT effectively.

4 Regulatory Framework

4.1 PAYT as part of economic instruments to promote adequate waste management

Brazil's solid waste management is currently based on the established principles of shared responsibility, waste management hierarchy, and financial sustainability. However, despite the comprehensive policy landscape, major challenges persist. Only 36% of the population has access to separate collection services, and nearly 26% of collected waste is still disposed of in open dumps (in terms of municipalities, see section 10.2).[3]

It is also important to mention the municipal laws regulating large waste generators that already exist in some Brazilian municipalities (e.g., Brasília/DF and Florianópolis/SC), as a strategic legal framework for the implementation of PAYT systems.

Brazil already has a legal framework that permits cost recovery and defines recycling and organic waste targets. The main gaps lie in segregated collection coverage, data availability and monitoring, fee implementation, and inclusion and enforcement – areas in which PAYT can play a relevant role if designed to reflect Brazilian realities.

PAYT is a tool that aims to set tariffs covering collection, treatment, and disposal costs. This is achieved through PAYT schemes such as variable tariffs based on container size, collection frequency, or type of waste, all of which are applied to promote adequate prevention and separate collection.

[3] Instituto Brasileiro de Geografia e Estatística. (2023). Pesquisa de informações básicas municipais – MUNIC 2023 [Survey of basic municipal information – MUNIC 2023]. IBGE. https://www.ibge.gov.br/estatisticas/sociais/saude/10586-pesquisa-de-informacoes-basicas-municipais.html; Associação Brasileira de Empresas de Limpeza Pública e Resíduos Especiais. (2023). Panorama dos resíduos sólidos no Brasil 2023 [Overview of solid waste in Brazil 2023]. ABRELPE.

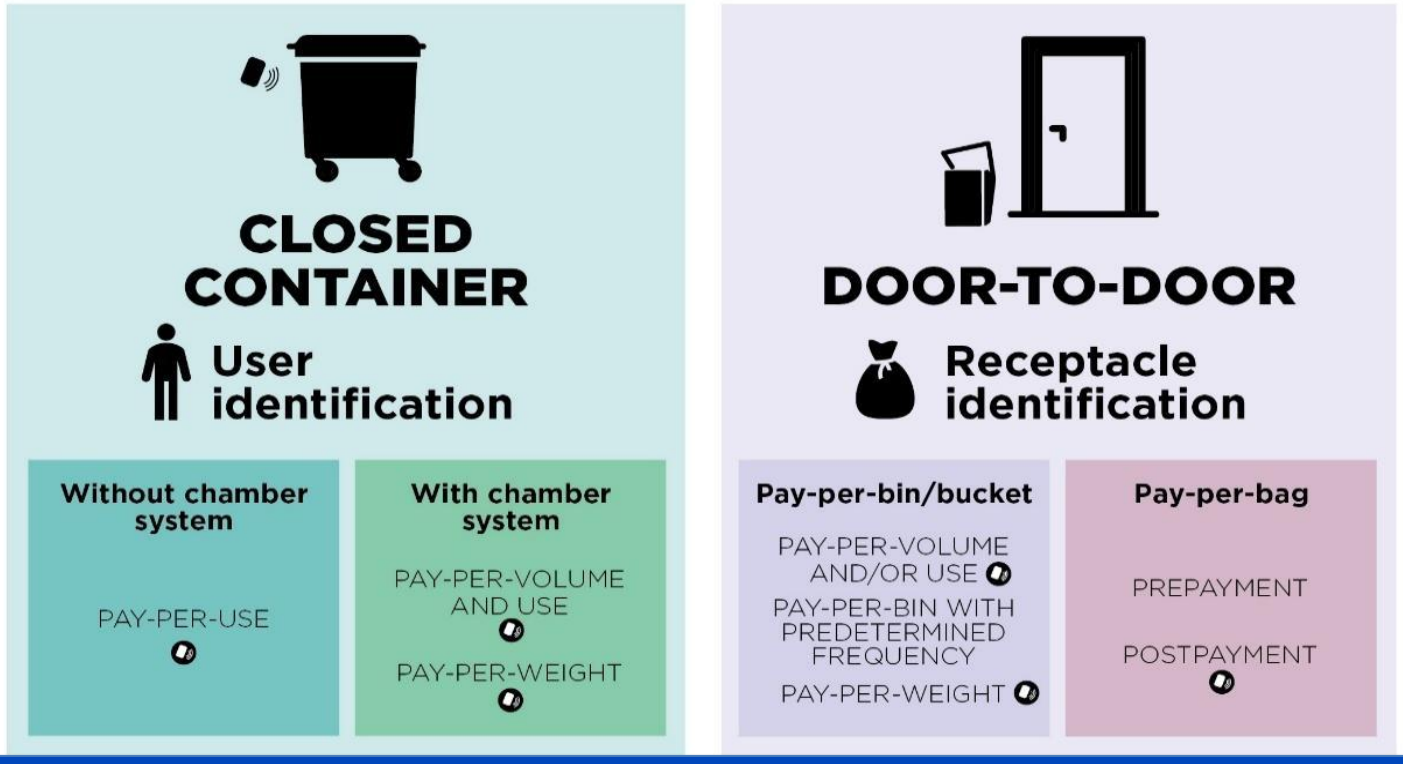


Figure 1 - Classification of PAYT Systems

Source: ENT Medi Ambient i Gestió

5 Types of PAYT Systems

5.1 Classification, Description and Comparison

PAYT schemes are designed so that waste generators – whether households or businesses – pay according to the amount and type of waste they produce.

The implementation of a PAYT system depends on the introduction of individualized waste collection systems, such as door-to-door (DtD) collection, containers with controlled access and user identification (ID), or prepaid bags. These models make it possible to identify each waste generator and measure the quantity and type of waste deposited. Therefore, the collection system determines two main categories of PAYT models:

- Receptacle-based identification systems: associated with DtD collection.
- User-based identification systems: closed containers with access control.

The measurement of generated waste can be based on:

- Number of disposals
- Bin, container, or bag volume
- Weight of each waste fraction

Once the waste generator has been identified and the corresponding measurements have been taken, the variable component of the fee can be applied according to each user's waste generation.

1. ***Door-to-door Collection Systems***

Five main PAYT models can be applied in Door-to-Door (DtD) collection systems:

a) Pay-per-bin / bucket:

- Per volume and use: Each household or group of users is assigned a container of known volume. Users can often choose the volume of their container. The bin/container is fitted with an identification device, usually a Radio Frequency Identification (RFID) chip or tag. The collection vehicle/operator reads this device at the time of emptying, registering each collected unit. The waste fee is then calculated based on the number of collections.

- Pay-per-bin with predetermined frequency: Users preselect both the container volume and the collection frequency from the options provided by the local authority, based on a preset schedule. The charge is determined by these two factors, regardless of the actual number of disposals, so no electronic equipment is required. This model generally applies only to commercial collection in densely populated areas.
- Pay-per-weight: The fee is calculated according to the weight of the waste in each collected container. Each container has a chip or tag that is read by the collection truck, which must be equipped with weighing instruments. This system is not widely used due to technical difficulties and higher costs compared to volume-based systems.

b) Pay-per-bag:

- Bags without user ID: Users pay the variable component of the fee by purchasing standardized waste bags. These are the only bags accepted for collection and are typically color-coded by waste fraction. The bags have no user identification and are distributed by the local government or through partner retailers. This prepaid-bag model does not require any electronic system.
- Bags with user ID: In this case, standardized bags incorporate an RFID tag or a QR code to identify the user electronically. Users pay for these bags either before use, usually via vending machines, or afterward through billing based on the number of readings.

In general, to ensure a robust and efficient system, it is advisable to include as many waste fractions (at least residual, and organic fraction) as possible in a DtD PAYT model, minimizing loopholes and ensuring a fair distribution of costs.

1. Closed Container Systems with Access Control

These systems are based on user identification. Containers are equipped with an electronic locking device that records users and allows the lid to open only when identification is verified. The most common identification methods include cards, key fobs, or mobile phones.

Two main categories exist:

- Without chamber system (pay-per-use): This system counts the number of times users dispose of waste in the container. There are no limits on the volume or weight of each deposit.
- With chamber system: The container includes a measured chamber or receptacle that limits the maximum volume of waste per use or records the weight of the deposited waste.

It is recommended that, at a minimum, RW and organic waste fractions require user identification to open the containers, as this helps prevent contamination and improper disposal. For other fractions, particularly packaging waste, controlled access can also be useful.

Access restrictions may also include opening hours, days of operation, or other programmable limits, allowing for gradual user adaptation to the new collection and charging system.

Comparison of the Main PAYT Models

PAYT schemes applied in DtD systems generally provide a strong correspondence between waste generation and payment, particularly in pay-per-bin or pay-per-bag configurations, where traceability can reach higher levels. These models tend to achieve good performance in promoting efficient waste collection, although outcomes vary depending on whether fees are linked to volume, frequency, or prepaid bags. Technological complexity and investment

costs range from low to high depending on the system design, while fraud risk is typically low

In contrast, PAYT schemes applied to closed containers ensure consistently high promotion of efficient waste collection and high traceability when based on volume or weight (e.g., chamber systems). Simpler systems such as pay-per-use show lower correspondence between waste generation and fees. These models are characterized by higher technological complexity and investment costs, particularly for weight-based systems, and relatively high maintenance requirements. Fraud risk is moderate.

Overall, DtD systems offer greater flexibility and, in some configurations, lower costs and risks, while closed container systems can provide robust user control and scalability at the expense of higher technological and financial requirements.

Table 1 below summarizes and compares the main features of the PAYT models described above

.

It should be noted that policy priorities must be carefully aligned with country-specific institutional, fiscal, and enforcement capacities. In South–South countries, the primary policy concern is fraud risk, as uncontrolled dumping practices are more widespread than in The Organization for Economic Cooperation and Development (OECD) countries. Therefore, PAYT schemes that can be easily eluded should be avoided. Likewise, excessive reliance on complex technologies, individual identification, or frequent user interaction may increase vulnerability to misuse, evasion, and informal practices. Limiting opportunities for fraud is therefore essential to safeguard both revenue collection and the credibility of the system.

Closely linked to this is the certainty of revenue collection, which represents a key policy objective in contexts characterized by weaker administrative capacity and higher collection volatility. PAYT models that ensure predictable and enforceable revenue streams, including prepaid mechanisms or simplified charging structures, are often more appropriate in such settings.

Technological complexity constitutes a further critical factor, as highly sophisticated systems may face challenges related to maintenance, operational continuity, and institutional sustainability over time. By contrast, in OECD countries, stronger governance frameworks and higher administrative capacity allow policymakers to place greater emphasis on other objectives, such as improving the precision of the link between waste generation and payment, maximizing incentives for waste reduction, and achieving higher environmental performance.

In these contexts, higher investment costs and greater technological complexity can be justified by long-term efficiency gains and broader environmental policy goals.

Table 1 - Comparison of the main PAYT models

ASPECT	CONTAINER ID SYSTEMS (DTD)			USER ID SYSTEMS (CLOSED CONTAINERS)		
	PAY-PER-BIN OR BAG (PER VOLUME AND/OR USE)	PAY-PER-BIN (PREDETERMINED FREQUENCY)	PAY-PER-BAG (NO ID, PREPAID BAG)	PAY-PER-USE	CHAMBER SYSTEM (BY VOLUME AND USE)	CHAMBER SYSTEM (BY WEIGHT)
Promotion of efficient waste collection	High	Low	High	High	High	High
Correspondence between payment and waste generated	High – Very high	Medium	Very high	Medium-Low	High	Very high
Technological complexity	High	Low	Low	High	Very high	Very high
Investment cost	High	Medium	Low	High	Very high	Very high
Maintenance cost	Medium	Low	High	High	High	Very high
Fraud risk	Low	Very low	Low	Medium-High	Medium	Medium
Need to link to user or taxpayer register	Yes	Yes	No	Yes	Yes	Yes
Certainty of fee collection	Medium	Very high	Medium	Medium	Medium	Medium
Prepaid fee collection	No	Yes	Yes	No	No	No

5.2 Fractions to Be Charged and/or Subsidized/Incentivized

When deciding which waste fractions to measure or include in the design of a PAYT scheme, several aspects must be considered:

- Charging RW represents an incentive to reduce this fraction, either by adopting waste reduction measures or by participating in separate collection. For this reason, it is always a key component of a PAYT system. However, it can also lead to waste tourism or illegal dumping (fly-tipping). To prevent these practices, local authorities should ensure comprehensive monitoring, and data should be analyzed to detect abnormal disposal patterns per user.
- The organic waste fraction represents the heaviest fraction of municipal waste and should therefore be a top priority for separate collection.
  - At the household level, it is generally not recommended to charge organic waste, as this may discourage proper separation. Instead, it may be preferable to monitor and incentivize correct sorting through bonuses or discounts, as in SAYT systems.
  - Conversely, for large commercial producers, charging for organic waste is recommended, as generation levels vary significantly depending on the type of business and often require more frequent collection, thereby increasing service costs.
- Packaging waste can be significantly reduced through changes in consumer habits and is one of the most challenging fractions to recycle. There are therefore valid reasons to charge for this fraction for both households and businesses. However, the fee should be set at a much lower level than for RW, so as not to discourage proper separation.
- Paper, cardboard, and glass are fractions that are not typically charged, as doing so could discourage their separate collection.

5.3 SAYT, KAYT, BAYT, and Gamification Approaches

SAYT (Save As You Throw), KAYT (Know As You Throw), and BAYT (Benefit As You Throw) models extend the PAYT philosophy beyond direct financial mechanisms by integrating behavioral insights, digital tools, and gamified engagement. Together, they form a spectrum of incentive and feedback systems that promote waste separation, reduction, and recycling through information, motivation, and participation rather than exclusively through monetary penalties.

SAYT focuses on savings rather than direct charges for waste generation. Instead of paying directly for waste generation, citizens save through reduced collection fees, rebates, or indirect savings, such as community credits, service discounts, or savings derived from composting and reduced consumption. Municipalities may offer discounts or points on utility bills when households reduce waste generation or increase recyclable fractions.

> Brazilian adaptation potential: connection to local “eco-bonus” schemes; credits for using returnable packaging or participating in composting hubs.

This may imply a small increase to the waste tax for users that will not get any rebate, to maintain the overall economic balance.

KAYT focuses on information and feedback. Citizens receive data on their waste generation patterns, fostering awareness and self-regulation. Households can access this information through apps, SMS, or public dashboards, promoting transparency as a motivational tool. In Brazil, there is potential for integration with existing digital platforms.

BAYT emphasizes tangible benefits linked to waste separation or reduction. Individuals or communities receive rewards such as coupons, vouchers, transportation credits, mobile data packages, or collective benefits, including funding for local projects, community gardens, or schools when neighbourhoods meet waste reduction targets. This approach is particularly effective in informal settlements or low-income communities, where social recognition and shared rewards may be more motivating than direct financial savings.

Curitiba provides one of the earliest large-scale examples of a BAYT approach, in which households and communities received tangible rewards – such as food, transportation credits, and social recognition – in exchange for waste separation in the "Cambio Verde" programme[4]. This experience demonstrates the effectiveness of positive incentives in low-income and informally serviced areas.

Gamification and social incentives use playful, competitive, and social elements to encourage pro-environmental behavior, turning waste reduction into a rewarding challenge.

Brazil already has strong precedents in participatory governance and digital civic engagement, such as MOPA and "Brasil Participativo", and these tools help build trust and engagement prior to the introduction of full PAYT schemes. SAYT, KAYT, and BAYT therefore expand the PAYT paradigm into a more inclusive framework. When combined with gamification, they transform waste management from a punitive system into a motivational, participatory, and data-driven process that aligns environmental goals with community well-being and civic pride.

5.4 International Context and Knowledge Gaps in the Global South

PAYT schemes are widely recognized as market-based instruments that effectively increase source separation, recycling, organic waste collection and valorisation, and to some extent reduce waste generation. Countries such as South Korea, Italy, and Japan have demonstrated higher participation rates and improved monitoring compared to flat-rate systems through approaches such as RFID-based identification, door-to-door collection, and transparent bag schemes.

At the core of PAYT's success in these contexts lies a robust infrastructure and governance framework, including efficient collection systems, advanced data management, citizen engagement, and regulatory enforcement. PAYT also supports climate mitigation objectives by diverting organic waste from landfills, which are major sources of methane emissions.

However, when applied in the Global South, including Brazil, significant knowledge and implementation gaps remain. While the conceptual foundations of PAYT are consistent across regions, enabling conditions—such as administrative capacity, social equity considerations, and reliable waste data—are often limited. In Brazil, only a small proportion of municipalities have introduced user fee systems for waste management, estimated at approximately 8% as of 2023.[5]

Waste pickers ("catadores") collect and process a significant share of recyclable materials, yet they are frequently excluded from PAYT policy design. Without integrating this workforce, PAYT risks reinforcing existing inequalities rather than promoting

[4] Prefeitura Municipal de Curitiba. (n.d.). Programa Câmbio Verde [Green Exchange Programme]. https://www.curitiba.pr.gov.br/noticias/populacao-de-curitiba-pode-trocar-material-reciclado-por-alimentos-saudaveis-no-cambio-verde/75746

[5] Dutra, R. M. S., & Siman, R. R. (2024). Charges to generators for solid waste management services: An analysis of the financial sustainability of Brazilian municipalities. Revista de Gestão Social e Ambiental, 18(3), e5876. https://doi.org/10.24857/rgsa.v18n3-172

environmental justice. Tailored approaches are therefore required in the Global South, combining economic incentives with social inclusion and capacity building.

Another critical gap relates to data and monitoring systems. PAYT relies on accurate measurement of waste volumes to ensure fairness and transparency. Brazil continues to face fragmented and incomplete waste data, particularly regarding organic waste generation and disposal pathways. Without reliable information systems, PAYT cannot function effectively or deliver the intended environmental benefits.

In this sense, implementing PAYT in Brazil and other Global South countries is not solely a matter of financial design, but of institutional maturity. It requires strengthening municipal governance, developing integrated waste data systems, ensuring equitable fee structures, and aligning economic incentives with broader social and environmental objectives.

5.5 Overview of PAYT Models and South–South Examples

While PAYT is well documented in high-income contexts, its adaptation in the Global South is relatively recent and remains experimental. Key challenges include limited data infrastructure, the presence of informal waste sectors, and low willingness to pay. Nevertheless, a number of innovative experiences provide relevant lessons.

What Works Internationally (and Why)

- **South Korea (RFID- and weight-based PAYT):** Households use RFID-tagged bins or cards, while collection trucks weigh organic and residual waste and bill users on a monthly basis. Results include sharp reductions in RW and significant increases in organic waste capture. Key features include ubiquitous data systems, strict enforcement, dense urban logistics, and strong public education.
- **Italy (door-to-door "porta a porta," stickered bags):** Municipalities implement DtD collection by waste fraction (organic waste, paper, plastics/metals, and residual waste) and apply charges per lift or per bag for residual waste. Results show that many cities achieve over 70% separate collection. Key factors include dedicated organic waste collection services, small residual containers, social inspectors, and transparent billing. See Annex 19 for additional information.
- **Japan (authorized transparent bags):** Residents purchase authorized municipal bags, paying for residual waste in a way that nudges reduction, reuse, and meticulous sorting. Key features include partnerships with retailers, strong anti-contamination norms, and consistent rules across neighborhoods.
- **The Netherlands and Belgium (DIFTAR: pay per-volume):** Smart lids or bag-insert systems apply charges per opening or per bag. Results include reductions in residual waste and increase in recycling and organic waste collection. Key elements include clear contamination penalties and well-developed bring banks for glass and paper.
- **United States and Canada (unit pricing):** Simple bag- or tag-based systems perform well, particularly in small- to mid-sized municipalities. Key success factors include low-tech implementation, strong communication strategies, and seasonal yard-waste programs.

Cross-Cutting Lessons from International Experience

1. Ensure frequent and convenient organic waste collection before increasing charges on residual waste.

2. Pair PAYT with clear rules, visible enforcement, and easy access to recycling and repair options.
3. Start with simple measurement systems (bag/tag or per-lift) and upgrade to smart technologies only where institutional and technical capacity exists.
4. Apply two-part tariffs, combining a fixed fee for service availability with a variable PAYT component based on waste generation.
5. Incorporate equity safeguards, including discounts or adjustments for low-income households and multi-family housing.

Ecuador – Santa Cruz (Galápagos Islands)

This system was introduced in 2021 and differentiates between organic waste (green bags) and RW (black bags). Within one year, cost recovery increased from 45% to over 80%, and separate collection nearly doubled. Despite subsequent political discontinuity, the model demonstrated that simple and visible pricing mechanisms can significantly improve user behavior and financial sustainability when combined with enforcement and community education.[6] See Annex 19 for additional information.

Tanzania – Dar es Salaam

In Dar es Salaam, a smart monitoring system improved willingness to pay and service transparency, functioning as a preliminary step toward full PAYT implementation. By linking the digital identification of users and service providers, the city increased revenue collection and user registration. This approach demonstrates that PAYT principles can be introduced progressively, starting with verified service delivery and fee transparency before moving toward variable pricing.[7] See Annex 19 for additional information.

[6] Bayas-López, H. (2024). Primera réplica del modelo tarifario basado en volumen para la gestión de residuos en Santa Cruz–Galápagos [First replication of the volume-based tariff model for waste management in Santa Cruz–Galápagos]. FIGEMPA, 18(2), e6622. Gobierno Autónomo Descentralizado Municipal de Santa Cruz. (2021). Ordenanza que regula la administración y recaudación de la tasa para la gestión integral de residuos sólidos mediante el modelo tarifario basado en volumen [Ordinance regulating the administration and collection of the fee for integrated solid waste management through the volume-based tariff model]. Consejo de Gobierno del Régimen Especial de Galápagos.

[7] Pellatt, J., & Palfreman, J. (2023). Smart technology solution for a cleaner city: A case study of Dar es Salaam, Tanzania. GeoJournal, 88(5), 5221–5245. https://doi.org/10.1007/s10708-023-10902-w

Comparative Insights and Transferability

Comparative analysis of PAYT systems highlights several universal success factors alongside context-specific adaptations Table 2:

Table 2 - Comparative Insights and PAYT Success Factors

SUCCESS FACTOR	HIGH-INCOME CONTEXTS	LOW- AND MIDDLE-INCOME CONTEXTS
Technology	RFID, smart bins, integrated databases	Low-tech (bags, stickers), mobile data collection
Financing	Cost recovery through waste tariff systems	Gradual introduction via prepaid or hybrid models
Behavioral Change	Strong trust, enforcement, and data feedback	Communication strategies and willingness-to-pay campaigns
Inclusion	Equity discounts for vulnerable users	Integration of informal sector and cooperatives

The literature review highlights an important caveat: although many studies report environmental improvements – such as reduced residual waste and increased recycling – evidence on full economic and financial sustainability remains limited, particularly in developing countries. This implies that, for South–South adaptation, monitoring of cost recovery, revenue flows, and enforcement mechanisms must be embedded from the outset.

Lessons for South–South Cooperation

- **Phased implementation is essential:** Start with verified service delivery (as in Tanzania), move to cost transparency (as in Ecuador), and only then introduce variable pricing (as envisaged for Brazil). **Social inclusion must be embedded**, with cooperatives and associations acting as intermediaries between users and municipalities.
- **Technology should fit institutional capacity**, not the reverse. In resource-constrained settings, prepaid bags or QR-based billing systems may outperform complex RFID solutions.
- **Strengthen the evidence base:** There is insufficient peer-reviewed evidence on PAYT performance under conditions typical of the Global South, such as informality, limited data systems, and partial service coverage. Given the research gaps identified in the 2010–2022 review, implementing agencies should integrate robust monitoring and evaluation frameworks – including financial indicators – from the beginning.
- **Promote regional exchange platforms:** Cooperation among municipalities in Latin America, Africa, and Asia can accelerate learning, standardize indicators, and strengthen both financial and behavioral design.

Global PAYT experience confirms that economic incentives can effectively drive waste reduction when combined with social engagement, institutional trust, and environmental equity. In the Global South, PAYT's potential lies not only in charging for waste, but in reshaping governance and accountability. By adapting lessons from Europe and Asia to local realities – as demonstrated in Ecuador and Tanzania – and closing evidence gaps through systematic monitoring, countries such as Brazil can pioneer a more inclusive, data-informed, and climate-aligned generation of PAYT systems.

6 Behavioral Science and the Perception of PAYT

6.1 Behavioral Drivers and Nudging Mechanisms Related to PAYT

Behavioral science provides a powerful lens to understand how citizens actually respond to policy instruments such as PAYT. While economic theory assumes that households react rationally to price signals, real-world behavior is shaped by habits, perceptions, emotions, and social norms. Waste management is a particularly rich domain for behavioral insights, as it involves repeated, low-involvement actions within households that are often influenced by convenience and by what neighbors do rather than by cost alone.

PAYT introduces a price signal that links waste generation to individual responsibility; however, its success depends largely on how the scheme interacts with the surrounding psychological and social context. PAYT should therefore be accompanied by behavioral insights to ensure that incentives are perceived as visible, fair, and motivating.

The concept of nudging, introduced by Thaler and Sunstein (Sunstein), is central to behavioral policy design. It suggests that small, well-timed changes in how choices are presented – without restricting freedom – can guide people toward decisions that are beneficial both individually and socially.

Unlike PAYT, nudging explicitly excludes economic incentives and operates through psychological and social cues rather than through prices or penalties. In many contexts, particularly where citizens lack practical tools such as appropriate containers or where source separation of organic waste has not yet been implemented, PAYT may be perceived as an unfair charge. In such cases, nudging can be equally or even more effective, as it builds trust and engagement by providing positive feedback before introducing financial variability.

The key elements of nudging include:

1. **Social norms:** Individuals rarely decide in isolation; they calibrate their behavior based on what peers are doing. When residents receive feedback such as "Your household produces less RW than the neighborhood average," it activates a natural desire for social approval that can have lasting effects.

2. **Salience and feedback:** Making information visible at the point of decision – for example, by highlighting the cost per bag or displaying individual setouts in an app – creates a cognitive nudge. Citizens become more aware of the consequences of each disposal action and begin to self-regulate waste generation.

3. **Perceived observation and accountability:** The sense of being monitored through personalized bags, bins with access control, or periodic performance reports enhances honesty and compliance. This so-called "watching eyes effect" is well documented in behavioral science: even symbolic observation increases cooperation.

4. **Habits and simplicity:** Habit formation is critical for sustained environmental behavior. When systems are intuitive – through color coding, fixed collection days, and clear rules – positive habits are reinforced. By contrast, overly complex tariffs or container rules disrupt learning processes and reduce compliance.

6.2 Lessons Learned from the literature

Evidence from energy-use reports in the United States demonstrates the effectiveness of social comparison feedback. In these programs, electricity bills include simple visual cues, such as emoticons, comparing household consumption with that of peers. Millions of households have experienced sustained reductions in energy use of approximately 1.5–3% over several years, achieved solely through behavioral feedback rather than economic penalties.[8]

This experience illustrates how visibility and social benchmarking can translate complex policy objectives into clear and actionable cues. Similar feedback mechanisms have since been applied to water use, recycling, and mobility programs across Europe and Asia. Figure 2 presents an example tested in Pamplona, Spain, where social norm feedback was provided based on the use of organic waste containers with access control.

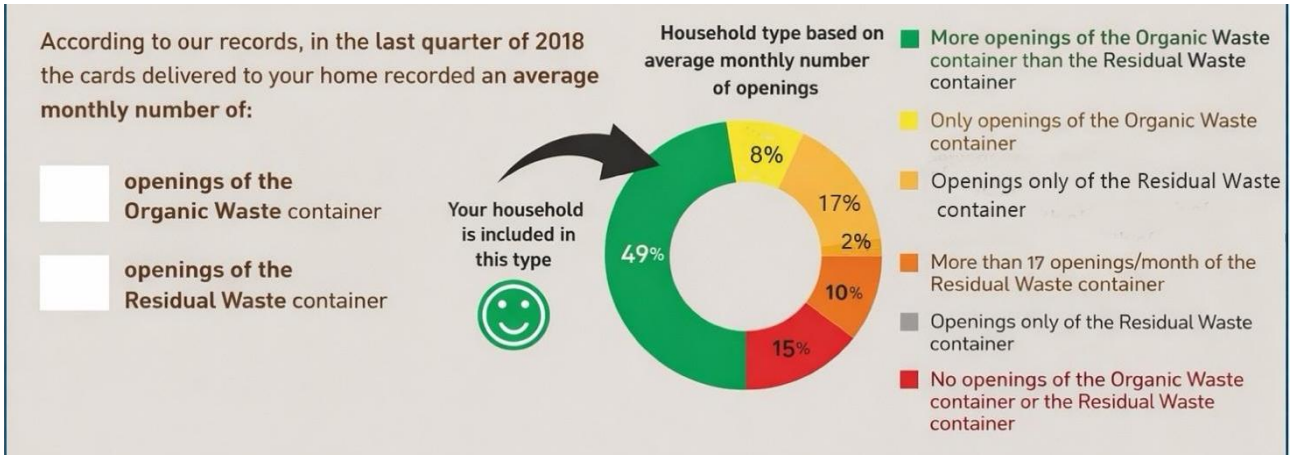


Figure 2 - Waste report in Pamplona, Spain, nudging users with social norm (nr of openings of the organics bin)

In a recent European field experiment under the REthinkWASTE (European Union [EU] funded LIFE project)[9] households tested the KAYT approach through personalized WhatsApp messages comparing their RW generation with neighborhood averages. Results showed that social-norm feedback alone reduced RW by approximately 5–6%, without any change in fees or an increase in illegal dumping.

In low- and middle-income countries, the primary behavioral challenge – preliminary to any PAYT scheme – is how to increase citizens' willingness to pay for basic waste services. In pilot areas of Dar es Salaam, Tanzania, targeted information campaigns explaining how waste fees are used led to increased willingness to pay and improved fee compliance. The study (see Annex) shows that a large majority of respondents (85.3%) were willing to pay more for solid waste management services, conditional on assurances and commitments from service providers to improve service quality and reliability.[10]

6.3 Sorting habits vs. waste prevention habits

Pay As You Throw (PAYT) schemes, by applying a variable charge to residual waste, create a direct and immediate economic incentive for households to improve their sorting behavior. The mechanism is straightforward: every kilogram or litre of residual waste that a citizen diverts into the

[8] Allcott, H. (2011). Social norms and energy conservation. Journal of Public Economics, 95(9–10), 1082–1095. https://doi.org/10.1016/j.jpubeco.2011.03.003

[9] ACR+. (2021). LIFE RethinkWaste – Catalogue of PAYT and KAYT practices. https://rethinkwaste.eu/life-rethinkwaste-projects-catalogue-of-payt-and-kayt-practices-published-by-acr/

[10] Pellatt, J., & Palfreman, J. (2023). Smart technology solution for a cleaner city: A case study of Dar es Salaam, Tanzania. GeoJournal, 88(5), 5221–5245.

correct recycling stream — paper, glass, plastic packaging, organic — translates into a tangible reduction in their waste fee. This makes sorting at home a relatively low-effort, high-reward adjustment as soon as the infrastructure is already in place: the bins are provided, and the citizen simply needs to pay more attention to where each item ends up. The behavioral shift required is essentially organizational, not transformational.

Waste prevention, which sits at the top of the waste hierarchy, demands something far more ambitious. Reducing the actual volume of waste generated - buying fewer packaged products, choosing refillable containers, avoiding single-use items - requires citizens to rethink purchasing decisions, alter long-established consumption routines, and sometimes accept higher costs or reduced convenience. Even when PAYT schemes extend variable tariffs to recyclable fractions like plastic packaging, the price signal alone is rarely sufficient to trigger this deeper change. A household may dutifully sort its plastic into the yellow bin, but choosing to buy unpackaged pasta, drinking tap water or carrying a reusable container to the supermarket is a qualitatively different kind of effort — one that touches lifestyle, identity, and the broader commercial ecosystem in which consumers operate.

PAYT therefore typically acts as a powerful lever for sorting compliance and, only indirectly and to a limited extent, as a catalyst for prevention. Genuine waste reduction requires complementary policy tools — extended producer responsibility, reuse infrastructure, awareness campaigns — that address the structural roots of consumption rather than just its downstream management.

6.4 Transparency, Feedback and Continuous Adjustment

One key insight emerges from literature: constant feedback based on individual data builds trust and reinforces accountability. When households can frequently access information on their own performance – as in KAYT approaches – rather than receiving feedback only once per year through a waste invoice, behavior improves. A recent paper about a Swedish case study[11] (letters sent periodically to residents to compare individual their residual waste production to the one of “efficient neighbors” , and the Bergamo case study (see Annex) provides a clear example of how transparency, feedback, and continuous adjustment support behavioral change.

The following guidelines support effective transparency and feedback:

- Use social-norm feedback to show residents how their waste generation compares with that of peers.
- Make environmental impacts salient and visible at the moment of disposal.
- Leverage the “feeling observed” effect through personalized identification systems.
- After effective nudges are in place, behavioral variability decreases, making PAYT easier to implement and more socially acceptable.
- Provide transparent and timely feedback through mobile applications or periodic reports.
- Build trust through clear communication and transparent use of revenues.
- Continuously adapt messages and system design based on real-world data

[11] Ek, C., & Söderberg, M. (2024). Norm-based feedback on household waste: Large-scale field experiments in two Swedish municipalities. Journal of Public Economics, 238, 105191. https://doi.org/10.1016/j.jpubeco.2024.105191



Figure 3 - Tags in Switzerland and a volume reducer (on the right) for paying for 60 liters

7 Technology for Collection and PAYT Systems Implementation

7.1 Simple and Low-Tech: Volume-Based and Prepaid or Postpaid Bags

Simple and low-tech schemes represent the first wave of PAYT implementation in Europe and remain among the most widespread approaches due to their low cost, ease of administration, and high replicability. A classic example is the German volume-based approach, in which households select bins of different sizes and pay fees according to the chosen volume capacity. This method is intuitive and transparent, as the direct relationship between bin size and cost encourages residents to minimize waste. Although it does not precisely measure the actual amount of RW generated, it nevertheless sends a clear economic signal. Under this system, a sticker is typically purchased annually according to bin volume and corresponds to the variable component of the fee. Another well-known model is the use of prepaid bags, as implemented in Zurich through the Zurisack system. In this approach, residents purchase official municipal RW bags at supermarkets or kiosks, with the disposal fee embedded in the bag price. This model internalizes waste management costs directly into the act of disposal, linking waste generation to an immediate economic decision. It has proven effective in increasing recycling rates and reducing RW, while maintaining a low administrative burden for municipalities. Notably, a similar approach was adopted in the first PAYT scheme implemented in Latin America, in the Galápagos Islands, Ecuador (see Annex fact sheet).

In Italy and several other countries, postpaid standard bags are also widely used. Under this model, households receive a predefined number of standard RW bags distributed by the municipality. Costs are calculated at the end of the billing cycle based on the number of bags actually used and returned. Cities such as Bergamo (see Annex fact sheet) have successfully implemented this system, often in combination with KAYT elements and

extensive DtD collection to maximize waste separation.

The strength of these low-tech approaches lies in their accessibility. They do not require expensive hardware such as RFID chips or electronic locks and can be rolled out quickly across large territories. They are also less prone to technological failures and can be managed by municipalities of different sizes. However, their main limitation is the potential for illegal dumping or the use of unauthorized bags, which requires strong monitoring and targeted public communication campaigns. That is also why municipalities with uncontrolled dump sites need parallel closure plans before introducing PAYT. In short, low-tech PAYT schemes are highly effective when accompanied by enforcement and awareness-raising measures and remain a reference point for newly designed systems.

7.2 High-Tech: RFID Tags on Bags or Bins, Cards, and Locked Containers

Recent trends show that PAYT schemes increasingly rely on technology compared to earlier implementations. As a result, the effectiveness and reliability of technological solutions are critical to ensuring accurate billing.

Figure 4 summarizes the electronic identification systems used for containers and users in the two main efficient waste collection models (DtD and locked containers). For prepaid systems based on standardized bags or for buckets with predetermined collection frequency, as described above, the use of technology is not required.

Several identification technologies are commonly used:

- RFID using electromagnetic cards
- Near-field communication (NFC) via smartphones
- QR codes applied to bags or containers and read using smartphones

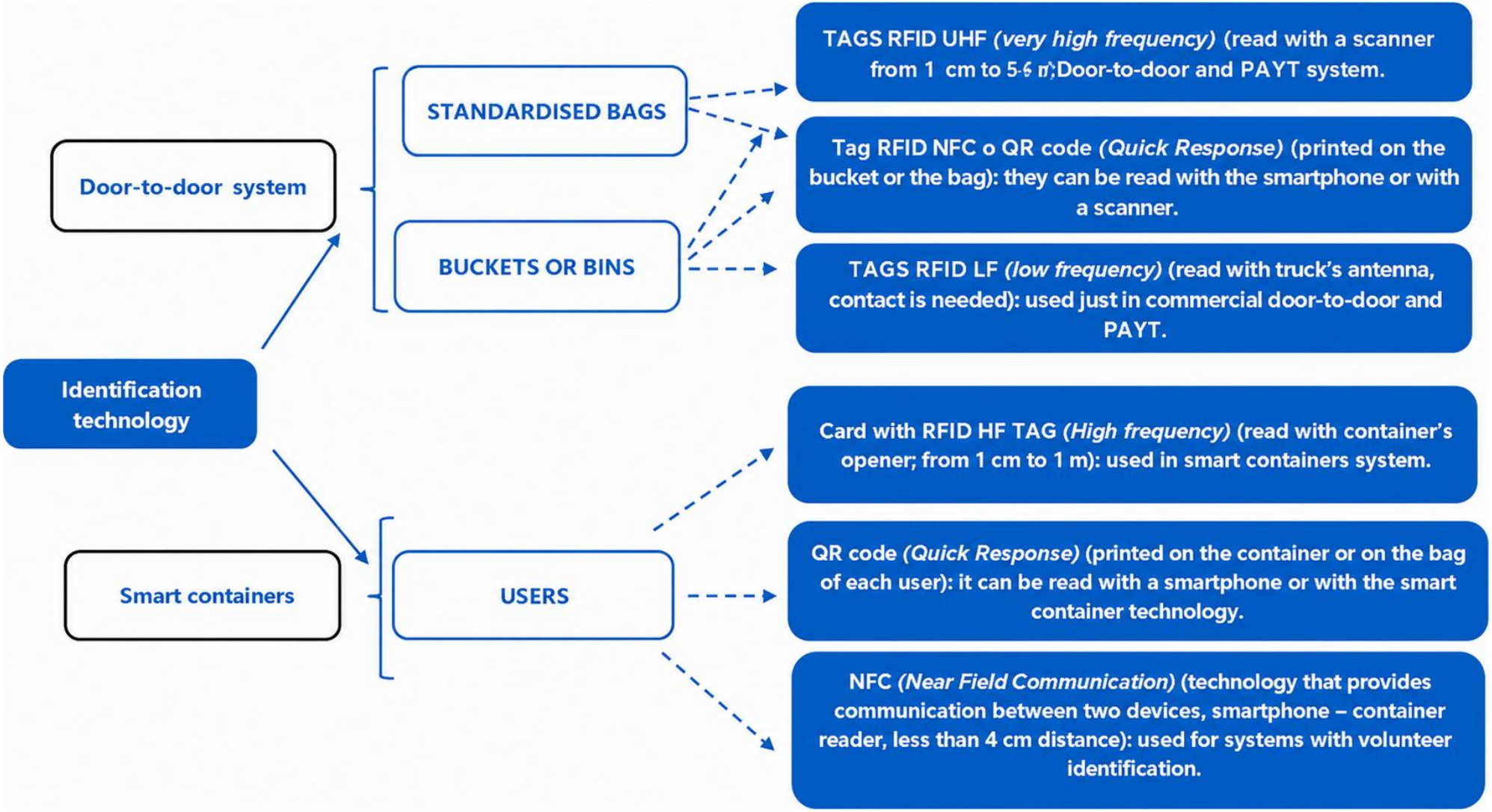


Figure 4 - Diagram of the electronic identification systems used in DtD collection systems and locked container



Source: Contarina (Veneto), ID-Waste.

User ID solutions rely on the integration of electronic locks into containers, buckets, bins, or bags, combined with RFID, NFC, or QR code technologies.

1) RFID is used to identify containers or users through radio waves. An RFID system consists of a tag, a reader, and an antenna. The reader sends a signal to the tag via the antenna, and the tag responds by transmitting its unique identification information.

The operating frequency of the RFID system determines its application in DtD schemes:

- Ultra-high frequency (UHF): A short wavelength allows for a longer reading range, typically between 1 and 5–6 meters. This configuration is suitable for identifying tags fitted to waste bins or buckets using a truck-mounted antenna or an operator's wristband.
- Low frequency (LF): This wavelength requires close contact between the truck antenna and the RFID tag fitted to the bin, usually when the lifting mechanism engages the container. It is more commonly used in commercial DtD collection systems.



Source: Twente Milieu; Styria (Austria), ID&A

In the case of locked containers:

1) High frequency (HF): This frequency typically has a reading range between 1 cm and 1 meter. Its most common application is user identification through passive RFID smart cards for curbside locked containers equipped with a reader. Each access and use is recorded.

2) NFC: NFC technology enables communication between two electronic devices, one of which is typically a portable device such as a smartphone. The two devices must be within a distance of less than 4 cm. NFC-enabled devices can function as readers, keys, or electronic identification tools.



Waste deposited in collective containers can be controlled through locking systems using NFC technology. When an authorized NFC device is brought close to the locking mechanism, the container opens and allows waste to be deposited. Each access is registered.

3) A Quick Response or QR code is a square, two-dimensional matrix that functions similarly to a barcode. Its primary purpose is to register and transmit information, typically via smartphones.





QR codes can be used to identify standardized bags in DtD schemes or to control access to locked containers.

7.3 Challenges and Solutions for Multi-Family Buildings and Dense Areas

One of the most persistent challenges in PAYT implementation is adaptation to multi-family buildings and densely populated urban areas, where individual accountability is more difficult to ensure. Shared containers are common in apartment buildings, making it challenging to assign waste volumes or disposal frequencies to specific households, even though such systems have been implemented in many municipalities in Northern Italy. Without careful design, collective collection systems can undermine the incentive structure of PAYT and weaken the polluter-pays principle.

A primary challenge is identification: determining which user generated which waste. In contexts where individual bags or buckets are not feasible, municipalities have tested access-controlled solutions in which residents unlock shared containers using magnetic cards or electronic keys. These systems, however, introduce additional technology and maintenance costs for users and municipalities.

To address space constraints, cities have experimented with semi-underground containers, compact smart bins, or shared collection points with restricted access. For example, access-controlled container systems in France and Belgium demonstrate that PAYT principles can be maintained while optimizing space use and allowing different collection schemes to coexist within the same city.

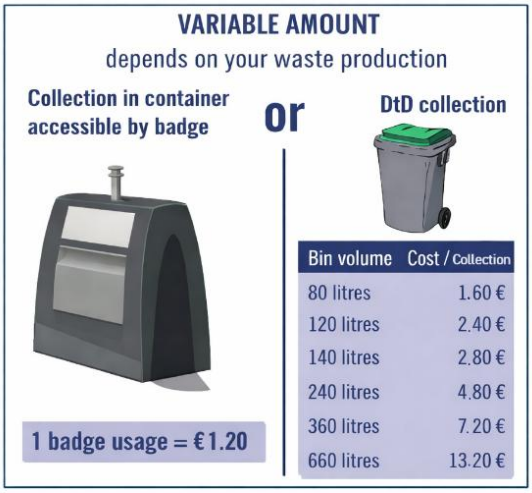


Figure 5 - A mixed collection scheme in France (Communauté de Communes Terres Touloises) allowing both large collective containers and individual bins with different volumes

Social dynamics also play an important role. In multi-family settings, anonymity can encourage free-riding or illegal disposal. In such contexts, communication and social-norm strategies are essential. Awareness campaigns, transparent information on neighborhood recycling performance, and regular feedback can foster positive peer pressure.

Finally, the risk of waste tourism must be considered. Enforcement mechanisms – such as local police patrols, cameras in high-risk areas, and fines – are often combined with incentives, including reduced fees for compliant users.

In conclusion, while multi-family buildings present structural and social barriers to PAYT implementation, strengthening trust at the micro-community level is critical. Effective systems help shift perceptions from “it is not my fault if my neighbour does not recycle” toward a shared sense of responsibility and collective performance.

Specificities of a Commercial-Only PAYT System

Commercial waste constitutes a significant share of municipal waste (when formally assimilated to MSW) and represents a major opportunity to improve separate collection rates. Conversely, when this waste is not

collected separately, it can create operational problems in container-based collection systems on public streets, leading to overflow and congestion. Certain types of commercial waste may also cause additional issues, such as odours from organic waste. To address these challenges, many municipalities implement dedicated commercial waste collection systems, most commonly through DtD schemes.

In municipalities with a high concentration of large waste producers and individualized commercial collection systems, local authorities may opt to implement a commercial-only PAYT system. This can be done only if this stream is assimilated to municipal waste, so that these generators pay a municipal waste charge. In the case of collection based on the contracting of private service providers, PAYT is somehow already intrinsically in place if the fee for RW collection is higher than organics or other recyclables; if not, the waste collection company unfortunately will not care much about increased waste sorting as most of the times these amounts are not accounted for reaching MSW recycling targets.

When assimilating commercial waste to municipal, a separate collection system should clearly specify recycling targets for them and address only large commercial generators, excluding small businesses whose waste generation patterns are comparable to those of households, which will use the common scheme in place for them. When designing a commercial PAYT system, it is essential to define which waste fractions are included and to select the most suitable and efficient collection system, taking into account the existing household collection model. Otherwise, commercial waste may be improperly disposed of in the household waste stream. The risk of such "leakage" is highest in systems with open public containers; by contrast, a commercial DtD collection system with technological identification offers the most effective means of minimizing this risk.

First, the selection of which fractions to charge or incentivize is critical, as it determines which large commercial generators are included in the system. Incentives should take the form of a positive variable component. Whenever possible, the residual (mixed) fraction should be subject to a fee. If the organic fraction is incentivized, care must be taken when setting incentive levels to ensure that the variable component of the charge for organic waste is never negative, as this could create inequities relative to businesses that generate little or no organic waste. For further guidance on situations that may justify charging or incentivizing different fractions, see section 5.2.

Second, system choice is a key consideration. When implementing a commercial-only PAYT system, municipalities should provide specific containers or bins for businesses that are clearly distinct from those used by households. Depending on the chosen model, the risk of fraud varies. In bin-based systems—such as pay-per-volume, pay-per-use, or pay-per-weight—electronic identification of each business significantly reduces this risk. The risk is particularly low in pay-per-bin systems with predetermined collection frequency, although this model provides weaker incentives for waste prevention and separation. In prepaid bag systems, limited monitoring capacity increases the risk of leakage into the household waste stream. By contrast, postpaid bag systems using electronic tags or QR codes can substantially mitigate this risk.

In parallel, when defining which businesses qualify as "large generators" for charged or incentivized fractions, municipalities should establish minimum thresholds for daily or weekly waste generation. Another important consideration is that, for businesses, the fixed component of the fee should not be uniform. Instead, it should vary according to

characteristics such as the type of activity, floor area, or operational capacity (for example, number of seats). See section 8.1 for details. **Incentive Mechanisms and Compliance**

Positive incentives may include reduced fees for verified recycling or composting, public recognition labels (such as “Green Business” or “Zero Waste Partner”), and access to municipal incentives or environmental tax deductions.

Compliance and enforcement can be strengthened through integration with business licensing requirements, including proof of waste management compliance as a condition for license renewal, spot inspections and audits of large generators, and the application of fines or withdrawal of privileges in cases of improper disposal. Table 3 outlines sector-specific challenges and corresponding PAYT solutions.

Table 3 - Sector-Specific Adaptations

SECTOR	CHALLENGES	POTENTIAL PAYT SOLUTIONS
Restaurants & Food Markets	High organic waste fraction; frequent collection required	Volume-based fees; incentives for composting; collaboration with local composting centres
Retail Stores & Shopping Centres	Mixed packaging waste	Partnership with recyclers; weight-based tariffs; reporting through digital tools
Offices & Banks	Mainly paper, low-frequency waste	Reduced collection frequency; integration with recyclers; lighter tariff model
Hotels & Hospitality	Mixed waste, variable occupancy	Dynamic tariff per occupancy rate or waste audits
Street Markets	Informal generation patterns	Collective PAYT agreements with vendor associations; simplified monitoring

8 Technical Aspects Related to the Design of the Fee

8.1 Definition of the General or Basic Fee

In a PAYT scheme, the basic fee applies to all users by virtue of their access to the waste collection service, regardless of their actual level of use.

Basic Fee for Households

The household basic fee can be defined according to several criteria, depending on their ability to reflect potential use of the service. The most common models are summarized in Table 4

Table 4 - Variables Used to Define the Household Basic Fee

MODEL	DESCRIPTION	ADVANTAGES	DISADVANTAGES
Flat rate	Identical amount for all dwellings.	Simple to manage and communicate.	Regressive: does not consider economic capacity.
Registered residents	The fee is adjusted according to the number of residents per household.	Greater proportionality with potential waste generation.	Requires updated population registers; may be difficult to verify.
Property value	Fee linked to the property's value.	Incorporates an economic capacity criterion.	Requires ranges to avoid excessive disparities.
Dwelling surface area	Calculated based on the property's square meters.	Stable and easily accessible data.	Poor correlation with waste generation.
Water consumption	Based on recorded household water use.	Can be integrated into the water bill (low charge collection costs and low unpaid charges).	Weak correlation with waste generation; may cause confusion.
Municipal zoning	Different rates depending on the zone of the residence (e.g. city centre, suburban areas).	May reflect differences in waste collection costs.	Practically no correlation with waste generation.

Basic Fee for Economic Activities

Unlike households, waste generation from economic activities varies significantly depending on activity type and scale. Common options for defining the commercial basic fee are presented in Table 5.

Table 5 - Variables Used to Define the Commercial Basic Fee

MODEL	DESCRIPTION	ADVANTAGES	DISADVANTAGES
Type of activity	Classification according to the business activity.	Allows the fee to reflect expected waste fractions and generation intensity by activity type.	Requires accurate external data, often complex to link with fiscal records; must be updated to reflect actual activities.
Surface area of the activity	Fee based on the floor area of the economic activity.	Stable, easily available data.	Does not always reflect the intensity of waste generation.
Number of employees / accommodation capacity	Fee according to staff number or estimated service capacity.	Indicates intensity of use.	Data may be difficult to obtain and update.
Municipal zoning	Different rates according to location (e.g. street category).	May correlate with commercial activity levels and collection costs.	On its own, without reference to activity category, does not explain waste generation.

It is common practice to combine at least two criteria to determine the basic fee. Using multiple variables allows for better alignment between the fee structure and the actual characteristics of each user.

8.2 Design of the Variable Component of the Fee

A central challenge in designing the variable component of the fee is determining which waste fractions should be subject to PAYT charging and which should be incentivized

through contribution-based reductions under SAYT models. Section 5.2 outlines the fractions typically associated with each approach.

Under PAYT, the variable component is always positive and increases in proportion to actual waste generation. Its primary objective is to encourage waste reduction for specific fractions. As noted previously, this approach is most commonly applied to the residual (mixed) fraction and, in some cases, to packaging waste.

By contrast, SAYT aims to promote participation in selective collection. Its configuration may include positive or negative values.

How do the positive and negative SAYT components work?

In the case of a positive SAYT component, all fee amounts across the different bands of participation are positive or neutral; however, the greater the number of contributions for the incentivized fraction, the lower the payment required from the user.

In contrast, in the case of a negative SAYT component, all fee amounts across the bands are negative or neutral. In this case, the greater the number of contributions of the incentivized fraction, the larger the discount applied.

In practice, behaviour-based fee systems often combine charging and incentivizing mechanisms across selected waste fractions. In all cases, the overall fee applied to the user should remain positive or at least neutral.

Finally, it is important to note that certain PAYT systems can operate without technology, such as prepaid bag systems or pay-per-bin schemes with predetermined collection frequencies.

Box – How PAYT and SAYT Work in Practice: Marta's Experience

Marta and Renato live in two apartments in a Brazilian city where separate collection for recyclables and organic waste has recently been introduced. The municipality applies a two-part waste fee:

a fixed fee for service availability; and

a variable component linked to behavior.

Scenario A – PAYT (negative incentive)

Renato does not separate his waste consistently and frequently disposes of mixed RW.

RW bags disposed of in one month: 12

Tariff: R$ 3 per residual bag

Variable fee: 12 × R$ 3 = R$ 36

Because Renato generates more RW than the neighborhood average, his monthly bill increases. The cost signal is immediate and visible, encouraging him to reconsider his habits.

Renato becomes aware that poor separation directly increases his costs.

The system discourages RW generation and is effective when convenient alternatives for organic waste and recyclables are available.

Scenario B – SAYT (positive incentive)

Marta starts separating organic waste and recyclables correctly.

RW bags disposed of in one month: 6

Organic waste correctly separated: high participation

SAYT bonus for verified organic separation: –R$ 12

PAYT charge for residual waste: 6 × R$ 3 = R$ 18

Net variable fee: R$ 18 – R$ 12 = R$ 6

Marta still pays for residual waste, but her effort is rewarded through a reduction in the variable component.

Impact:

PAYT is perceived as fair and controllable.

The incentive structure rewards good behavior without eliminating the price signal.

Behavior change is reinforced through positive feedback rather than punishment alone.

Key Takeaway

PAYT creates a cost signal that discourages waste generation, while SAYT introduces positive incentives that reward correct separation. When combined, the system benefits from both approaches, shifting from a purely punitive logic to a behaviorally balanced mechanism. This combination increases acceptance, perceived fairness, and long-term compliance – an especially important consideration in the Brazilian and broader Global South context.

The following elements should be considered when configuring the variable component:

- The configuration of the variable fee – whether based on charges or reductions – can be established in several ways:
  1. Unit-based values, where each contribution has a direct impact on the fee amount.
  2. Contribution bands, where contributions are grouped into predefined bands and a specific amount is assigned to each band. This option is increasingly used, as it provides greater robustness and results in fewer disputes from users in cases of potential technological errors.
- The inclusion of minimum and/or maximum participation thresholds, or specific bands for non-participation, can further refine the design of each module. For example, in unit-based configurations, it is generally recommended to establish a minimum number of payable contributions per user, even if they do not actually occur. In reduction-based modalities, maximum thresholds are often set to prevent excessively high discounts that could exceed the remaining payable variable component. It is also advisable to include a non-participation band (zero contributions) with a significantly higher charge than the minimum fee, in order to discourage fraudulent or non-participatory behavior – except in the case of vacant dwellings, where such a condition can be duly demonstrated.

8.3 Other Aspects (e.g. potential environmental reductions)

Waste fees may include exemptions or reductions under specific circumstances. In general, waste charges tend to have a regressive effect, and social reductions are therefore used to mitigate impacts on the most disadvantaged population groups. The most common reductions are based on indicators such as minimum wage thresholds or household income conditions. These reductions are typically granted upon request, meaning that users must apply and demonstrate eligibility in accordance with the criteria defined in the fiscal ordinance.

Environmental reductions may be applied to encourage the use of recycling centres or the practice of home composting.

It is important not to confuse the implementation of a PAYT system with the introduction of broader environmental incentives or fiscal benefits, such as those linked to recycling centre use or home composting practices.

Below are some examples of how environmental reductions may be applied to households under behavior-based fee systems:

- Reduction for participation in home and/or community composting: A percentage reduction in the basic component of the fee may be granted when participation in composting is verified. Alternatively, in systems applying contribution-based reductions for the organic fraction, the composting reduction may be set equivalent to the value of the variable component corresponding to the highest participation level in selective collection of that fraction.
- Reductions for use of recycling centres: In systems without a variable component, some municipalities grant discounts on the basic fee when user access to recycling centres is recorded. In behavior-based systems, this reduction can be incorporated into the variable component through different approaches: 1) applying a unit discount per visit, up to a predefined maximum number of visits; 2)

establishing a minimum threshold of visits required to qualify for the reduction; or 3) defining contribution bands with increasing reductions as the number of visits increases, within predefined minimum and/or maximum limits).

In the case of commercial activities, some potential reductions may address self-management of organic waste or adoption of best environmental practices.

9 Legal and Juridical Aspects of PAYT Implementation

9.1 Legislative Boundary Conditions Allowing the Introduction of PAYT

Brazil's legal framework already enables the introduction of PAYT, however, key enabling conditions – such as institutional capacity, infrastructure, data systems, and enforcement – must continue to mature for widespread implementation.

The Waste Collection Fee is a mandatory municipal charge applied by local governments to cover the costs of waste collection, transport, and final disposal. It was consolidated under the New Legal Framework for Basic Sanitation (Federal Law No. 14.026/2020), which requires municipalities to charge for the collection and treatment of municipal solid waste and to ensure the financial sustainability of waste management.

Key Aspects

- **Municipal obligation:** to charge a waste management fee or tariff, in line with the polluter-pays principle, to achieve universal access to basic sanitation services.
- **Municipal authority:** mandated by federal law, each municipality is responsible for defining and managing its own tariffs, typically within the Municipal Tax Code.
- **Calculation methods:** vary across municipalities and commonly consider property type (residential, commercial, industrial), built area, location, and collection frequency.[12]

PLANARO is a forthcoming policy[13] instrument under development by Brazil's Ministry of Environment and Climate Change (MMA), establishing the systemic conditions – infrastructure, governance, and incentives – that make PAYT feasible and equitable in the Brazilian context, transforming household-level behavioral change into measurable climate action and social progress.

Effective implementation of PAYT

The existence of a minimum regulatory and enforcement framework for municipal solid waste management is a prerequisite for PAYT implementation. Structural deficiencies – such as uncontrolled disposal, limited inspection capacity, or insufficient service coverage – constitute major barriers to the effective application of PAYT.

In the Brazilian context, effective implementation requires, at a minimum:

- Compliance with PNRS requirements to eliminate open dumps and ensure environmentally adequate final disposal.
- Availability of licensed landfills or treatment facilities with traceable waste flows.
- Municipal regulations that clearly define user obligations, service standards, and penalties for illegal dumping.
- Operational enforcement capacity, including inspection, monitoring, and administrative sanctioning.

PAYT should be introduced as a sequencing instrument, following or accompanying

[12] Agência Nacional de Águas e Saneamento Básico. (n.d.). Normativos publicados pela ANA [Standards published by ANA]. Governo Federal do Brasil. https://www.gov.br/ana/pt-br/assuntos/saneamento-basico/Normativos-publicados-pela-ANA

[13] Agência Brasil. (2025, February 12). Governo abre consulta sobre plano para resíduos orgânicos urbanos [Government opens public consultation on plans for urban organic waste]. https://agenciabrasil.ebc.com.br/meio-ambiente/noticia/2025-02/governo-abre-consulta-sobre-plano-para-residuos-organicos-urbanos

investments in basic waste infrastructure, regulatory clarity, and enforcement mechanisms. Positioning PAYT within a broader regulatory consolidation strategy reduces implementation risks and aligns the instrument with the progressive obligations established under Brazilian environmental law.

10 Implementation Phases and Timeline

10.1 Milestones and hints for a proper implementation

The introduction of a PAYT system cannot be immediate. It requires a gradual process in which administrative, technical, and behavioral foundations are consolidated before applying a variable tariff. The overall timeline may span more than a decade, with the initial years dedicated to building fiscal, organizational, and social acceptance conditions. In countries such as Brazil, where separate collection systems and user databases are often incomplete, preparatory phases are particularly critical.

Before introducing a variable tariff, municipalities must establish a dedicated waste fee, ensure full cost recovery of waste services, and progressively integrate technical tools – such as databases, identification systems, and enforcement mechanisms – together with social instruments, including communication strategies and nudging approaches.

Table 6 illustrates a hypothetical multi-phase implementation pathway, presenting both the sequential logic and practical milestones. Examples are drawn from European experience, where thousands of municipalities have already implemented PAYT schemes, alongside adaptation notes relevant to the Brazilian context.

"Milestone zero" for any PAYT implementation is the elimination of uncontrolled dumpsites. As long as illegal dumping remains an accessible and low-cost alternative – as is still the case in many parts of Brazil – any variable waste fee risks backfiring, leading not to improved separation but to increased littering and environmental degradation. In policy sequencing terms, PAYT reforms should only advance once uncontrolled dumping is sufficiently constrained. Where informal disposal remains widespread and inexpensive, PAYT mechanisms are likely to be perceived as easily avoidable, undermining behavioral incentives and compliance. Under such conditions, PAYT pilots and rollouts may generate unintended effects rather than improvements in waste separation and service efficiency.

Table 6 - Suggested timeline for the implementation of PAYT starting from a low baseline situation

PHASE	MAIN ACTIONS AND OBJECTIVES	EXPECTED OUTPUT / MILESTONE	BRAZILIAN CONTEXT – KEY NOTES
1. Establish a specific waste fee	Separate the waste fee from general property taxation to ensure transparency and earmarking for waste services.	Municipal waste fee ordinance (not property-based).	Many municipalities still include waste charges within the Urban Propriety Tax (IPTU); this step is essential to create fiscal visibility and user accountability.
2. Increase willingness to pay and compliance	Communication campaigns emphasizing the "polluter-pays" principle and the shared responsibility for the product life cycle principle: everyone must contribute to cost coverage before any variable tariff can be applied.	Payment compliance > 90%.	In Brazil, payment rates are often low; this phase may require local campaigns and enforcement support.
3. Achieve full cost coverage (100%)	Gradually align waste fee revenues with total waste management costs (collection, treatment, disposal).	Financial sustainability of municipal waste services.	Italy reached full coverage after ~15 years (D.Lgs. 22/97 to DPR 158/99); a similar long-term horizon is realistic in Brazil.

PHASE	MAIN ACTIONS AND OBJECTIVES	EXPECTED OUTPUT / MILESTONE	BRAZILIAN CONTEXT – KEY NOTES
4. Build and integrate user databases	Create or consolidate databases linking waste generators, property records, and census data.	A functioning, integrated database of taxpayers and users.	In Brazil, cadastral and fiscal databases are often fragmented; data integration is a prerequisite for traceability.[14]
5. Establish a complete separate collection scheme (including organics)	Ensure all households and commercial users are equipped with containers or bags for each fraction (residual, recyclables, organics). Develop logistics and treatment capacity, especially composting.	Fully operational separate collection system covering at least 70–80% of waste, with functioning organic waste collection and treatment.	In Brazil, this is a crucial precondition: without organics separation, PAYT on residual waste risks being socially unacceptable and technically ineffective, as users lack the tools to comply.
6. Pilot user identification systems	Introduce simple tools: RFID tags on bins, standard pre-paid bags, or access-card containers.	First ID and traceability of waste generators.	Start with low-tech pilots in small municipalities before scaling up Requirements: waste charge established, organics collection in place, residual waste disposal fee higher than organics composting gate fee
7. Enforce standardization and limit evasive behavior	Regulate the use of standard bags and locked containers; apply sanctions for non-compliance.	Controlled system with traceable waste inputs.	Enforcement capacity must be built progressively, starting with awareness and moving to gradual sanctions.
8. Introduce KAYT elements	Send informative statements showing that users are controlled and compared to peers. Simulate new PAYT bills to show potential savings and encourage behavior change.	Behavioral adaptation before real PAYT.	Particularly useful in Brazil, where users may resist new tariffs; KAYT creates familiarity and transparency.
9. Define PAYT coefficients	Design tariff structure: fixed vs variable parts. Base coefficients on WR generation, family size, dwelling surface, etc.	Technically justified tariff model.	Brazil may start with hybrid models (surface + standard bags) before full measurement systems.
10. Approve municipal PAYT ordinance	Official adoption of PAYT by local council, defining rates, coefficients, enforcement, and data management.	Legal framework for PAYT implementation.	Municipal ordinances should be supported by national guidelines and regional harmonization.
11. Gradual enforcement and yearly adaptation	Monitor “borderline” users, refine coefficients, and update communication and data.	Stable PAYT system with increasing user acceptance.	Annual adjustments allow correction of data errors and progressive expansion of coverage.
12. Long-term consolidation and transition to KAYT	Once PAYT achieves full behavioral alignment, economic pressure can be relaxed. Focus shifts to KAYT instruments and social norms.	Sustainable waste prevention culture.	The end goal is autonomy and responsibility, not permanent tariff pressure.

A successful PAYT implementation is a journey rather than a one-time reform. Each phase builds on the previous one, ensuring fiscal robustness, social acceptance, and technical readiness. In countries such as Brazil, the initial steps – establishing a dedicated waste fee, achieving full cost recovery, and building reliable user databases – are mandatory before any variable component can be applied. Only once these

[14] Afonso, J. R. R., Araujo, E. A., & Nóbrega, M. A. R. (2012). The urban property tax (IPTU) in Brazil (Working Paper No. WP13JA2). Lincoln Institute of Land Policy. https://www.lincolninst.edu/publications/working-papers/urban-property-tax-iptu-brazil/; Paiva, C. dos A., & Antunes, A. F. B. (2018). Proposta de integração entre os dados do registro de imóveis e do cadastro imobiliário urbano [Proposal for integrating real estate registry and urban property cadastre data]. Boletim de Ciências Geodésicas, 24(4). https://doi.org/10.1590/s1982-21702018000400026

foundations are in place can PAYT evolve into a fair and efficient system.

10.2 The Key Role of the Organic Fraction

The implementation of separate collection for the organic fraction is an indispensable precondition for any PAYT scheme. Without the ability for citizens to properly sort organic waste, the introduction of a variable tariff applied to the residual fraction would be socially unfair and technically ineffective. Organic waste represents the largest share of municipal solid waste in most Brazilian municipalities; its separate collection therefore constitutes the foundation for reducing mixed waste, lowering methane emissions, and creating the economic and environmental conditions necessary for PAYT to succeed.

However, establishing collection alone is not sufficient. The system must ensure that treatment through composting or AD is economically viable – ideally cheaper, or at least not more expensive, than disposal of RW. Achieving this condition requires high-level policy intervention, including targeted subsidies and environmental levies or incentives, as market-based mechanisms alone – such as compost sales revenues or carbon credit schemes – are generally insufficient. This is particularly the case where landfill disposal remains inexpensive and not reflective of full environmental costs, a situation that still prevails in most contexts worldwide and significantly weakens the economic case for organic waste treatment. If landfill disposal or dumping remains the cheapest option, PAYT mechanisms may paradoxically penalize those who separate waste correctly, thereby undermining trust and compliance.

As successfully demonstrated in Catalonia,[15] such a mechanism allows to rebalance economic incentives, rewarding composting and discouraging disposal. The challenge is even greater in Brazil, where, according to recent data, around 1698 municipalities (30%) still rely on illegal or uncontrolled dumpsites.[16] In these conditions, any kind of industrial composting will inevitably appear more costly than cheap dumping, even when environmental and social benefits are considered. Therefore, implementing PAYT without first addressing the full organic waste management chain – from separate collection to affordable treatment – risks exacerbating inequities rather than fostering circularity. The national government must therefore act as both an economic and institutional enabler, ensuring that organic waste management becomes the cornerstone upon which a credible, fair, and effective PAYT system can be built.

[15] LIFE BIOBEST project - guiding the mainstreaming of best bio-waste recycling practices in Europe, D3.2: Guideline on governance and economic Incentives. https://zerowasteeurope.eu/wp-content/uploads/2024/06/Jun24_240626_LIFE-BIOBEST_WP3_D3.2_Guideline-governance-economic-incentives_web.pdf

[16] SINISA 2024, Relatório da Gestão Municipal do Saneamento Básico, https://www.gov.br/cidades/pt-br/acesso-a-informacao/acoes-e-programas/saneamento/sinisa/resultados-sinisa/copy_of_RELATORIO_SINISA_GESTAO_MUNICIPAL_2024_v2.pdf

11 Economic Aspects Related to Implementation

Costs can be grouped into three main categories: initial costs, investment costs, and operating including maintenance.

Initial costs include technical and legal preparatory studies required for system design and legal articulation, as well as participatory processes and communication campaigns. An optional element is the development of a mobile application to support system operation and user interaction.

Investment costs depend largely on the PAYT system adopted:

- In pay-per-bin models, the main costs relate to the purchase of bins – typically equipped with identification tags – and the purchase or adaptation of collection vehicles. This may include onboard computers, software installation, reading and communication equipment, and devices to process incidents during collection.
- In pay-per-bag models, the primary investment costs are associated with the manufacturing of standardized bags required for collection.
- In systems based on closed containers with user identification, the main investment costs relate to purchasing the containers, particularly when equipped with chamber systems. In some cases, collection vehicles also require adaptation. An additional cost involves providing users with ID cards or equivalent identification tools.

Additional investment costs may arise from adapting recycling centers to facilitate monitored waste delivery in specific cases.

System Operating and Maintenance Costs

Once the system is operational, the main costs are associated with staffing for system operation and supervision, as well as the purchase, maintenance, and replacement of equipment and collection materials. As with investment costs, operating costs depend on the type of PAYT scheme implemented.

- Pay-per-bag schemes involve recurring costs related to the procurement of standardized bags. Additional staff – either municipal or contracted – are required to manage and supervise bag distribution through local retailers.
- In pay-per-bin models, the main recurring costs relate to maintenance and replacement of bins and their associated tags or chips.
- Systems based on closed containers with user identification entail significant maintenance costs for both mechanical and technological components, particularly those related to identification and data transmission. These systems are also more vulnerable to vandalism, resulting in additional costs.

Certain costs are common to all PAYT systems, notably increased personnel dedicated to system supervision and enforcement. Collection management software that centralizes and processes data generated during service delivery is also required for all technology-based PAYT schemes. Software-related costs may include license purchases with regular updates or subscription-based payments under software-as-a-service (SaaS) models. If a mobile application is used, additional costs arise from its maintenance and updating.

Although operating costs may increase, reductions in waste generation and improvements in source separation following PAYT implementation typically lead to lower treatment costs for mixed waste, along with increased revenues from the sale of recyclable materials and, where applicable, from EPR

schemes. By contrast, higher collection rates of organic waste increase treatment costs for this fraction. In principle, organic waste treatment through composting or AD should be less costly than mixed waste disposal when environmental benefits and revenues from compost and biogas are taken into account. However, this is often not the case in contexts where incentives for compost and biogas are absent and landfill disposal remains inexpensive, making organic waste treatment financially uncompetitive.

Quantitative estimates of these changes in waste flows are required to calculate appropriate waste fees, as they directly affect both costs and revenues within the waste management system.

The cost of implementing is PAYT schemes – such as RFID bins, antennas, software, and related infrastructure – is estimated at approximately €5 (29 BRL) per capita per year.[17]

[17] Giavini, M. (s.d.). PAYT (Pay As You Throw) to reach 80% recycling. Interreg Europe Policy Learning Platform. https://www.interregeurope.eu/good-practices/payt-pay-as-you-throw-to-reach-80-recycling

12 Potential Results Regarding Waste Flows

PAYT systems create incentives for users to reduce waste generation and improve source separation. The magnitude and direction of these effects depend on several factors, including the PAYT model selected (which fractions are charged or incentivized, fee levels applied, and collection methods) and the municipality's baseline conditions prior to PAYT implementation.

Table 7 summarizes, in qualitative terms, the general trends typically observed following the introduction of PAYT systems:

Table 7 - Trends observed when implementing a PAYT system

ACTION	EXPECTED TREND
Overall waste generation	Tends to diminish
Residual waste collected	Tends to diminish
Organic waste collected	Tends to increase
Collection of other recyclable fractions	Tends to increase but depends on the collection model and on whether they are subject to PAYT or SAYT
Participation in commercial waste collections	Tends to increase
Deliveries to the local waste recycling centre	Tend to increase
Deliveries to access-controlled container zones	Tend to increase, but this may depend on whether and how the use of these areas is charged
Bulky waste collected	Tends to increase
Household composting	Negligible, unless specific reductions or benefits are provided in the waste charge
Organic treatment	Tends to increase following increased separate collection of organic waste.
Illegal waste disposal	Tends to increase but depends on the model adopted, the services offered and the implementation of sanctions and enforcement practices

In terms of greenhouse gas emissions, PAYT systems deliver benefits mainly through:

- Avoided emissions: Since landfilled organic waste is a relevant source of methane (CH_4), any reduction in this fraction resulting from increased separate collection and organic waste treatment has a direct and significant impact on methane emissions.
- Biogas production: Separately collected organic waste can be treated in AD facilities, producing biogas that can replace fossil fuels.
- Avoided upstream emissions through recycling: More effective separate collection increases recycling rates. Producing materials from recycled feedstock generally requires significantly less energy than producing them from virgin raw materials – particularly in the case of aluminium, steel, plastics, paper, and glass – resulting in substantial avoided upstream carbon dioxide (CO_2) emissions.

13 Communication, Public Education, and Enforcement

13.1 Public Awareness Campaigns and Behaviour Change Messaging

Public communication must precede and accompany PAYT implementation to ensure public acceptance and sustained participation. Awareness campaigns should clearly communicate that PAYT is not simply a new tax, but a tool to promote fairness, transparency, and environmental improvement. Messaging should emphasize citizens' ability to control costs by reducing waste generation and improving separation.

As highlighted in the behavioral science chapter, emotional and social motivators—such as pride, community identity, and visible cleanliness—can be as powerful as economic incentives. Campaigns should combine traditional and digital media, street-level engagement, and feedback loops showing collective progress in order to reinforce behavioral change.

13.2 Transparent Communication on Objectives and Fairness

Transparency is critical to building trust in PAYT systems. Citizens must understand how fees are calculated, which service improvements are expected, and how revenues or savings are reinvested. Clearly communicating objectives – such as "less waste, more recycling and composting, cleaner streets" – helps counter perceptions of hidden taxation.

Visual tools, including infographics and dashboards, should illustrate the link between individual effort and community-wide benefits. Authorities should also clearly explain social fairness mechanisms, such as reductions for low-income users or community recycling credits, reinforcing PAYT's image as equitable and socially inclusive.

13.3 Role of Schools, Civil Society, and Digital Platforms

Schools, non-governmental organizations (NGOs), neighborhood associations, and local influencers play a key role in supporting behavioral change. Civil society organizations can help monitor implementation, mediate conflicts, and translate PAYT messages into local contexts, particularly in informal or underserved areas.

Digital tools – such as mobile applications or WhatsApp channels – can be used to share reminders, provide feedback on participation rates, and report problems, ensuring that PAYT communication is participatory and continuous rather than top-down. However, care should be taken to avoid engagement limited only to already motivated users.

13.4 Integration of Waste Cooperatives and Informal Sector Associations

Brazil's waste-picker cooperatives, which represent a degree of formalization of the informal sector, can play a decisive role in PAYT implementation. Their strong community ties and daily interaction with households make them effective intermediaries for explaining the system, reinforcing trust, and increasing willingness to pay, as illustrated by the Dar es Salaam case (see Annex).

In early implementation phases, cooperatives can support door-to-door awareness activities, help clarify the relationship between service quality and fees, and provide valuable social feedback. At later stages, trained cooperative members may also assist with visual assessments of waste quantity or quality, supporting the development of variable components within PAYT schemes while ensuring inclusiveness and social legitimacy.

13.5 Addressing Risks of Illegal Dumping, Fraud and Preventive Actions

Introducing a variable waste fee may unintentionally stimulate illegal dumping or misuse of containers if preventive conditions are not secured. A fundamental prerequisite is the closure and remediation of all existing uncontrolled dumpsites: without this “milestone zero,” any PAYT system risks simply shifting disposal to informal or illegal areas. Communication strategies must therefore combine civic education with a clear zero-tolerance approach to dumping. Preventive actions include maintaining convenient and frequent collection services, ensuring sufficient drop-off points, monitoring critical areas, and providing anonymous reporting channels. Transparent monitoring and proportional enforcement, combined with visible rewards for compliant users, help make responsible behavior the social norm and prevent fraud or opportunistic avoidance practices.

13.6 Enforcement Mechanisms and Monitoring

Effective enforcement closes the loop between communication, service, and accountability. Sanctions should be proportional, transparent, and publicly communicated, reinforcing that enforcement protects compliant citizens rather than punishing them arbitrarily. Local inspectors, municipal guards, and community leaders can collaborate in monitoring, supported by digital reporting tools and geolocated data. Indicators such as reductions in mixed waste, complaint rates, and littering hotspots should be regularly published, ensuring that PAYT remains credible, fair, and continuously improved.

14 Other Economic Instruments: Landfill Taxes and Feebate Scheme

Economic instruments play a crucial role in improving waste management outcomes.

Improved waste management solutions, which are typically more costly, focus primarily on waste charges to finance it. However, economic incentives applied at national or regional levels must also be considered, to be coherent with instruments implemented at the local level.

The most visible application of the polluter-pays principle in waste management policy is the use of landfill and incineration taxes. These instruments are widely applied in countries with more advanced waste management systems. The World Bank Group, for example, explicitly notes that "economic instruments in support of the waste hierarchy include landfill taxes that increase the cost of disposal".

Landfill and incineration taxes increase the cost of disposal compared to alternative treatment options, such as composting. In the case of municipal waste, these taxes are generally paid by local authorities, which are also responsible for waste collection. As a result, municipalities are incentivized to adopt strategies that divert waste away from landfills and incinerators. In practice, this typically involves improving separate collection of organic waste and recyclables, with priority given to quality composting or anaerobic digestion of the organic fraction. Mechanical-biological treatment (MBT) can be considered a temporary option to stabilize the organic fraction while separate collection of organics develops, with the added advantage that it can be easily converted into quality composting facilities.

There is a well-documented negative correlation between the total cost of landfilling (gate fee plus landfill tax) and the share of waste sent to landfill. Landfill and incineration taxes often differentiate rates according to the type of facility (e.g., landfill versus incineration, incinerators with or without energy recovery) or the type of waste treated (e.g., pretreated waste from MBT facilities versus direct landfilling).[18]

An additional factor that enhances the effectiveness and efficiency of landfill and incineration taxes is predictability in the evolution of tax rates. When future rate increases are clearly signalled, stakeholders can better anticipate disposal costs and make informed decisions regarding long-term investments in alternative treatment capacity.

As is common with environmental taxes, public acceptance tends to be higher when revenues are earmarked for related purposes. In the waste sector, this may include dedicating revenues to investments higher up the waste hierarchy, such as composting and other treatment facilities, subsidy programs for municipalities implementing separate collection or waste prevention measures, and public awareness campaigns.[19]

Fee-rebate or feebate-schemes represent another relevant economic instrument. Given that municipalities often cooperate to share waste collection services and treatment infrastructure, feebate systems aim to influence how costs are distributed among

[18] Watkins, E., Hogg, D., Mitsios, A., Mudgal, S., Neubauer, A., Reisinger, H., Troeltzsch, J., & Van Acoleyen, M. (2012). Use of economic instruments and waste management performances: Final report. European Commission, DG Environment. https://op.europa.eu/en/publication-detail/-/publication/566f28fd-3a94-4fe0-b52d-6e40f8961c7e

[19] European Environment Agency. (2000). Environmental taxes: Recent developments in tools for integration (Environmental Issues Series No. 18). https://www.eea.europa.eu/publications/Environmental_Issues_No_18

participating municipalities in order to incentivize better environmental performance.

A feebate system could reward those municipalities making significant steps towards more ecological waste management, whilst penalizing the others, using the average values as a reference. Some indicators that could be used to define fees/rebates to stimulate separate collection could be per capita generation collected separately, or per capita generation of organic waste entering composting facilities or percentage of separate collection of organic waste.[20]

Other economic instruments have also some relevance for local finances, e.g. extended producer responsibility or taxes applied to specific products.[21]

[20] Puig Ventosa, I. (2004). Potential use of feebate systems to foster environmentally sound urban waste management. Waste Management, 24(1), 3–7. https://doi.org/10.1016/S0956-053X(03)00132-6

[21] Organisation for Economic Co-operation and Development. (2016). Extended producer responsibility: Updated guidance for efficient waste management. OECD Publishing. https://www.oecd.org/env/extended-producer-responsibility-9789264256385-en.htm

15 South – South learning

15.1 Current Gaps and Global Barriers to PAYT Implementation

Developing and emerging economies share a set of structural barriers that hinder both the implementation and the systematic documentation of PAYT as a modern waste management instrument. These barriers can be summarized as follows:

- Incomplete waste collection systems, with segments of the population remaining unserved.
- Low data reliability, particularly regarding waste generation and composition.
- Weak cost-recovery mechanisms, with relatively few municipalities applying user-based fees.
- A strong presence of waste pickers whose activities are not fully integrated into formal systems.
- Waste management initiatives that are often short-term pilot projects, with limited follow-up, monitoring, or peer-reviewed documentation.

15.2 Need for Pilot Projects and South-South Collaboration

The introduction of PAYT systems in Brazil – and across the Global South – cannot rely solely on the direct transfer of European or East Asian models. Pilot projects are indispensable to test, adapt, and validate PAYT under real social, economic, and institutional conditions. Pilots provide an empirical bridge between the existing national legal framework in Brazil (PNRS, PLANARES, and Law No. 11.445/2007) and practical implementation at the municipal level.

To ensure replicability and learning value, PAYT pilot projects in the Brazilian context should follow several guiding principles:

- **Gradual approach:** Combine fixed service fees with low-tech variable tools, such as standardized prepaid bags or stickered bins.
- **Inclusive governance:** Integrate waste pickers (“catadores”) from the outset as communication agents and data collectors, enhancing legitimacy and social inclusion.
- **Integrated monitoring:** Use digital dashboards that consolidate service coverage, user compliance, and financial flows.
- **Cross-sector coordination:** Align with PLANARO objectives, ensuring that composting or AD capacity for separated organic waste is available prior to PAYT rollout.
- **Evaluation and knowledge sharing:** Involve independent academic partners or technical institutions to document impacts and publish results, addressing current research gaps.

15.3 Potential Cases for Further Exploration

Dar-es-Salam

Both Dar es Salaam (Tanzania) and Brazilian cities face comparable urban waste management challenges:

- Rapid urban growth and the presence of informal settlements.
- Limited municipal budgets for solid waste management.
- The need to strengthen cost recovery and user accountability in service delivery.

While Brazil’s TCL is mandatory under Federal Law No. 11.445/2007, it remains largely a flat-rate fee not linked to actual waste generation. By contrast, Dar es Salaam has implemented differentiated waste tariffs – a transitional form

of PAYT – that offers relevant lessons for Brazil.

Institutional Framework in Dar es Salaam

- Decentralized model: Waste management is overseen by municipal councils that contract private operators, including community-based organizations and small enterprises.
- Fee collection: Users pay directly to licensed collectors or through integrated billing systems.
- Regulation: Tariffs are approved by local authorities and periodically reviewed to ensure affordability and cost recovery.
- Monitoring: District officers track service coverage and user complaints.

This structure reflects a service-based, participatory model that is well suited for adaptation in Brazilian cities already working with waste-picker cooperatives or private contractors. A key distinction from Brazil is that tariffs are linked to service levels rather than property characteristics such as area or location Table 8.

Table 8 - PAYT Service Level (Tanzania)

USER TYPE	TARIFF BASIS	APPROX. MONTHLY FEE	KEY NOTES
Residential (low-income)	Fixed rate per household	2,000–3,000 TZS (~USD 0.80–1.20)	Subsidized in informal areas
Residential (middle/high income)	Fixed rate per bin or collection frequency	5,000–10,000 TZS (~USD 2–4)	Higher rate for larger volumes
Commercial (shops, restaurants)	Volume or frequency-based	30,000–50,000 TZS (~USD 12–20)	Negotiated or metered
Institutions (schools, offices)	Contracted service	Variable	Often cost-recovery basis

Key Features Relevant to Brazil

1. Service-based charging: Users pay for the service actually provided, improving transparency and perceived fairness.
2. Differentiation by generator type: More effectively reflects the polluter-pays principle than flat municipal fees.
3. Decentralized private participation: Small-scale private or community operators handle collection efficiently in dense or low-income areas.
4. Digitalization and accountability: Mobile payments (e.g., M-Pesa) and community reporting enhance compliance and reduce corruption risks.
5. Flexibility for informal areas: Allows inclusive waste management through negotiated or collective tariff arrangements. Table 9 summarizes the Dar es Salaam approach to PAYT alongside recommended adaptations for Brazil.

Table 9 - Dar Es Salaam approach to PAYT

STAGE	DAR ES SALAAM APPROACH	RECOMMENDED ADAPTATION FOR BRAZIL
1. Tariff differentiation	Tariffs vary by user type and frequency.	Municipalities can adjust TCL/TCRS to reflect waste generation categories (residential, commercial, institutional).
2. Direct payment mechanisms	Users pay private contractors or via mobile systems.	Integrate TCL into utility bills (water, electricity) to improve cost recovery.
3. Private/community collection	Small operators under municipal supervision.	Expand partnerships with cooperatives and SMEs in waste collection.
4. Digital tools	Use of apps and mobile money for reporting and payments.	Link with MOPA or similar participatory platforms for real-time feedback.
5. Gradual PAYT transition	From flat tariffs to quantity-based pricing.	Pilot KAYT ("Know As You Throw") schemes with data feedback before full PAYT.

Policy Recommendations

1. Adopt progressive tariffs that reflect waste generation and service levels.
2. Enable digital payment and monitoring systems to improve transparency and cost recovery.
3. Encourage public–private partnerships, particularly with sector cooperatives.
4. Integrate communication and gamification tools (SAYT, KAYT, BAYT) to strengthen public engagement.
5. Use Dar es Salaam's staged model as a roadmap for PAYT readiness, progressing from flat-rate fees to differentiated and data-based pricing.

15.4 Organic Waste Collection and Valorization in Brazil

Although collection traditionally focuses on recyclable materials, autonomous actors often recover organic fractions for secondary uses, particularly food waste suitable for animal feed or resale within informal food chains. This practice is rarely captured in official data but is widely observed in urban markets. Recognizing and understanding these informal organic waste flows is important for designing PAYT systems that do not disrupt existing livelihood strategies and that can potentially integrate recovery pathways into more formalized organic waste management chains.

15.5 Recommendations for Brazil to Lead in Regional Innovation

Brazil can close existing evidence gaps by piloting, monitoring, and publishing inclusive PAYT models that combine economic incentives with social equity, thereby leading regional learning and climate action in waste management. Brazil is particularly well positioned to assume a leadership role in South–South PAYT innovation because:

- It already has robust legal and planning frameworks (PLANSAB, PNRS, PLANARES, and Law No. 11.445/2007), in addition to PLANARO, currently being drafted by the MMA,
- It benefits from strong networks of waste-picker cooperatives and associations that can support inclusive implementation.
- It is a member of international climate and methane reduction initiatives, which can facilitate access to funding for monitoring and scaling up PAYT pilots.

However, documented municipal experiences remain scarce. Establishing and publishing the first Brazilian PAYT pilot case studies – for example through GMH-supported projects – would address a significant global research gap and provide a benchmark for other Global South countries.

16 Final considerations on the Relevance and Applicability to the Brazilian Context

16.1 Social equity and inclusion

Brazil faces pronounced income inequality, high levels of urban informality, and uneven access to public services. Without appropriate safeguards, PAYT risks being perceived as punitive or regressive, disproportionately affecting low-income households with limited capacity to adapt waste practices. To ensure fairness, municipalities should consider the following measures:

- Infrastructure: Households must have access to convenient and frequent separate collection – particularly for organic waste – before financial incentives or penalties related to RW are introduced.
- Waste-picker cooperatives can play a bridging role in communication, monitoring, and trust-building, ensuring PAYT systems are socially legitimate and locally embedded.
- Social tariffs and exemptions: Reduced fixed fees for low-income households, beneficiaries of social programs.

16.2 Urban and Rural Waste Management Realities

Brazil's geographic and socioeconomic diversity requires differentiated PAYT models. Urban areas often face challenges related to non-formal areas, high-density housing and multi-family buildings; PAYT implementation in such contexts should rely on mixed systems (e.g., prepaid bags, closed containers, and DtD collection) supported by strong monitoring capacity.

Rural and small municipalities typically face limited financial resources and low data availability. In these contexts, low-tech PAYT approaches – such as DtD collection, prepaid bags, or fixed-frequency bin systems – are often more appropriate. These municipalities require technical guidance and financial support to improve basic waste collection services and establish waste fees as a foundation for PAYT.

Intermediate and peri-urban municipalities must address issues related to urban sprawl, discontinuous infrastructure, and informal settlements, adapting collection models to local territorial and social conditions.

Brazil cannot apply a single national PAYT model. Instead, regional differentiation and phased adoption are essential.

16.3 Institutional and Financial Capacities of Municipalities

Most Brazilian municipalities currently lack the technical, financial, and administrative capacity to immediately implement PAYT. Key constraints include incomplete or outdated taxpayer and cadastral databases, limited cost-accounting systems for waste management, and weak integration between service levels and billing models.

Capacity-building efforts should therefore prioritize digital tools, data management systems, and, where appropriate, the creation of regional technical consortia to share resources and reduce management costs. In municipalities with limited capacity. PAYT should begin with simple, low-tech tools and progressively evolve toward more advanced systems, such as RFID-based or chamber-equipped containers, as institutional maturity increases.

Tools to Calculate Waste Fees in Brazil

The Federal Ministry for Environment with the support of German Development Cooperation (GIZ) developed tools (ProteGEEr project) to help municipalities dealing with waste management, in 2021. A calculation tool for determining the costs of municipal waste services and the basic calculation value for the corresponding fees or tariffs, through either a comprehensive assessment with detailed waste management expenditure data or a simplified assessment, is now available. This tool allows the definition of alternative, differentiated fee or tariff structures that take into account social criteria, waste generation levels, and other factors. (Governo do Brasil, 2021).

Waste fees in Brazil

Most Brazilian municipalities have implemented rudimentary waste fees, which are generally property-based rather than service-based. A recent study covering 1,851 municipalities (representing about 47% of Brazil's population) found that, while the adoption of waste service charges increased by 17%, only around 8% of municipalities achieved financial self-sufficiency through waste fees. This means that most municipalities still rely heavily on general municipal budgets, taxes, or other revenue sources rather than cost recovery through waste fees.[22]

Waste fees in Brazil are typically property-based and therefore fail to provide strong behavioral incentives, such as reducing waste generation or improving source separation. The lack of up-to-date data on waste generation volumes and composition in many municipalities further hampers the design of volume-based or behavior-linked fees. These challenges are compounded by limited technical capacity and training within municipal administrations to accurately assess service costs and implement more sophisticated charging models. In addition, many municipalities still have limited selective collection or recycling services.

The ProteGEEr project was a technical cooperation initiative between Brazil and Germany to improve MSW. It was implemented within the framework of a technical cooperation agreement between the Ministry of Cities, the Ministry of the Environment, the Brazilian Cooperation Agency, and the German Development Cooperation (GIZ). There is now a tool based on municipal costs designed to establish a system for charging fees tariffs.[23]

Implementation in non-formal areas

Implementing PAYT in informal areas presents specific challenges. The absence of formal addresses requires alternative identification systems, such as QR plates on dwellings, GPS-based location points, or neighbourhood-based billing. Irregular occupancy patterns, seasonal residents, and informal tenancy arrangements further complicate fee attribution. Informal areas are also characterized by narrow passages, irregular street layouts, and a high share of recyclable recovery by informal workers, making conventional PAYT models difficult to apply.

Despite these constraints, PAYT can be implemented in informal areas through co-design approaches, visible service improvements, digital verification tools, low-tech solutions, and collective incentives.

[22] Dutra, R. M. S., & Siman, R. R. (2024). Charges to generators for solid waste management services: An analysis of the financial sustainability of Brazilian municipalities. Revista de Gestão Social e Ambiental, 18(3), e5876. https://doi.org/10.24857/rgsa.v18n3-172

[23] Calculadora de Taxas ou Tarifas dos Serviços de Manejo de Resíduos Sólidos Urbanos, ProteGEEr / Ministério das Cidades: https://www.gov.br/cidades/pt-br/acesso-a-informacao/acoes-e-programas/saneamento/protegeer/calculadora-de-taxas-ou-tarifas-dos-servicos-de-manejo-de-residuos-solidos-urbanos

However, PAYT cannot be built on top of unreliable services. Before introducing any variable fee, municipalities must guarantee regular and predictable collection services, with identifiable collection teams, transparent communication channels, and community-level verification mechanisms (e.g., QR door plates or WhatsApp groups).

Implementing PAYT in informal areas requires a coordinated set of actions:

- Map the community and use a combination of participatory mapping with residents, GPS-based housing nodes and "Address-free PAYT" where each dwelling receives a QR plate instead of needing a formal address.
- Involve neighbourhood associations ("Associações de moradores"), local leaders, and youth groups must lead awareness activities.
- Resolve urgent issues first such as litter problems, rats and organic waste hotspots, manage the responsibility between municipality and local waste contractor. This builds trust: "We are not charging yet. First, we show how the system works, with simple, low-tech, and socially fair tariffs."
- Introduce separate collection and treatment of organics as without it in place PAYT is less effective; users shouldn't pay a variable tax based on unsorted waste production, if they don't have the possibility to separate the most relevant fraction of MSW. This must be accompanied by policies and programs that support organics collection and composting, making it economically more viable than landfilling.
- Automatic discounts for vulnerable households Ideally linked to social programs, remembering that no household in poverty should be forced into illegal dumping.
- The Integration of current waste pickers is essential for legitimacy as associations of waste pickers cooperatives must not just be partners, they must be co-managers and the roles for cooperatives should include DtD education, mapping and registering households, monitoring improper disposal, providing service verification and sorting recyclables with higher market value.
- Enforcement is difficult, and must be soft and not punitive as standard European-style fines do not work in low-income informal settlements and may backfire. Instead, enforcement should consider issuing warnings first, cooperative mediation, engagement via local leaders and repair-based sanctions (community volunteering). Avoid bureaucratic language, use storytelling, and short videos to enhance awareness.

On-site composting hubs strengthen PAYT by diverting organic waste at the source, reducing the amount of RW that households pay for. They also increase citizen participation and lower municipal collection and disposal costs, making PAYT more effective and sustainable.

"Micro-PAYT" can be a powerful low-tech option when used with standardized municipal bags (residual only) sold at subsidized prices inside the areas, in local shops and even color-coded for fraction and volume, helping informal workers ("catadores") and Cooperatives in getting cleaner recyclables.

Households often prefer PAYT-by-bag because no technology required, no address required and no container space needed, as it matches existing waste behaviour (bag deposit at collection point).

16.4 Role of Waste Picker Cooperatives and Associations

Brazil has one of the world's most structured and politically organized networks of informal

workers, represented through national and regional movements such as MNCR, UNICATADORES, and hundreds of cooperatives and associations. These actors perform essential public-interest functions: they ensure high recycling rates, maintain daily community-level contact, and operate with a deep understanding of social dynamics in both formal and informal areas.

In this context, the integration of waste-informal workers cooperatives into PAYT schemes is not only a matter of social justice, it is a technical and operational necessity. A PAYT system that fails to incorporate cooperatives risks undermining livelihoods, weakening selective collection performance, and losing the community trust required for PAYT acceptance.

Conversely, a well-designed PAYT scheme can significantly strengthen the role of cooperatives and generate more stable income, better working conditions, and higher-quality recyclable streams.

Community trust and proximity

“Catadores” have long-standing relationships with households and businesses, particularly in low-income and informal settlements where municipal presence is limited. Their proximity increases service legitimacy, trust in new rules or fees, and participation in selective collection, including organic waste.

This role cannot be fully replaced by private operators or municipal staff.

Proven operational capacity

Cooperatives already provide sorting, collection, and quality-control services in many municipalities.

Their knowledge of material flows and contamination patterns is unmatched. PAYT schemes depend on clean, well-separated recyclables and organics, something cooperatives already incentivize and monitor.

Circular economy alignment

Brazil’s PNRS explicitly recognizes waste informal workers as central actors in recycling. PAYT strengthens circularity; cooperatives reinforce the social dimension of circularity. Their integration therefore supports just transition principles, carbon-mitigation objectives (recycling + methane reduction), as well as municipal compliance with PNRS and PLANARES.

Opportunities for Cooperative Integration in PAYT

Engagement in DtD awareness and pre-PAYT communication, e.g. distributing bags/containers, explaining new collection rules as they bridge municipal communication gaps and reduce misinformation, as well as supporting the monitoring of container misuse and contamination. Other ways that they can support PAYT preparations include:

- Identify hotspots of improper disposal.
- Flag contamination trends.
- Provide photographic evidence for municipal dashboards.
- Suggest targeted communication for affected areas.
- Be part of the enforcement in a socially sensitive way.

Their daily operational presence gives them situational awareness that municipalities often lack.

Sorting and quality control of recyclables, increasing revenue leading to cleaner recyclables and higher commercial value per ton, less manual re-sorting and risk exposure, more revenue for cooperatives and improved financial sustainability.

Cooperatives can manage a hotline, local WhatsApp channels, or in-person neighborhood support.

Roles Cooperatives Can Play in PAYT Implementation and a comprehensive PAYT strategy can involve cooperatives at multiple stages Table 10:

Table 10 - Cooperatives within PAYT

STAGE	COOPERATIVE ROLES
Pre-implementation	Awareness, data collection, mapping communities, identifying vulnerable households, co-designing communication material
Pilot rollout	Distribution of bags/tags, DtD communication, first-line support for questions, quality control
Operation	Monitoring, reporting misuse, collecting recyclables, sorting, managing local drop-off points, operating small scale composting plants
Evaluation	Providing qualitative insights, reporting operational challenges, supporting surveys
Expansion	Training cooperatives in neighboring municipalities, helping scale best practices

The risks associated with excluding cooperatives from PAYT systems are well documented. One major concern is the loss of access to recyclable materials. Access-controlled containers and PAYT-regulated disposal points can unintentionally restrict traditional collection routes, preventing cooperatives from accessing recyclables on which they depend.

Another significant risk is increased competition with private operators. As PAYT may incentivize municipalities to privatize or concession parts of the waste management system, waste picker cooperatives risk losing contractual opportunities unless they are explicitly integrated from the outset. In the absence of such integration, PAYT can undermine cooperative livelihoods by reducing income streams, introducing exclusionary technical requirements (e.g., RFID-based systems), and exacerbating tensions between cooperatives and municipal service providers.

Strategies for Ensuring Cooperative Inclusion in PAYT

To avoid these risks, municipalities should adopt explicit strategies and institutionalize their role and include cooperatives in municipal PAYT ordinances, formalize roles via service contracts, including organic waste collection and small scale composting where suitable, provide training on digital tools (QR/RFID systems) and ensure participation in planning committees.

Provide stable financial support for awareness activities

- Provide contracts for selective collection
- Share savings from reduced landfilling
- Support equipment upgrades (PPE, balers, sorting lines)

Include cooperatives in enforcement mechanisms

- Cooperatives can issue contamination reports
- Provide visibility to their role in “social inspection”
- Support municipal surveillance with neighborhood knowledge

Integrate cooperatives in data governance

- Provide access to dashboards
- Integrate cooperative-collected data into municipal monitoring systems
- Train them in data interpretation for feedback loops

Municipalities benefit by integrating cooperatives as PAYT acceptance increases significantly. Public communication becomes more effective, illegal dumping decreases

through local monitoring thus PAYT becomes both environmentally and socially fair, strengthening the local circular economy.

16.5 Legal and Regulatory Considerations

Brazil's federal legislation already allows PAYT as PNRS (Law 12.305/2010) establishes the polluter-pays principle, Law 11.445/2007 mandates cost-recovery and waste tariffs and PLANARES and PLANARO create targets and structures for organics and recycling.

A Resolution from the National Environment Council (Conama) is being drafted, establishing basic criteria and general guidelines for the regulation of large generators of solid waste at the municipal level. The proposed regulation stipulates that municipalities will have a deadline to regulate the activities of large generators, requiring from them a Solid Waste Management Plan (PGRS) and annual registration.[24]

But national law is not enough, municipalities must regulate PAYT locally through ordinances defining:

- Waste fractions.
- User categories.
- Fixed and variable components.
- Enforcement mechanisms.
- Complaint procedures.
- Data protection and transparency.

Brazil must still strengthen:

- National guidelines on PAYT criteria definition, enforcement, and data management.
- Harmonization across states to avoid incoherence.
- Support for municipalities in drafting ordinances.
- Alignment with General Data Protection Regulation (LGPD).

With these improvements, the legal framework becomes a strong enabler rather than a barrier.

16.6 Public Perception and Cultural Considerations

PAYT is not only a technical reform, it is a cultural shift. In Brazil, waste collection is widely perceived as a "right" associated with municipal responsibilities, not as a service linked to individual behavior. This perception creates resistance to variable tariffs.

Key considerations include:

- Trust in public authorities is often low: citizens fear "new taxes" with no service improvement.
- Waste separation habits are still progressing with only one-third of the population accessing regular selective collection.[25]
- Cultural factors: Brazilian households often deal with limited indoor space, favoring simpler bag-based systems; small buckets and bins

To overcome cultural resistance:

- Communicate PAYT as grounded in "fairness", not to be seen as a penalty.
- Link variable tariffs to visible service improvements.
- Use nudging, KAYT, and gamification to introduce behavioral change before monetary variation.
- Use schools, cooperatives, neighborhood councils, and digital tools as amplifiers.

PAYT acceptance grows when citizens see direct results and feel the system is

[24] Conselho Nacional do Meio Ambiente. (n.d.). Consulta pública – Resolução sobre grandes geradores de resíduos sólidos [Public consultation – Resolution on large generators of solid waste]. Brasil Participativo. https://brasilparticipativo.presidencia.gov.br/processes/rcprococonvegeradores

[25] Nascimento de Andrade, F., & Vieira de Araujo, F. (2025). An analysis of the legal and management aspects of plastic waste in Brazil. Sustainable Futures, 10, 101120. https://doi.org/10.1016/j.sftr.2025.101120

transparent, fair, and beneficial to the community.

16.7 Brazil leading PAYT in South America

The combination of waste management environmental objectives in the legal framework and the Zero Methane Program offers a policy foundation for integrating economic instruments and behavioral tools. The gradual expansion of selective collection and the formalization of informal workers cooperatives (“catadores”) create conditions for inclusive PAYT pilot projects. Brazilian municipalities can adopt a phased approach: start with service verification and low-tech tools (bags, stickers, or RFID pilots), then evolve toward full PAYT once separate collection systems and databases are consolidated.[26]

Brazil is well positioned to lead South–South learning on PAYT in South America.

[26] (IBGE, 2024; MMA, 2022, 2025)

17 Strategic Recommendations and Priority Next Steps for PAYT in Brazil

Brazil is at a pivotal moment to modernize municipal solid waste management through the use of economic instruments, improved data systems, and citizen-centered governance. PAYT has the potential to become a core mechanism for financial sustainability, behavioral change, and climate action. However, its successful implementation depends on phased design, institutional readiness, and coordinated action across federal, state, and municipal levels, with active participation from service operators, civil society, and the private sector.

This chapter presents strategic recommendations and priority next steps to guide municipalities, state governments, and federal agencies in building the enabling conditions for PAYT and preparing the first Brazilian pilot projects.

17.1 Identify Candidate Municipalities for Pilot Projects

Lead stakeholders:

- Municipal governments and/or intermunicipal public consortia (urban cleaning and sanitation, as well as environmental departments)

Supporting stakeholders:

- State environmental and sanitation agencies
- Ministry of Environment and Climate Change
- Ministry of Cities
- IBGE, SNISA, SINIR and other data main source of information in MSW

Role and rationale:

Municipalities should be selected based on objective readiness criteria, including service coverage, disposal compliance, billing capacity, political commitment, and availability of basic waste data. State and federal institutions can also financially support municipalities through calls for proposals to select pilot projects for the implementation of PAYT schemes, and may finance studies, environmental awareness campaigns, the purchase of specific equipment and collection containers, thus ensuring territorial balance across regions.

17.2 Develop Capacity Building and Technical Assistance Programs

Lead stakeholders:

- Federal government (Ministry of Cities; Ministry of Environment)
- ENAP (National School of Public Administration)

Supporting stakeholders:

- State governments
- Universities, research institutes, civil society organizations, and technical cooperation agencies
- International development partners
- Civil society organizations

Role and rationale: Capacity building should target municipal technicians, regulators, and decision-makers, focusing on PAYT design, legal structuring, tariff setting, social safeguards, and monitoring systems. Federal leadership is essential to ensure standardization, scale, and continuity, while states can contextualize training to regional conditions.

17.3 Create a National PAYT Learning Course (ENAP)

Lead stakeholders:

- ENAP

- MMA
- Federal sanitation and environmental authorities

Supporting stakeholders:

- Municipalities participating in pilots
- Sinir
- State sanitation agencies
- Civil society organizations and cooperatives

Role and rationale: A national ENAP managed learning platform focused on waste management should serve as a repository for guidelines, legal templates, case studies, and performance data from Brazilian and international PAYT experiences. ENAP is well positioned to host and institutionalize this learning platform component which will be done in coordination with SINIR (Sistema Nacional de Informações sobre a Gestão dos Resíduos Sólidos) which will serve as a repository of PAYT related information ensuring knowledge continuity beyond individual pilot projects.

17.4 Conduct Feasibility Studies and Impact Assessments

Lead stakeholders:

- Municipal and intermunicipal governments and/or intermunicipal public consortia (with technical support)

Supporting stakeholders:

- Consulting firms and research institutions
- State governments
- Federal agencies (methodological guidance and co-financing)

Role and rationale: Before implementation, municipalities should conduct technical, financial, legal, environmental, and social feasibility studies. These assessments should explicitly address equity impacts, informal sector integration, enforcement capacity, and risks of illegal dumping, forming the basis for informed political and regulatory decisions.

17.5 Launch Collaborative Demonstration Projects

Lead stakeholders:

- Municipal governments and/or intermunicipal public consortia

Supporting stakeholders:

- Waste service operators (public or private)
- Waste picker cooperatives and associations
- Technology providers
- Community-based organizations

Role and rationale: Demonstration projects should be co-designed and co-implemented with service operators, cooperatives, and communities to ensure operational feasibility and social acceptance. Early inclusion of waste pickers and local stakeholders reduces conflict risks and strengthens PAYT's legitimacy and effectiveness.

17.6 Considerations and recommendations for Pilot Development

Lead stakeholders:

- Municipal governments and/or intermunicipal public consortia

Supporting stakeholders:

- State and federal oversight bodies
- Audit courts and regulatory agencies
- Civil society and community representatives

Key considerations:

- Start with simple, transparent PAYT models (e.g. bag, tag, or frequency-based systems);
- Combine PAYT with improved recycling and organics services before charging higher residual waste fees.
- Integrate social safeguards for low-income households and informal settlements.

- Establish clear enforcement rules supported by education rather than punitive measures.
- Monitor performance and adapt tariffs and operational design iteratively.

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19 Annex - Case Studies

19.1 Bergamo, Italy: KAYT with vending machines

Case 1 – Bergamo, Italy	
Country and population	Italy, municipality with 180,000 inhabitants.
Key feature	Know As You Throw (KAYT)
User identification tools	Vending machines delivering rolls of standard bags to users, identified with their social security card. Each bag has a code printed and is univocally linked to a household. No RFID tags.
Waste fractions involved	Residual waste, plastic packaging: “target” amount of bags / year.
Background and highlights	Bergamo always had a curbside collection scheme with good recycling rates, and back in 2018 wanted to monitor citizens and waste producers and nudge them to use less RW bags per year. Bags are small (30 Liters) and you can get maximum 1 roll of 10 bags per month. Each time you ask for new bags, the machine shows your target number per year which is based on the average of households similar to yours. When getting past a certain “target” and then “maximum” threshold, you can no longer get bags from vending machines, but you can pay for more bags at a network of shops around the city; this is the variable price (PAYT) element.
Results	+5 points of separate collection rate, in just a few months, up to 77% on overall MSW, after the introduction of the KAYT system. The municipality kept the system as it is without introducing any more advanced PAYT.
Pictures	  
References	EU funded LIFE RethinkWaste project, PAYT and KAYT catalogue of case studies. https://rethinkwaste.eu/wp-content/uploads/2021/05/03_LIFE-REthinkWaste_Catalogue-final-updated.pdf ARS Ambiente. (n.d.). A Bergamo introdotto il sistema KAYT. https://www.arsambiente.it/a-bergamo-introdotto-il-sistema-kayt/

19.2 Santa Cruz, Galápagos, Ecuador: first PAYT case in Latin America

Case 1 – Santa Cruz - Galápagos	
Country and population	Ecuador – Municipality of Santa Cruz, Galápagos Islands; approx. 20,000 inhabitants (about 40 % of the total archipelago population).
Key feature	First case study of PAYT in Latin America. Pre-paid bag system (PAYT): mandatory purchase of standardized color-coded bags
User identification tools	Each official bag bears a printed barcode and municipal logo to prevent counterfeiting and track waste volumes. The barcode is not individually linked to households; it enables aggregate monitoring of bag sales and use per sector (residential, commercial, tourist). No RFID or digital ID system is in place.
Waste fractions involved	Green bag (funda verde): organic waste; lower unit price to promote composting and proper separation. Black bag (funda negra): residual non-recyclable waste; higher price reflecting treatment and disposal costs. Recyclables (glass, metal, Polyethylene Terephthalate [PET]) are collected separately through a blue bag (funda azul) that has no cost, or drop-off points. A specific red bag (with a price) is used for hospital waste.
Background and highlights	Before 2021, Santa Cruz used a uniform municipal sanitation fee recovering barely 45 % of costs. In 2021, CGREG approved a specific environmental rate for waste management, operationalized through the pre-paid bag system. Bag prices were calculated using generation coefficients (kg per user type) and real service costs for collection, transport, and final treatment. Organics bag price is actually higher than residual, due to cheap landfill gate fee; this is actually limiting citizen's willingness to participate in better sorting. The sale of official bags provides the municipality with a transparent, user-based revenue stream and encourages reduction of RW generation. A detailed enforcement system with fines and sanctions for not proper usage of the system was set up.
Results	Cost recovery: increased from ~45 % to > 80 % within the first operational year. • Payer coverage: +25 % more registered users contributing to the system. • Separate collection: almost doubled amounts in the first months of implementation (78.17 t in May 2021, 132.47 t in December). The most visible result was a reduction of RW, and also a reduction of total municipal waste. This may be due to increased littering, but there's no evidence about that. • Current status (2025): The system is still legally valid; nevertheless, indications from institutional communications suggest a de facto scaling-down after 2023, linked to changes in municipal administration following political elections.
Pictures	   
References	BAYAS-LOPEZ, Henry. Primera réplica del Modelo Tarifario Basado en Volumen para la gestión de residuos en Santa Cruz-Galápagos. FIGEMPA [online]. 2024, vol.18, n.2, e6622. Available on: http://scielo.senescyt.gob.ec/scielo.php?script=sci_arttext&pid=S2602-84842024000200209 . Epub 25-Sep-2024. ISSN 2602-8484. https://doi.org/10.29166/revfig.v18i2.6622 Gobierno Autónomo de Santa Cruz, Dirección de Gestión Ambiental. (2021). Ordenanza que regula la administración y recaudación de la tasa para la gestión integral de residuos y desechos sólidos en el cantón Santa Cruz, a través del modelo tarifario basado en volumen. https://www.gobiernogalapagos.gob.ec/wp-content/uploads/downloads/2021/01/PRESENTACION-DE-TASA-DE-RESIDUOS-SOLIDOS-2021-INDUCCION-CGREG.pdf Alcaldía de Santa Cruz. (n.d.). Tasa para la gestión integral de residuos y desechos sólidos en el cantón Santa Cruz [Facebook post]. Facebook. https://www.facebook.com/municipiosantacruz/posts/tasa-para-la-gesti%C3%B3n-integral-de-residuos-y-desechos-s%C3%B3lidos-en-el-cant%C3%B3n-santa-/335174481332478/

19.3 Dar Es Salaam, Tanzania. Improve willingness to pay

Case 3 – Dar Es Salaam, Tanzania	
Country and population	Tanzania – Dar es Salaam City, population ~6.5 million. Pilot areas: implemented in 8,000 households in Ilala Municipal Council (Majohe/Kinyerezi A/Kipunguni B wards) and Kinondoni Municipal Council (Kawe/Mbezi Beach A/Boko Basihaya wards).
Key feature	Digital management and monitoring tool for municipal solid-waste collection and fee payment based on QR codes and GPS tracking. Focus: verify that service is delivered, ensure that every user is registered and billed, and increase willingness to pay through transparent feedback.
User identification tools	DtD digital mapping: field officers equipped with mobile devices visited every household to record location, user data, and assign a unique QR code linked to that property. The QR sticker was placed on the house or waste container to identify service users during collection. The same system registers the private contractor responsible for that street or ward.
Waste fractions involved	General mixed municipal solid waste. The system measures collection performance and payment coverage, not waste composition or recycling. It functions as a verified-service and billing platform - a precursor to introducing true PAYT
Background and highlights	Introduced under the "Transforming Tanzania Cities" (TTC) project, implemented by Ardhi University, Tanzania Urban Resilience Programme, and local councils. Operational process: Collectors scan QR codes placed on a metal plate on each building (also with an RFID tag) using the Smart-TRACS mobile app when picking up waste. Each scan logs time, GPS position, and contractor ID — confirming that the household was serviced. The record is transmitted to the municipal dashboard, where supervisors can see daily collection coverage in real time. Revenue teams use the same database to identify users who have or haven't paid the monthly waste fee. Revenue collectors retrieve bills instantly when the revenue collector scans the smart tag, and can print bill-history receipts on request. Mobile money options increased payment convenience. Households receive confirmation through ward officers (printed receipts or SMS) that their payment is recorded and that their premises appear as "served."
Results	The system improved public trust because residents could visibly see officers scanning their QR stickers and know the service was officially logged. +129 % increase in identified service users in pilot wards. +13.5 % increase in total refuse-charge revenue. +55 % improvement in revenue-collection coverage (share of billed users who actually paid). Significant reduction in "ghost customers" and uncollected streets. Ward officers reported greater citizen willingness to pay once service delivery was verifiable. Qualitative reports indicate fewer missed collections, though there's no pre-pilot quantitative baseline for that Key Performance Indicator (KPI) Smart-TRACS is still used (2025) by the Ilala and Kinondoni municipal councils and being scaled gradually to other councils of Dar es Salaam.
Pictures	  
References	Pellatt, J., & Palfreman, J. (2023). Smart technology solution for a cleaner city: A case study of Dar es Salaam, Tanzania. GeoJournal, 88, 5221–5245. https://doi.org/10.1007/s10708-023-10917-3

19.4 Parma, Italy. From uncontrolled road containers to DtD and PAYT

Case 4 – Parma, Italy	
Country and population	Italy - City of Parma, 195,436 inhabitants, population density 746 inhabitants/km². Medieval historic center with narrow streets and small to medium apartment buildings in the outskirts. Parma hosts a large student population. The regional public multi-utility company IREN collects waste. Parma's size and demographic structure make it a representative example of a medium-sized European city successfully transitioning from traditional waste collection with big open containers on the streets toward a fully integrated DtD and PAYT scheme.
Key features	The system covers 100% of households and businesses, integrates biowaste and RW collection with separate billing based on actual service use, and includes emergency collection points with controlled access. This model links citizen responsibility directly to waste generation while maintaining strong public control and transparency.
User identification tools	Every household and business is equipped with dedicated RFID-tagged bins for RW and biowaste. The UHF transponder on each container allows automatic recognition during collection, registering the number of emptying for billing purposes. The collection vehicles are GPS-tracked, for service monitoring. An APP (EcoIren) provides users with real-time access to data on their collections, feedback submission (e.g., missed pickups, littering), and billing information. This technological backbone guarantees the accuracy of PAYT accounting and strengthens trust through transparency and user control.
Waste fractions involved	The PAYT system covers RW, collected once or twice per week in small, RFID-tagged bins. A minimum threshold of deliveries per household/year is set, included in the fixed tax (e.g. 30/year for a household with 4 people). A variable charge in €/liter applies over that threshold (about € 1.40 for a 40 liter bucket). Separate collections for kitchen waste, paper, plastics/metals, and glass are also in place but not directly linked to PAYT.
Background and highlights	Parma was one of the first large Italian cities to implement a PAYT scheme combined with a DtD collection system. The reform began between 2013 and 2014 under the city's Zero Waste strategy, aiming to raise recycling levels, reduce RW, and ensure cost fairness among users. Before 2012, Parma relied mainly on roadside containers, achieving less than 50% separate collection. The turning point came with the adoption of the Zero Waste strategy (2012), which launched the DtD transition, bio-waste collection, and the PAYT charge. The change required intense communication campaigns and citizen training, including the spectacular demonstration "Funeral of the road container" (see picture). The system also integrates social equity: families with newborns, elderly, or disabled persons receive special fee reductions and higher collection frequency. Boundary conditions were favorable (composting cheaper than disposal of RW)
Results	Within three years, the system achieved a 47% reduction in RW, and an increase from 48% to over 80% separate collection. (2021: 82%). RW generation: 102 kg/inhabitant/year. Bio-waste collected: 183 kg/inhabitant/year (Kitchen waste + garden waste). Impurities in kitchen waste: 3.3%. RW reduction: 47% (2012–2015). PAYT performance: over 80% of users stay below the threshold of the "included minimum deliveries" in the fixed part of PAYT waste tax. So the variable part is applied to the "bad guys" not willing to sort at home. The Parma experience demonstrates that PAYT succeeds only when coupled with full separate collection of the organic fraction, technological traceability, and stable public governance.

Case 4 – Parma, Italy

Pictures







References

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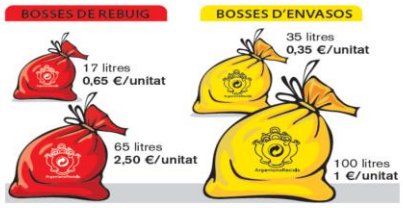
19.5 Argentona, Spain. Pioneer municipality with pay per use bags

Case 5 – Argentona, Spain	
Country and population	Spain – Municipality of Argentona, located in Catalonia (Barcelona province). Around 12,000 inhabitants, with a total surface area of 25.2 km² and an urban area of 3.5 km². Urban density: 3,363 inhabitants/km², combining a dense town center with apartment buildings and low-density residential areas with detached houses. The Argentona Town Council directly manages the waste collection system.
Key features	Argentona's waste management model integrates DtD collection and PAYT charging. The system began in 2004 with the separate collection of biowaste and RW through a DtD scheme, and by 2010 it had evolved into a full PAYT system known as "Taxa Justa" ("Fair Charge"). The PAYT system was progressively expanded to all suburban zones by 2016, covering 100% of households and businesses. The PAYT charge combines a fixed part, depending on household size, and a variable part, linked to the number of standardized pre-paid bags. Strong citizen participation, public communication, and continuous monitoring are key to its success.
User identification tools	The system uses pre-paid standardized bags bearing the municipal logo for RW (red) and LP – light packaging (yellow). Originally, both bag types were used by households and businesses, though later the yellow bags were reserved for commercial use only. Each bag acts as an identification and billing unit – a simple, low-cost alternative to electronic tagging. Permanent staff and an information office monitor use pattern, provide feedback to users, and manage anomalies such as incorrect disposal or misuse. Businesses are additionally charged for biowaste bins, depending on container volume and frequency of collection.
Waste fractions involved	The PAYT scheme covers: ▪ Residual Waste: red pre-paid bags (17 L) at €0.65 per unit. ▪ Light packaging: yellow pre-paid bags (100 L) at €1 per unit (only for businesses). ▪ Biowaste: charged by container size for businesses. Other fractions such as paper/cardboard and glass are collected separately outside the PAYT scheme. Each household receives a quota of 10, 20, or 25 bags included in the fixed part of the charge, depending on household size. Additional bags must be purchased at collaborating shops.
Background and highlights	The reform began with a participatory process, information campaign, and a three-month pilot period before permanent implementation. Argentona's approach demonstrates how a low-tech PAYT system can operate effectively through community engagement. Municipal follow-up and enforcement mechanisms ensure proper use, with fines for illegal disposal or "waste tourism." The "Fair Charge" system links cost directly to waste generation, promoting equity and transparency.
Results	Between 2008 and 2019, total waste generation decreased by 26% (to 1.27 kg/inhabitant/day), while separate collection increased from 52.8% to 87.6%. RW generation fell by 15% (2009-2013), and LP waste by 16%. Quality of sorted materials remains high, and the use of the municipal recycling center has grown significantly. Public acceptance is strong, and the PAYT system is now embedded in local waste governance as a reference model for small and medium municipalities.

Case 5 – Argentona, Spain



Pictures







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ECOGESTUS, Resíduos, Estudos e Soluções, Lda.

14 Rua 30 de Junho, 3090-401 Alhadas, Figueira da Foz, Portugal

contacto@ecogestus.com

Tel.: +351 965 784 613 | +351 233 109 034

ARS Ambiente Srl

45 Via Carlo Noè, 21013 Gallarate (VA), Italy

info@arsambiente.it

Tel.: +39 0331 777991

ENT Environment management

Josep Llanza, 1-7, 2n 3a, 08800 Vilanova i la Geltrú, Spain

info@ent.cat

Tel.: +34 938 93 51 04