Stockholm Environment Institute

Plastic waste management and recycling in Mombasa, Kenya

A scoping study of the value chain and its institutional, policy and regulatory frameworks

SEI report
April 2022

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Cover photo: George Njoroge, SEI

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The Keep Sweden Tidy Foundation is a non-profit organization that promotes recycling and combats litter through public awareness campaigns and environmental education..

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Preface

The Waves of Change project is implemented by a consortium led by the non-profit organizations Hand in Hand and Keep Sweden Tidy, with other project partners, in Sweden, India and Kenya. The overall purpose of the project is to reduce plastic leakage to the world's oceans, and thus contribute to a more sustainable environment in Sweden, India and Kenya.

The project consortium aims to achieve this by working towards three concrete sub-goals: 1) reduce plastic waste at sea and on land through preventive measures and improved plastic and waste management processes; 2) create green, profitable, small businesses that increase household income by promoting a circular economy, with a focus on plastic; and 3) identify and share local solutions to the global and borderless plastic challenge through learning and exchanges of experience between authorities, companies, academia, civil society and individuals in Sweden, Kenya and India.

Hand in Hand Sweden commissioned the Stockholm Environment Institute (SEI) to undertake this scoping study, to obtain an overview of the ecosystem of stakeholders and processes involved in the plastic waste management and recycling value chain; the relevant institutional, policy and regulatory frameworks linked to the plastic value chain; and any relevant best practices for use in "cross-learning" experiences. Hand in Hand will use this knowledge to inform the implementation of the Waves of Change project. The baseline knowledge generated from this study also is relevant for policymakers, practitioners and researchers, as well as other stakeholders working towards more sustainable plastic waste management and recycling value chains in other areas, particularly in low- and middle-income countries with similar contexts to Mombasa.

Summary

Plastic waste management and recycling activities have the potential to reduce the environmental impacts of plastic production and to tap the economic value of would-be waste materials through circular economy approaches. This report focuses on the framework for establishing effective practices in Mombasa, Kenya, with policymaking, institutional support and regulations, and with implications for similar contexts elsewhere.

In the county of Mombasa, Kenya, a growing urban population has contributed to increased volumes of waste. Plastic waste management and recycling in the city typically involve reuse, recovery and recycling, and have been practiced formally and informally over the past three decades. These recycling and management practices are an opportunity to generate income and jobs, as well as to reduce the environmental impact of plastic pollution, especially in light of the recent growth of the region's population, which has led to increasing waste and unemployment.

Despite decades of such work, little is known about the stakeholders involved and the kind of interactions and linkages existing between them. This study clarifies the activities and linkages established in plastic waste management and the recycling value chain, the institutional and governance structures, and the policy and regulatory framework applied in solid waste management in general, and plastic waste management and recycling in particular, in the county and the city proper.

This scoping study entailed a review of scientific and policy literature complemented with interviews with stakeholders, including government policymakers, enforcement agencies' officers, representatives of non-governmental organizations (NGOs) that are involved in promoting waste management and plastic waste recycling, research organizations, and the private sector. Questionnaires were administered to recycling entrepreneurs, alongside observation of plastic waste recycling activities in successive levels of the value chain. The following findings were generated from the study.

Stakeholders and activities along the recycling value chain

We found that the major sources of plastic in the county are households, manufacturing industries and the service sector, comprised of hotels and other institutions in the hospitality industry. Plastic waste management and recycling involves collection, aggregation, preprocessing and conversion of plastic waste to products, by actors referred to as recyclers.

The main plastic polymers recovered throughout Mombasa County for recycling are polyethylene terephthalate (PET), high density polyethylene (HDPE) and polyvinyl chloride (PVC). Each has its own pricing, processing methods and market. Low density polyethylene (LDPE), polypropylene and polystyrene are not recycled and substantial proportions of these materials are disposed off in dumpsites and as litter across the county, causing harm to the environment.

Plastic recycling is implemented through various projects and businesses across the value chain. Although activities for collection and aggregation are largely informal, succeeding stages of the chain become more formalized. The plastic waste management and recycling activities are complemented by incentive mechanisms and capacity building measures that are promoted by the government, private sector and NGOs. The support systems include tax waivers and subsidies, provided by governments; training and capacity building programmes; market linkages to support development of recycling enterprises, provided mainly by NGOs; and venture capital, provided by the private sector and development partners.

Institutional and governance structures linked to the plastic waste value chain

Plastic waste management and recycling in Kenya are regulated by the three arms of government, comprised of the executive, legislative and judicial branches, with input from sector agencies and departments within the two levels of government, national and county. The national and county government structures are complemented by stakeholders' coordination platforms for specific groups and for diverse stakeholders; the mandate of these platforms is to represent stakeholders' interests and to articulate the challenges experienced in plastic production, use, recycling and disposal.

Policy and legal frameworks linked to the plastic waste value chain and their enforcement

National and county level policies include the National Solid Waste Management Strategy, the National Sustainable Waste Management Law and the Mombasa County Solid Waste Management Act. These policies advocate for reduction, recovery and recycling (3R) of waste.

Broad-based laws and regulations on environment and waste management, as well as those specific for plastic, are used to ensure compliance and achievement of the objectives, values and targets set for sustainable plastic production, use, recycling and disposal. They include a ban on production of plastic carrier bags, restrictions on use of certain types of plastic in specified areas, and an upcoming Extended Producer Responsibility (EPR) regulation requiring manufacturers to take responsibility for their waste, especially packaging materials.

However, the socio-economic and environmental impacts of plastic production, use and disposal still persist – despite the existence of institutions, laws and regulations, as well as plastic recycling initiatives. Only a small fraction of plastic waste is salvaged for recycling; this suboptimal situation, if rectified, could provide employment opportunities and reduce the environmental impacts of plastic waste, especially pollution of marine environments.

Challenges and constraints

Various constraints and challenges experienced at different levels of the value chain hamper the potential inherent in plastic waste. These include occupation-related constraints, such as negative social perceptions and exploitation of people working in recycling activities, as well as occupational hazards from poor working conditions and exposure to rain and hot weather in the work environment. Recycling workers are also exposed to health risks from handling contaminated materials without proper personal protective equipment.

Challenges related to production and processing were also reported by interviewees, including poor quality of materials, lack of appropriate sites for recycling operations, and unfavourable legal and regulatory frameworks. The sector also contends with business challenges, such as an inability to sustain recycling enterprises due to high costs of production, limited investment in growth of recycling, and little investment in research and development of plastic waste management and recycling processes.

Conclusions

Various stakeholders – including the two levels of government, NGOs, donor agencies, and the formal and informal recycling sector – have made considerable efforts towards implementing sustainable plastic waste management and recycling in Mombasa. As a result, plastic collection and processing activities are spread out across the city.

However, various factors have held back the development of robust plastic resource recovery and recycling: opportunities for development remain underutilized for waste management, employment creation and income generation. More innovations and investments in plastic waste recycling in the county are needed in order to increase employment and livelihood opportunities and to rid the environment of plastic waste.

Recommendations

In order to overcome these barriers and to increase the widespread adoption of plastic waste recycling, we make the following recommendations:

- The County Government of Mombasa should implement waste segregation at sources, as stipulated in the Mombasa County Solid Waste Management Act, in order to improve recovery and recycling of plastic.
- The plastic recycling stakeholder platforms need to develop measures to eliminate exploitation and child labour and to promote occupational health and safety across the value chain.
- The county government should designate spaces and collaborate with relevant stakeholders to construct adequate recycling facilities, including waste collection points and material recovery facilities.
- Financial institutions should support recyclers with investment and expansion capital in the form of grants and affordable credit facilities to boost recycling activities.
- Actors in the recycling value chain should maintain quality standards to ensure products from recycled plastic are competitive in the market.
- Both the national and county governments should streamline the compliance and regulatory requirements, especially those pertaining to licensing and permits, which are currently not recycler-friendly.
- National research institutions need to be more proactive in harnessing knowledge for innovation in plastic recycling.

Abbreviations

CEJAD	Centre for Environment Justice and Development
EIA	Environmental Impact Assessment
EMCA	Environment Management and Coordination Act
EPR	Extended Producer Responsibility
HDPE	High Density Polyethylene
IUCN	International Union for Conservation of Nature
KAM	Kenya Association of Manufacturers
KAWR	Kenya Association of Waste Recyclers
KEPRO	Kenya Extended Producer Responsibility Organisation
KES	Kenyan Shillings
LDPE	Low Density Polyethylene
NECC	National Environmental Complaints Committee
NEMA	National Environment Management Authority
NGOs	Non-Governmental Organizations
PET	Polyethylene Terephthalate
PETCO	Kenya PET Recycling Company
PVC	Polyvinyl Chloride
VAT	Value Added Tax
WWF	World Wide Fund for Nature

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1. Introduction

Globally, plastic production is growing, outpacing the production of other human-made materials (Geyer et al., 2017). Today's massive volume of plastic production coupled with poor waste disposal practices has been linked to an increase in adverse effects on human health and the environment, with impacts on climate, terrestrial and marine pollution, and chemical contamination (Barra et al., 2018).

In Kenya, plastic manufacturing has steadily grown, with more than 100 companies manufacturing plastic articles (Opondo, 2020b). Consequently, plastic is prevalent in Kenya's economy, as reflected by the flows and transfers of plastic, consisting of retail products, generation of plastic waste, collection and diversion of plastic waste, and its exit via exports, resale and disposal (Mukui, 2015). The sector is mainly characterized by a linear model of produce-use-dispose, whereby huge volumes of plastic are disposed in landfills and also leak into terrestrial and aquatic environments.

Poor management of plastic waste has consequences for sustainability. It has become a major challenge, attracting considerable attention from various stakeholders within related fields.

Kenya's national and county governments have taken actions for plastic waste management and recycling through policies, plans, strategies and regulations (Opondo, 2020b). Among the provisions in policy and regulatory instruments are requirements for manufacturers to adopt more sustainable approaches in production, disposal, recovery and reprocessing of plastic. Throughout the country, a culture of recycling is growing that links formal with informal players within plastic waste recovery and processing in urban centres.

Non-governmental organizations (NGOs) such as Hand in Hand Eastern Africa have initiated programmes geared towards promoting plastic recycling enterprises and to stimulate stakeholder collaboration.

Despite the existence of many interventions to counter the adverse impacts of plastic production, use and disposal through recycling activities, it is still difficult to navigate the policy, institutional and governance structures linked to the plastic waste value chain in the Kenyan context. Moreover, not much research has been done in the past to identify the stakeholders active in the plastic management sector, their interactions, and the institutional, policy and regulatory frameworks that govern their activities.

To understand how plastic waste management and recycling in Kenyan urban areas is implemented, we conducted a scoping study in Mombasa. The objective of the study was to obtain an overview of the ecosystem of stakeholders and processes involved in the plastic waste management and recycling value chain in Mombasa; pinpoint the relevant institutional, policy and regulatory frameworks linked to the plastic value chain; and identify relevant best practices for use in cross-learning experiences.

Mombasa County is located along Kenya's coastline at the Indian Ocean and consists of urbanized and a peri-urban zones. The city of Mombasa is the second largest in Kenya and has a population of about 1.2 million people, with an annual population growth rate of 3.1% (Kenya National Bureau of Statistics, 2019). The city forms a major economic and logistical hub, serving as the major seaport for several countries in the Eastern Africa region (KAM, 2019), and has other thriving industries and services, including fisheries.

Mombasa's economic activities, rapid urbanization and population growth results in high volumes of solid waste generation. A study that quantified the amount of waste that Mombasa County generates estimated about 850 metric tons (tons) of waste per day, of which about 120 tons is plastic (Palfreman & Clark, 2015). The proportion of plastic in municipal waste varies by

neighbourhood depending on income levels: 19% from high-income residential areas; 11% from middle-income estates; and 12% from low-income areas.

While a fraction of plastic waste is recovered for recycling, the uncollected and mismanaged waste leaks out of waste management streams and contributes to pollution of the terrestrial environment and to the marine environment of the Indian Ocean. Marine litter especially has been blamed for harming the ecology of aquatic life forms and limiting the socio-economic activities of coastal inhabitants (UNEP, 2017).

This scoping study examined the various activities conducted along the plastic management and recycling chain, and how they interact with the institutional and governance structures and the prevailing policy and regulatory framework. Findings from the study inform our recommendations on ways and means to expand the plastic recycling sector and to catalyse the transition towards a plastic circular economy in Mombasa, which can be replicated in other urban centres throughout the country and beyond.

2. Study methodology

We used a two-pronged methodological approach, including desk studies and fieldwork.

Desk-based studies included a literature review conducted at the onset of the study, to provide insights on the current state of practices and challenges in the plastic value chain. The focus of the review was on literature concerning the Kenya and Mombasa context.

We also analysed policies and regulatory documents addressing solid waste management and plastic waste management, to gain familiarity with the contextually relevant policy and regulatory frameworks in Kenya. The main sources were policy and regulatory documents at national and subnational levels, as well as some at the regional level. The documents were accessed electronically through a general search engine and from the websites of relevant organizations. The study team's familiarity with the policy landscape in Kenya also made it easy to identify relevant policy and regulatory documents.

A thematic analysis was then conducted for each of the relevant documents using a code book. Relevant information extracted from each document included the name of the document, the implementing agency, the date the policy or regulation was created or enacted, the period it would cover, the available format of the policy, and any policy gaps identified as well as suggestions to address the gaps.

The field-based methods included interviews and field observations, as described below.

a. Interviews with key informants and recyclers

To supplement the desk-based work, interviews were conducted 20–25 September 2021 by part of the study team with several stakeholders in Mombasa. The interviews targeted national and municipal public authorities, industry associations and research organizations. The interviewees also included representatives from NGOs and community-based organizations that support plastic waste management, recycling activities and pollution control programmes.

We observed SEI ethical practice during the study in the following ways: We reflected upon and articulated the benefits and potential harm to livelihoods of participants and ways to mitigate this. We made assessment of risks to the physical, emotional, financial, environmental or social well-being of participants and put in place appropriate mitigation measures. We ensured the voices and opinions of participants belonging to groups suffering severe discrimination or disadvantage were accommodated in the study, and we did not involve children or any other people legally defined as minors in the research activities. Prior and informed consent from research participants was also obtained, and feedback to the project participants and boundary partners was incorporated as an important component of the study. (Boundary partners are individuals or groups that contribute to and are part of vision for recycling and circular economy, whom the study can inform and affect change.)

We used a semi-structured questionnaire to obtain the stakeholders' views regarding the plastic value chain, policies and regulations, enforcement, incentives, and challenges they experience. Interviewers used the English language to converse with representatives of these organizations; these interviewees were considered to have expert knowledge on various aspects of plastic waste management and recycling. The variety of informants enabled us to incorporate multiple perspectives from across the range of stakeholders and to engage in different types and sources of data and information. The number and types of respondents to the key informant interviews are outlined in Table 1.

For plastic waste recyclers, an easily accessible sample comprised of plastic waste collectors, aggregators and processors was selected. The numbers and the different types of recyclers interviewed are also included in Table 1. A questionnaire with closed-ended questions and a

few open-ended questions was then administered to members of community groups or their representatives involved in waste collection and plastic waste aggregation. The respondents also included supervisors, managers or directors of waste processing ventures. The questionnaire was administered in both English and Kiswahili.

Table 1. Profiles of the respondents interviewed in this scoping study.

Recyclers	Number of respondents	Key informants	Number of respondents
Collectors with aggregation	3	National public authority	1
Aggregators only	1	Municipal authority	1
Category I processors	1	NGOs/CBOs	3
Category I and II processors	3	Research organizations	2
Category I and II processing and conversion	1	Industry association	2
Total	**9**	**Total**	**10**

b. Observation of recycling activities

The recyclers questionnaires were administered at their sites of operation, and this provided an opportunity to observe conditions and to verify the information and data provided by respondents. This also helped to visualize recyclers' activities, i.e. how plastic sorting, washing, grinding, flaking and other steps are done, the tools and equipment used, and the procedures for each of these activities. It also helped to determine whether a certain observation required further clarification or follow-up.

c. Data analysis

The qualitative data obtained from the desk and field activities were synthesized using content analysis techniques and represented using narratives, tables and illustrations. Quantitative data were entered in Excel and analysed.

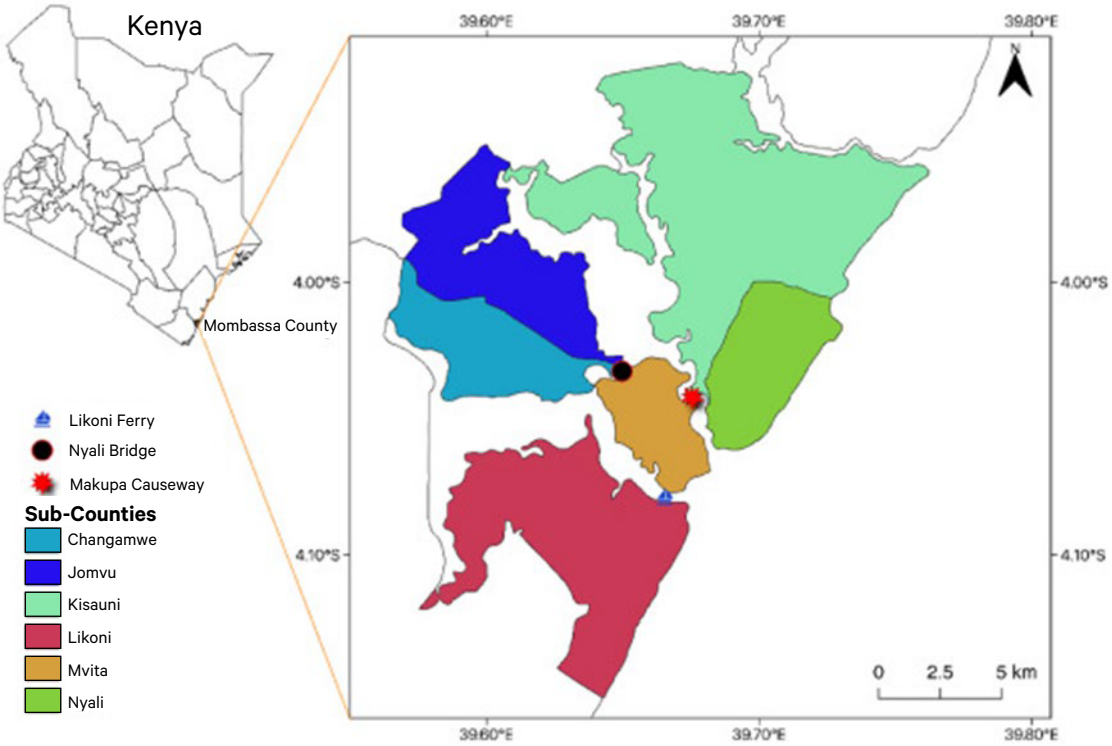
3. Findings

We present the main findings on the three thematic areas investigated in the scoping study, as follows: stakeholders and their activities along the plastic waste and recycling value chain, the governance and institutional structures for managing plastic in Mombasa, and the relevant policy and regulatory framework linked to plastic waste and recycling activities in Mombasa.

3.1 Actors and activities in the plastic management and recycling value chain

Plastic waste generation, management and recycling activities are spread out in different parts of Mombasa County. The management of waste is undertaken by the County Government of Mombasa and is decentralized to the six administrative units of its sub-counties, Mvita, Nyali, Kisauni, Jomvu, Changamwe and Likoni (see Figure 1).

Figure 1. Map of Mombasa County showing the six sub-counties and link points between Mombasa Island and the mainland

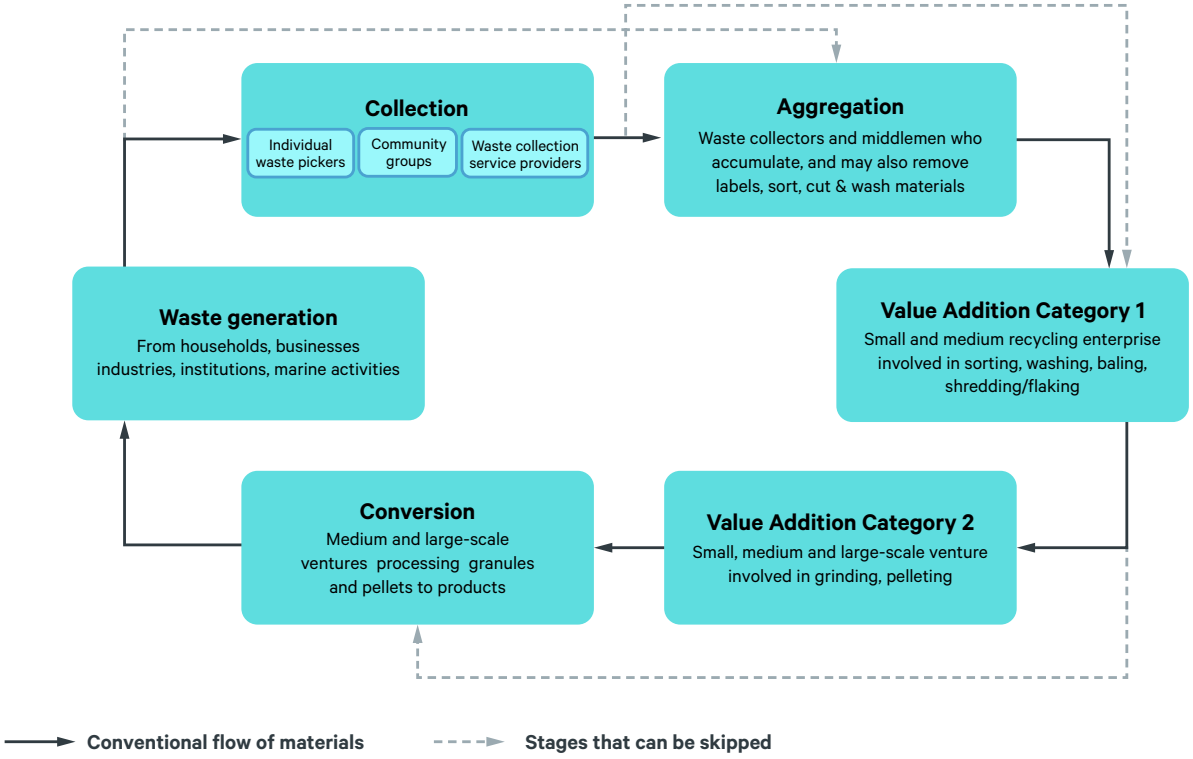


Source: Kithiia et al., 2020

After waste materials are released from various sources, recyclers then collect and sort or aggregate the plastic into different polymers. The materials flow through market mechanisms into the processing phase, where they are converted into secondary materials that can then be fed into production processes to manufacture products, as shown in Figure 2.

Both male and female individuals are involved in the sector as members of plastic collection groups and employees in the processing factories. Some are indigenous to the county, while others are urban migrants in search of employment opportunities.

Figure 2. Overview of activities and actors at the different stages of the plastic waste recycling value chain



Sources and types of plastic waste

Interviews and observations at waste aggregation and processing sites showed that recyclers in the county collect different types of plastic materials, consistent with the classification highlighted in Table 2. The polymers are broadly classified into the following categories: polyethylene terephthalate (PET), high density polyethylene (HDPE), polyvinyl chloride (PVC), low density polyethylene (LDPE), polypropylene and polystyrene, others.

Plastic materials enter the country either as raw material or as finished products. Interviews with key informants established that because plastic is widely used as packaging for other products, much of the plastic emanates from single use packaging items. Based on accounts of the key informants, sources and types of plastic waste in Mombasa can be categorized as follows:

- Households and institutions – Plastic items released into the waste stream include packaging materials such as PET bottles for drinking water, as small as 300 millilitres and as large as 15 litres. Soft drinks are yet another major source of PET waste; recently the hand sanitizers used during the Covid-19 pandemic have become another source of PET waste. Households and institutions also use plastic-packaged products from the cosmetics, pharmaceutical and agricultural chemicals (agrochemicals) industries, which also contribute to PET volumes.

- Containers made of HDPE are mainly used in households and institutions, typically for food, beverage and personal hygiene products, and these also constitute a significant fraction of plastic waste originating from households and institutions. Plastic waste materials consisting of items manufactured using LDPE and polystyrene are often discarded and therefore observed to constitute the bulk of plastic in the environment.

- Commercial sources – Outlets that sell goods, such as shops, restaurants and supermarkets, and service providers, such as hotels, learning institutions, and hair salons, also release

Table 2. Types of plastic and their recycling and reuse potential in Mombasa

Type of plastic	Example of plastic waste materials	Recycling and reuse potential
1. PET	Food packaging, plastic soft drink and water bottles, detergent bottles	Recycled and reused
2. HDPE	Milk bottles, shampoo bottles, detergent bottles, oil jerry cans, and toys	Reusable and recyclable
3. PVC	Electric and plumbing pipes and floor carpets	Recyclable, not reusable
4. LDPE	Bread bags, frozen food bags, squeezable bottles, fibre, bottles, clothing, furniture, carpet shrink wraps and garment bags	Reusable but rarely recyclable
5. Polypropylene	Margarine and yogurt containers, caps for containers	Reusable but rarely recyclable
6. Polystyrene	Egg cartons, fast food trays, and disposable plastic silverware	Reusable but rarely recyclable
7. Others	These include items made with a resin other than the six listed above or a combination of different resins	Not recyclable or reusable

Note: The classification is modified to suit the Mombasa context and is adopted from a classification system developed by the Society of the Plastics Industry (SPI) in 1988. The numbers are also referred to as SPI codes. Manufacturers typically mould the SPI code within a triangular loop of arrows onto plastic products. This is intended to guide plastic consumers and recyclers about the type of plastic of which a given product is made.

Source: (Połomka et al., 2020; Seaman, 2012).

significant quantities of plastic to the waste stream. The plastic from urban commercial zones includes packaging materials, construction waste such as pieces of PVC pipes, and cement bags.

- Industrial sources – Comprised of plastic waste generated from the manufacturing industries located in the county, these can be divided into two types of waste materials: plastic waste from the manufacturing processes themselves and mixed waste from factories.

- Tourism and fishing – Plastic waste materials from these sectors are disposed of on beaches and fish landing sites and in the ocean by tourists, tour operators and fishers. The waste is comprised of food and beverage packaging materials used by tourists and worn-out fishing gear. Participants also reported municipal wastes accumulating in open areas and along waterways, which are also washed by run-off water from rain to the ocean, making a significant contribution to the marine litter problem in the Indian Ocean.

Collection and aggregation

When intentionally disposed of, plastic waste can be deposited in designated and undesignated transfer or disposal points. Collectors pointed out that high volumes of plastic are obtained from certain hotspots within commercial, residential, industrial or recreational locations, and especially in areas that are grossly underserved or totally lacking in waste collection services.

The collectors also reported that the types of plastic waste found in a particular area usually are consistent with the kind of socio-economic activities happening in the locality. Collectors further noted that volumes of disposed plastic waste typically increase on weekends and during festive or holiday seasons. The volumes of some materials such as PET increase during the dry season as people consume more bottled water.

Like other wastes, plastic is often haphazardly disposed of, due to lack of waste segregation infrastructure and well streamlined waste disposal systems. Depending on where and how materials are recovered, collectors may be categorized as itinerant waste pickers, organized collection groups, and municipal waste collection companies, as indicated in Figure 2. Groups and individual waste pickers involved in collection pick the waste directly from shops, restaurants and institutions, as well as in the streets, on beaches and at waste disposal sites. Some individuals and informal groups specifically search for plastic for use in recycling, while others provide general waste collection services to households and businesses, for which they charge a fee. The waste pickers and the informal groups were found to operate within the vicinity of their communities. The collectors segregate the plastic from the mixed wastes and sort the materials into different types.

Garbage collection companies, on the other hand, collect wastes from households, businesses and institutions usually for a fee and mainly operate in middle- and high-income areas, where residents can afford their services. Most of the private collection service providers do not extract plastic for recycling but concentrate on collection and disposal services.

Interviews with recyclers showed that plastic collection activities by informal waste pickers and community groups are the most prevalent method for recovery of plastic waste materials. This provides the rationale to concentrate efforts to increase the volumes of plastic for recycling by building well-designed and well-implemented community-based initiatives.

The groups interviewed during the fieldwork for this study have been involved in the collection of plastic or general waste for two to five years. The collector-aggregators were found to gather at least two to four different types of plastic polymers, which they sold to processors within Mombasa.

The buying price for different types of unprocessed plastic ranged between KES 10 and KES 27 (USD 0.10 and USD 0.27) per kilogram. The HDPE fetched a better price than other polymers, which can be attributed to the fact that the recycling value chain is well developed. The prices of the materials also vary depending on the distance to the materials' source and whether the sellers deliver the materials or the buyers collect from the sellers.

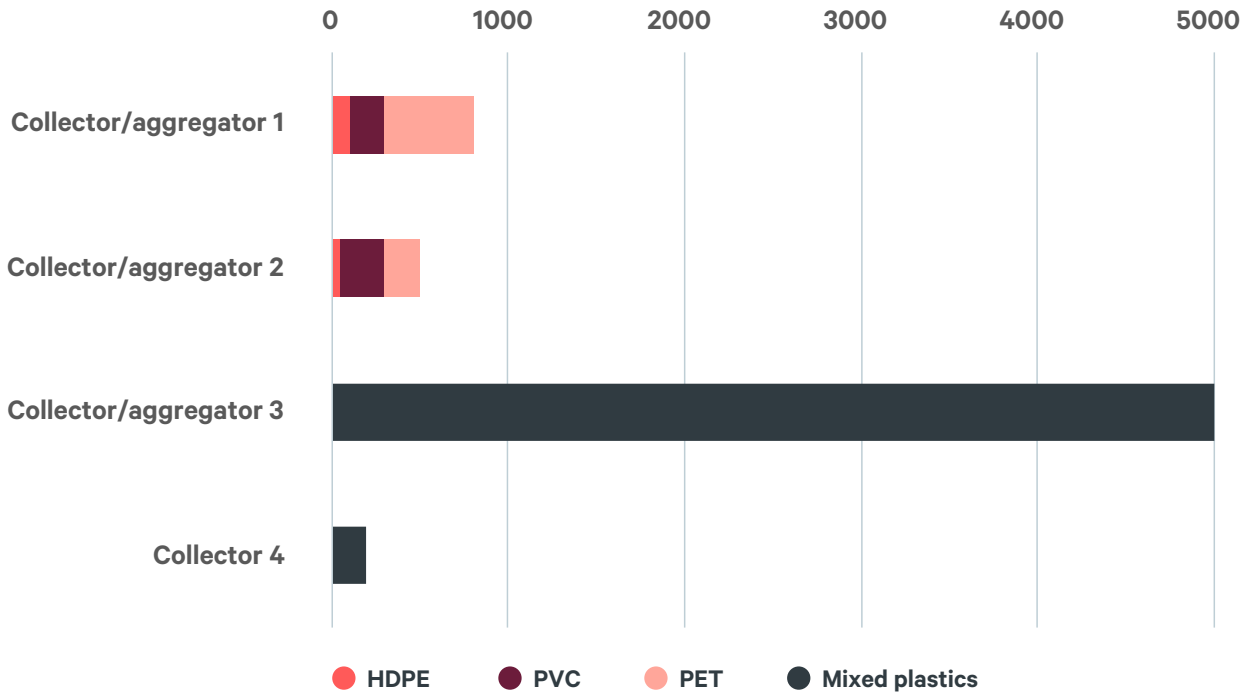
In all the community collection groups encountered during the study, members have other livelihood activities, such as small businesses within their localities or other informal jobs. Plastic collection is a secondary income generating activity. The community groups act as both collectors and aggregators of various plastic polymers, and hence they also buy materials from waste pickers.

The volumes collected per week or per month vary depending on the availability of members and their commitment to the activity. While some groups aggregate their materials before selling to processors, others sell their materials directly to processors without aggregating. Sorting of materials into the different plastic polymers or different colours for the same plastic is done by the collectors and aggregators.

Figure 3 shows the quantities of PVC, PET, HDPE or mixed plastic materials collected and/or aggregated by four respondents.

Significant discrepancies exist for the types and amounts collected or collected and aggregated by each group. The amounts of plastic materials channelled for processing by the collector-aggregators is also small compared to higher volumes absorbed by the processors. Materials that are recovered by waste collectors, including the community groups and waste pickers, are usually sold to recyclers, who undertake value addition in Category I (see Figure 2).

Figure 3. Indicative quantities of plastic materials collected and aggregated by each group in kilograms per month



Plastic Processing

An interview with a representative of the Kenya Association of Waste Recyclers (KAWR) established that plastic processors fall into three classes of value addition: Category I, for flaking and shredding; Category II, also referred to as semi-processors, that take the plastic a step beyond Category I; and so-called convertors of materials from these two levels into finished products.

- **Value Addition Category I.** These recyclers receive materials from between 100 and 300 aggregators from different locations in Mombasa and the neighbouring Kilifi and Kwale counties. Supply of materials happens in two ways: aggregators deliver materials to the sites of the processors, and the processors pick up the materials from the aggregators. The materials are further sorted and baled, or they are shredded into flakes or ground into finer particles, after which they are taken to the next stage in the recycling chain.

- Some buyers demand washed materials, while others do not, depending on the machine they use for further processing and the kind of products they make. Although the exact number of processors in Mombasa is not known, this scoping study identified five located in different parts of the county.

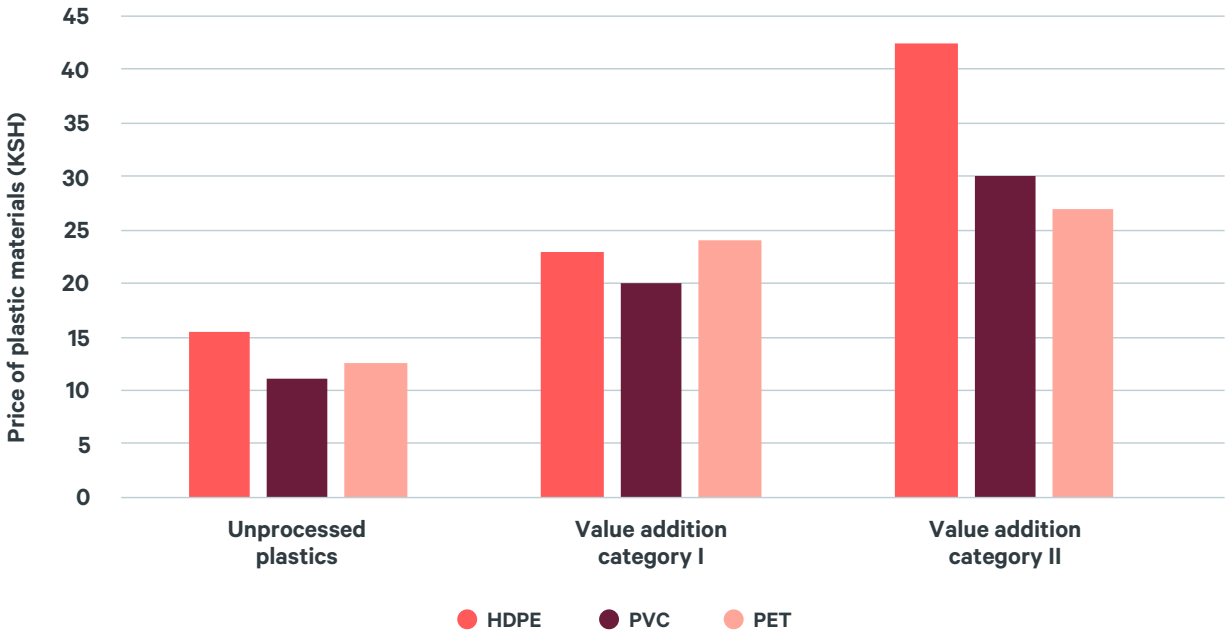
- **Value Addition Category II.** These processors further process the shredded plastic from Category I into finer particles. Some Category II processors also undertake Category I processing. The capacity of the Category I and II processors varies depending on the size of their machines and availability of materials. The skills required in both Category I and II include knowledge of different plastic polymers for sorting and ability to operate machines used in processing activities. Workers in these processing facilities usually receive on-the-job training both for sorting and machine operation.

Interviewees from both Category I and II processors indicated that they exhaust the materials from their suppliers and that they do not utilize their full processing capacity due to a shortage of materials. Both formal and informal ventures, of widely varying sizes and capabilities, are active

in the two categories. Some of the ventures are registered businesses with licenses and permits from both the national and county governments, while others are not registered. The machines used for processing in both categories are assembled in Kenya, which further demonstrates that plastic recycling has led to local innovations. The processors typically house their operations in semi-permanent structures that are supplied with water and electricity. The locations of these activities are also diverse, with some operating within residential areas and others in designated industrials sites.

The selling price of Category II processed plastic materials, either as flakes or pellets, ranged between KES 27 and KES 45 (USD 0.27 and USD 0.45) per kilogram, with PET fetching the lowest price and HDPE the highest. This implies that HDPE has a higher recycling value than PET and PVC. Figure 4 shows the variations in prices of unprocessed and processed plastic along the value chain.

Figure 4. Average reported prices of recyclable plastic materials at different stages of the recycling value chain



We observed that the prices of unprocessed plastic are more unstable than for the processed plastic materials. This means that the waste collectors and aggregators are most affected by price fluctuations.

Each of the polymers has a unique business model. Plastic polymers such as PVC and HDPE, which are converted locally, have constant market demand all year round. Increases in waste processing ventures lead to competition for materials, which causes prices to go up. When the price of virgin plastic in the world market goes up, the price of recycled plastic materials was reported to increase.

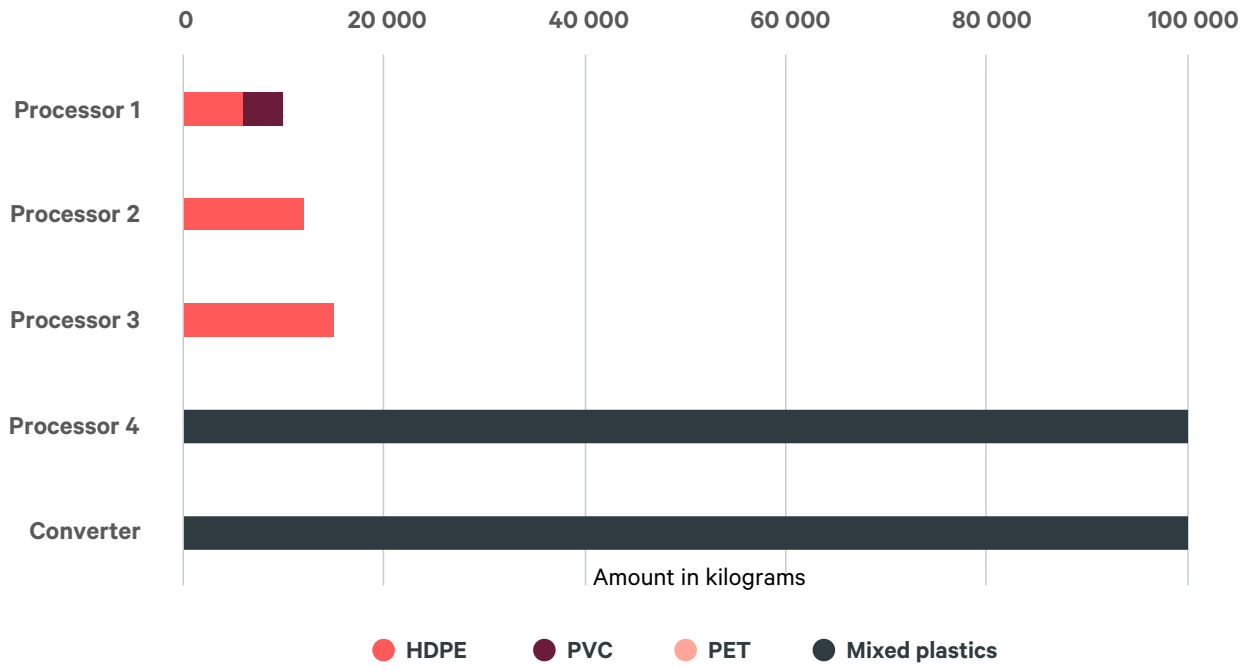
For all the plastic polymers, there is a shared market between Mombasa and Nairobi, particularly for conversion of materials to final products. Some actors operate as linked subsidiaries at successive stages of the value chain; i.e. Category I and II processors may be linked to a converter in a different location. Polymers such as HDPE were reported to have a market in neighbouring Uganda, where they are reported to fetch a better price than in Kenya.

Recycling PET in Kenya began recently, but the polymer only undergoes Category I and II value addition locally. Its conversion is done in overseas markets, and PET was observed to experience price fluctuations occasioned by unstable markets, which causes closure of local factories during certain seasons when demand goes down.

Converters manufacture the pellets and other particles generated in Category II into finished products, closing the plastic flow loop. Some converters engage in Category I and II processing as well as manufacturing of final products. The converters produce different products mainly for use in households and in the construction industry. Locally, HDPE is used to manufacture plastic containers, water tanks and polythene sheets, while PVC is used to manufacture floor tiling. Currently, PET is shredded and pelleted in Kenya and exported mostly to China for conversion to products. Weeco Recycling Company, a Chinese PET processing company, recently set up operations in Nairobi and Mombasa and plans to recycle PET packaging into pellets that will be converted into new products locally. Processing plastic waste into pellets for new products requires specialized machines that can create materials with high enough quality to meet market standards.

Figure 5 shows the quantities of plastic materials that are preprocessed and converted into products in a month, as reported by four preprocessors and one converter interviewed during the study.

Figure 5. Indicative quantities of plastic materials processed or converted by each venture in kilograms per month



Significant discrepancies were also observed in the types and amounts of plastic processed by the ventures that were visited during the survey. The processors obtain supply of materials from tens to hundreds of collector-aggregators in Mombasa and surrounding areas so that they can meet their processing capacities.

Capacity building and incentives for recyclers

Diverse stakeholders have provided recyclers with incentives and built their capacity by providing them with skills to engage in recycling activities. Some actors were observed to be collaborating with the Mombasa County Government and seeking to align their interventions with the government's waste management priorities. External support is usually in the form of short-term projects that last about 5 years, hence the need to collaborate with the county for sustainability of the projects.

The capacity building interventions and incentives which were gleaned from interviews and the literature review are summarized in Table 3.

Table 3. Capacity building initiatives for stakeholders across the plastic waste value chain in Mombasa

Activity	Type of capacity building or incentive	Beneficiary	Provided by
Waste collection	Recognition of waste collection groups through registration and identification	Waste collection groups spread across the six sub-counties in Mombasa	Directorate of Solid Waste Management, Mombasa County Government
Waste collection	Training on leadership and group formation	Waste collection groups across the six sub-counties in Mombasa	World Wide Fund for Nature (WWF), Hand in Hand Eastern Africa
Waste collection	Training on types of plastic and sorting	Waste collection groups across the six sub-counties in Mombasa	WWF, Hand in Hand Eastern Africa
Waste collection	Mobilizing a local women's group and provision of personal protective equipment	Female artisans from Kisiwani Conservation Network	Centre for Environment Justice and Development (CEJAD)
Waste collection	Training on enterprise development and business coaching for waste collectors	Waste collection groups in the six sub-counties	Hand in Hand Eastern Africa, Young Women's Christian Association (YWCA)
Marketing	Market research and information	Female artisans from Kisiwani Conservation Network	CEJAD
Waste collection	Identification of potential collection points, sorting stations, installation of facilities	Groups involved in waste collection in the six sub-counties, including along the beaches	WWF, Hand in Hand Eastern Africa, County Government of Mombasa, PETCO[1]
Marketing	Linking waste collectors and processors	Waste collection groups and processors	WWF, Hand in Hand Eastern Africa
Plastic processing	Plastic processing subsidy	Processors, with trickle down to collectors	PET Recycling Company (PETCO)
Plastic processing	Grants to invest in plastic processing ventures	Medium-large scale investors in plastic processing	Danida and World Bank
Plastic processing	Tax exemption on importation of recycling machines (later withdrawn)	Plastic processors	National Treasury
Legal and regulatory framework	Funding and technical support	County governments	Kenya Association of Manufacturers (KAM)

1 PETCO has installed PET waste drop-off facilities in the city and along county beaches.

Capacity building initiatives by NGOs

Several local and international NGOs have supported plastic waste collection initiatives through grants and as part of environmental conservation and poverty alleviation programmes. Notably, NGOs that have been traditionally involved in species and ecosystems conservation are now engaging in plastic waste advocacy and recycling interventions, geared towards reduction of marine pollution.

In the Old Town area of Mombasa, a pilot project developed by the Centre for Environment Justice and Development (CEJAD), in partnership with Kisiwani Conservation Network, supported 40 female artisans to partake in collecting and separating plastic materials for income generation and to reduce marine plastic. CEJAD also conducted market research for quality and sellable sculptures and items made from plastic and other recyclables from waste in the county.

Conservation organizations such as the International Union for Conservation of Nature (IUCN) and the World Wide Fund for Nature (WWF) are among the other NGOs involved in environmentally focused projects. For example, WWF started the Plastic Smart Cities platform, an initiative for closing the plastic loop and addressing waste management in cities around the world; three cities within Kenya are participating. Through the initiative, cities are required to set tangible commitments and share best practices while also connecting city stakeholders with vetted solutions to eliminate plastic pollution by 2030 (Kubasu, 2019).

In Mombasa, WWF is building the capacity of the informal sector, providing the needed infrastructure such as sorting stations, and supporting their organization into formal entities such as registered companies. Waste collectors' groups across the six sub-counties have been provided with skills on how to identify the various fractions of plastic and improve their waste collection activities. They have also been trained in leadership and entrepreneurial skills to scale up their waste collection ventures into profitability. A similar waste-to-value project by Hand in Hand Eastern Africa seeks to bring more people into the recycling sector by mobilizing community groups and providing them with trainings and other incentives to run improved waste recycling businesses.

The WWF waste-to-value programme will then link the plastic collector groups with private sector plastic processors, to enable them to supply a steady stream of recyclable materials and at the same time get better prices to support their livelihoods (Opondo, 2020a). The initiative, which began in 2021, is projected to result in the creation of more than 800 jobs in the waste recovery sector over the project's four-year duration. The project also has direct support from Danida, Denmark's international development cooperation agency, and is dubbed the Danida Market Development Partnership Waste to Value Project. The project seeks to establish a culture of responsible business conduct and sustainable practices, supported by the local community and authorities, as well as other entrepreneurs.

The IUCN is also implementing a project called Marine Plastics and Coastal Communities (MARPLASTICCs) in five countries: Kenya, Mozambique, South Africa, Thailand and Viet Nam. It aims to bring together key stakeholders to promote circular economy actions, share best practices, and stimulate national action to address plastic pollution.

Private sector initiatives

Individually and through public responsibility organizations, manufacturers have initiated recycling support programmes as part of their voluntary corporate social responsibility efforts or to comply with voluntary and mandatory regulatory requirements on plastic waste management.

PETCO is one such industry-led voluntary Extended Producer Responsibility (EPR) initiative. Established in 2018, the membership organization coordinates collection and recycling of post-

consumer PET packaging in the country. According to our interviews, about 16 manufacturers controlling approximately 60% of the beverage sector in Kenya participate in PETCO. PETCO is financed through voluntary EPR fees and grants from local and international donors, which are used to provide subsidies to recyclers across the value chain. PETCO has also established various collaborations, including with supermarket chains that set up drop-off points at their branches, where consumers can deposit used bottles to be collected by recycling firms.

"As an EPR scheme, we have not come to disrupt the value chain but rather work with the existing value chain, what we are doing is 'calling it out', which means we make it more transparent to third parties, to ourselves, to industry players, and even to government itself about how the process and flow of these wastes needs to be organized."

KII 1 – representative of an EPR Scheme

One interviewee also pointed out that PETCO's target is to have PET waste collectors operating within every county in Kenya material participating in the scheme. They also highlighted that PETCO provides training and personal protective equipment to collectors and also subsidizes processors, so that they may be able to purchase PET materials from the collectors at a better price.

These incentives, complemented by increased publicity, have increased collection and recycling of PET materials. Waste receptacles for PET packaging (mesh bins) to facilitate segregation at the point of waste collection have been installed by PETCO, and these were observed in various locations during the study, including in the city centre and the beaches.

The Kenya Association of Manufacturers (KAM) also launched the Kenya Extended Producer Responsibility Organization (KEPRO) in 2021. KEPRO's mission is stated as bringing together players in the waste value chain to address various types of post-consumer waste, for example, through providing incentives and subsidies to improve collection, sorting and waste processing. Other initiatives include Clean & Green Kenya and Clever Green Kenya, mentioned in web sources in connection with efforts to enhance plastic waste recycling through promotion of EPR schemes and the management of post-consumer plastic waste.

Government support mechanisms

In Mombasa, groups involved in waste collection are required to seek registration with the county government and are issued with identification badges. This is a form of certification that also allows them to drop off waste collected from residential estates in designated collection points. The groups are also invited to participate when the county government is planning or implementing solid waste management interventions. Community groups and other recyclers made contributions during the public participation forums for planning and legislation on solid waste management, and they are also engaged by county government officials in clean-up activities. The county has also linked the groups with partners, so they can get tailored support provided by various organizations.

A county official further observed that the county is developing a framework with a specific call for action on the following: awareness issues, infrastructure for solid waste collection, and promotion of recycling capacity. The framework also aims to build synergy between development partners and recycling players to address the plastic waste issue. The county has started to build infrastructure for a material recovery facility, and plastic waste is among the materials to be recovered. Key partners, including WWF and Hand in Hand, are also involved in supporting the establishment of waste infrastructure.

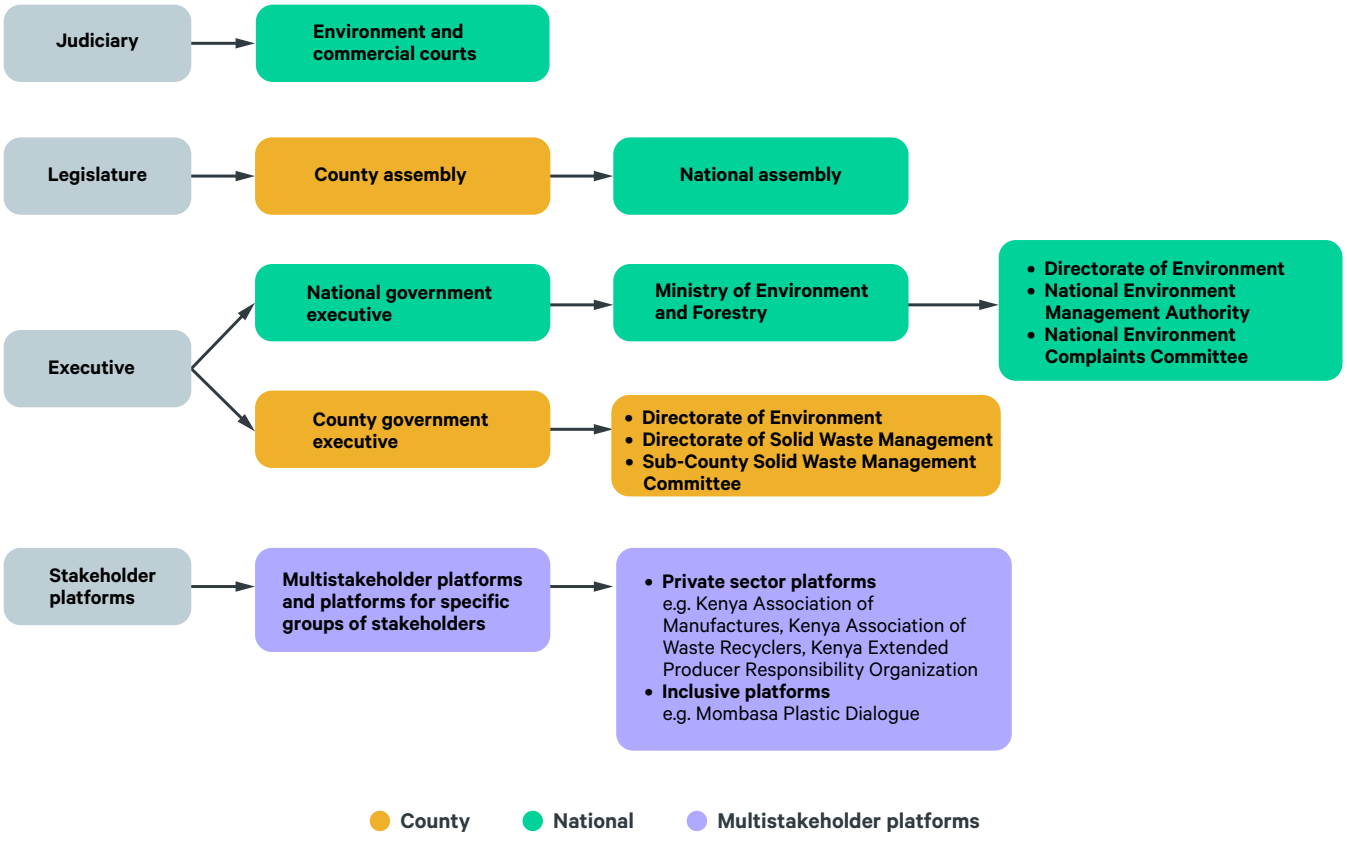
At the national level, the government has provided a tax exemption on importation of recycling machines. Such tax incentives by the national government showcase the commitment of the public sector to improve on private sector engagement in Kenya's waste management (KAM, 2019).

3.2 Institutional and governance structures for managing plastic

The production, use, management, recycling and disposal of plastic in Kenya is a collaborative role performed by the three arms of government, i.e. the judiciary, the legislature, and the executive, and is executed at both national and county levels, as shown in Figure 6. The commercial and environment divisions of the judiciary adjudicate on plastic-related production, distribution and environmental matters, such as waste disposal and pollution. The legislature enacts the laws and regulations governing plastic materials. It consists of the National Assembly, which legislates at the national level, and county assemblies that promulgate laws and regulations applied in the counties. The executive is in charge of the management and administrative matters and is composed of the Ministry of Environment and Forestry and state corporations in its jurisdictions, including the National Environment Management Authority (NEMA) and the National Environmental Complaints Committee (NECC) at the national level. The environment management and administrative structure at the county government of Mombasa consists of the Department of Environment, Waste Management and Energy, which includes the Directorate of Solid Waste Management, and the sub-county environment offices.

The three arms of government are complemented by coordination platforms, which engage stakeholders from the private sector and civil society, such as the Kenya Association of Waste Recyclers as well as platforms that bring together various stakeholders such as the Mombasa Plastic Dialogue. The private sector platforms represent the interests of their members in the plastic industry by articulating the challenges experienced in plastic production, use, recycling and disposal, and advocacy for favourable laws and policies. Notable plastic-related issues that have attracted engagement between the government, the private sector and other groups of stakeholders include the ban on manufacture, sale and use of thin film plastic carrier bags in 2017, consultation on the Sustainable Solid Waste Management Policy (2022), and the discussion on the proposed EPR Regulations (2021).

Figure 6. Institutional and governance structures for managing the production, use, recycling and disposal of plastic in Kenya



National level institutional governance structure

The national institutional system has evolved, with new mechanisms established during the past two decades. At the national level, the institutional framework is led by the Ministry of Environment and Forestry, whose role is the formulation of policies, while NEMA is the principal institution in government for the implementation of all relevant policies. For general waste management and plastic waste, NEMA has several crosscutting functions, which include a coordination and supervisory role as well as monitoring and enforcement roles.

The NECC, which is the national environment ombudsman, also perform specific functions in policy enforcement and implementation of sector activities. Public environment complaints generally and specifically relating to production, use, recycling and disposal of plastic are directed to the NECC.

County level institutional and governance structure

At the subnational level, implementation of environment management systems and policies is vested in the county governments or other local sectoral institutions. The County Government Act (2013) identifies solid waste management as a devolved function to be implemented by county government and assigns it the specific task of implementing nationwide policies within its jurisdiction. However, counties are free in their decision-making on how to effectively implement the function.

In Mombasa, the Department of Environment, Water and Energy is the coordination unit for all environmental matters. A directorate has been established within this department to handle solid waste management, including plastic waste. The unit carries out its role through personnel based at the department secretariat and environment officers working in the six administrative units shown in Figure 1.

> "What we are doing especially in Mombasa is to bring all the players together to work in complementarity; if we are all doing the same thing within the same community targeting the same groups, then we need to have an agreed approach to avoid duplication, e.g. instead of WWF retraining a group that has been trained by Hand in Hand on a particular skill, they should explore another area in which the group needs to be trained on."
>
> KII4 – NGO Official

Institutional and governance platforms created by other stakeholders

The private sector, NGOs and other relevant actors have formed platforms for collaboration and coordination, in order to represent their interests and to voice the challenges experienced in plastic production, use, recycling and waste disposal. Some of these platforms consist of specific groups of stakeholders, e.g. recyclers in a particular area, while others consist of diverse stakeholders, including national and county government representatives. The platforms are also meant to complement government efforts in the governance of the plastic sector.

Recyclers: There are several recyclers' associations that negotiate for better terms of engagement among the recyclers and with other stakeholders, including the national and county governments as well as manufacturers of plastic products. The KAWR is one such association, with over 700 members from different levels of the value chain, all the way from waste collection to conversion of waste to final products.

The Mombasa Plastic Dialogue: To attain impact for and to scale their interventions, WWF-Kenya, Hand in Hand Eastern Africa and Coastal & Marine Resource Development (COMRED), in partnership with the County Government of Mombasa, have initiated a multi-stakeholder sectoral dialogue. This convening is intended to bring together experts and decision-makers to the table to leverage resources and expertise, share knowledge, trade best practices, and chart the path forward towards making Mombasa County a "plastic-smart city".

Dubbed the Inaugural Mombasa Plastic Sector Dialogue, the forum has brought together leaders in the plastic industry, national and county governments, civil society organizations and academia. These participants are expected to co-design and develop "plastic-smart" action plans through knowledge sharing on best practices and global best practices (Nato, 2021).

At the national level, a partnership bringing together KAM, NEMA and the Ministry of Environment and Forestry was established in 2018. It was envisioned that through this partnership, both the public and private sector would support each other in the management of PET waste in Kenya (Mwaniki, 2018). This culminated in a platform on which consultations on various issues on plastic waste management, including the legal and the regulatory framework, were based.

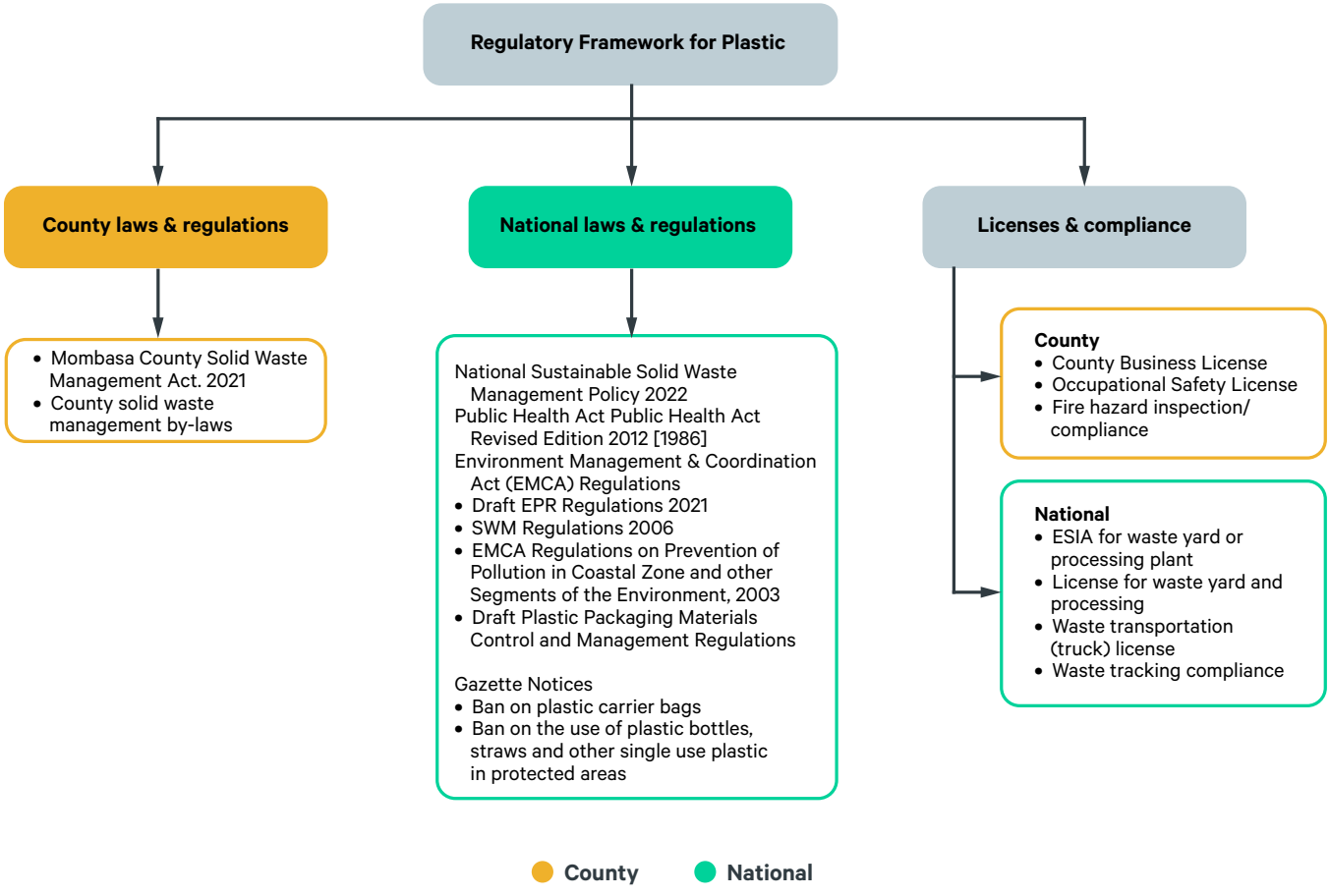
3.3 Policy and regulatory framework for plastic

The county and national governments have made efforts to promote sustainable plastic waste management and recycling through policy and regulation on production, consumption and recycling of end-of-life and single use plastic. The policies and strategies have advocated reducing, reusing and recycling (3Rs) of plastic waste materials into new products, for a clean environment and for income generation.

The regulations stipulate the responsibilities of various actors in the management of waste, impose restrictions on production and use of certain types of plastic, and recommend penalties and measures to be taken for violators. The regulatory framework also specifies the licenses and permits with which waste collection service providers and recyclers are required to comply in order to legitimately engage in waste handling and processing activities.

Figure 7 summarizes the policies and regulations governing plastic production, waste management and recycling at both national and county levels.

Figure 7. Policy and regulatory framework for plastic production and recycling in Kenya



Until recently, the existing environment management policies and laws did not expressly address plastic waste management and recycling. The policies and legislation applied only to the management and recycling of general municipal solid waste, addressing plastic waste management and recycling in very broad terms (Opondo, 2020b). Table 4 outlines national and county level policies and regulations that explicitly address solid waste management and plastic waste in particular.

Table 4. Overview of the policy and regulatory framework for plastic production, use, disposal and recycling.

Law/policy	Scope (materials or types of waste)	Year	Provisions, measures and targets
County/subnational			
Mombasa County Solid Waste Management Act	Municipal solid waste	2021	The act has provisions on various aspects of solid waste management including coordination, administrative structures and procedures; sites and facilities; licensing, fees and levies; prohibitions, fines and penalties, and so forth. Further provides for stakeholders' representation in county- and ward-level solid waste management committees; coordination and collaboration with national government; partnership with manufacturers, wholesalers and retailers; mechanism[s] for waste collection and transfer; designation of sites and facilities; and waste processing and transformation
Mombasa County Environmental Health and Sanitation Act	Municipal solid waste	2017	Provisions on the removal of litter in public places, street cleaning, and the establishment of an integrated county waste management plan and strategy.
Mombasa County Solid Waste Management By-Laws	Municipal solid waste		Rules combining solid waste management handling, cleanliness and sanitation inherited from the municipal authority, the predecessor to the county government.
National			
Environmental Management and Co-ordination Act (EMCA), No. 8 of 1999 (Rev. Ed. 2018)	All types of wastes including municipal solid wastes and hazardous wastes	1999 rev. Ed. 2018	EMCA section 86 calls on the authority to identify materials and processes that are dangerous to the environment and human health. It also prescribes the standards for wastes, their classification, and analysis and formulates and advises on standards of disposal methods and means for such waste.
EMCA Waste Management Regulation 2006 (Legal Notice No. 121/2006)	All types of wastes including municipal solid wastes and hazardous wastes	2006	Establishes rules for the management of municipal waste, provide a guide for licensing, transportation and disposal of waste, and advocates for economic incentives to manage waste and promotion of clean production, waste recovery, recycling and reuse.
EMCA Regulations on Prevention of Pollution in Coastal Zone and other Segments of the Environment, 2003 (Legal Notice No. 159/2003)	All waste categories	2003	The regulations apply to all waste categories and specify the requirements for handling, storing, transporting, treatment and disposal of waste from ships.
Gazette Notice No. 2334/2017 - Ban on domestic and commercial packaging in Kenya	Plastic carrier bags	2017	This ban covers manufacture, sale and use of plastic carrier bags and flat bags made from polyethylene (PE)
Draft Plastic Packaging Materials Control and Management Regulations	Plastic packaging materials	2018	The draft regulations provide guidance on manufacture, sale and use of legalized plastic packaging materials in the country.
Gazette Notice No. 4858 of June 2019 – ban on the use of plastic bottles, straws and other single use plastic in protected areas	Single use plastic packaging and other plastic	2019	The goal is to keep single use plastic out of all protected areas, which include national parks, game reserves, forests, museums, etc.
EMCA – Proposed Extended Producer Responsibility (EPR) Regulations 2021	Recyclable wastes	2021	Kenya's EPR Regulations aim to make producers responsible for the environmental impacts of their products throughout the product chain, from design to the post-consumer phase to alleviate the burden on counties and taxpayers for managing end-of life products, reduce the amount of waste destined for final disposal and increase rates of recycling. Plastic is among the waste materials that will be subject to the EPR Regulations.

Law/policy	Scope (materials or types of waste)	Year	Provisions, measures and targets
National Sustainable Solid Waste Management Policy 2022	Municipal solid waste	2022	The bill is aimed to establish a more sustainable, circular economy in which waste is recognized as a secondary resource. It applies EPR to extend manufacturers' financial or physical responsibility for a product to the post-consumer stage of the product.
National Solid Waste Management Strategy	Municipal solid waste	2014	Among other objectives, the strategy promotes consistency for the national and county governments' policies and actions in their performance of the solid waste management function.
Private Sector			
Kenya Plastic Action Plan	Plastic waste	2019	Kenya Plastics Action Plan is a private sector–led policy and plan developed by the Kenya Association of Manufacturers (KAM); it identifies the specific steps that the public and private sectors should undertake to achieve sound plastic waste management at the county level. The strategy advocates for the formation and regulation of EPR schemes and establishment of recycling value chains and standards (KAM, 2019).
Regional – East Africa			
The East African Legislative Assembly (EALA) introduced the Polythene Materials Control Bill (PMCB)	Plastic	2012	The Polythene Materials Control Bill was introduced in 2011, to control and regulate manufacturing and use of polythene bags within the East African Community (EAC) member countries by limiting the bags' production and distribution in the region.

Implementation of Mombasa County's policy and regulatory framework

Under the devolved system of governance in Kenya, which began in 2013, county governments are creating and reforming their solid waste management systems for the cities and towns within their jurisdictions, with NEMA providing them with standards, guidelines and technical support. With the exception of Nairobi, which has a solid waste management plan and a law in place (Haregu et al., 2017), most counties rely on the national-level legal framework for their solid waste management interventions. Pre-existing by-laws, some of which were adopted from the predecessor county councils and others developed in the recent past, are also used.

For purposes of enforcement, Mombasa County has been using the Public Health Act, which addresses solid waste management in some of its provisions. However, Mombasa now has a solid waste management policy that provides for enactment or adoption of laws, guidelines, standards and frameworks. Key among them is the Mombasa County Solid Waste Management Act 2021.

The law provides for establishment of an enforcement unit, and the department of environment is already piloting this unit, awaiting the bill to be passed into law. Mombasa County has approached NEMA to provide training to county enforcement officers and their formal appointment as environment inspectors charged with enforcement of the county solid waste management practices and standards stipulated in the legislation.

The County Government has further devolved the waste management function to its six sub-counties and 30 wards. The county health and environment personnel enforce the solid waste management using the Public Health Act by-laws that were applied by municipal authorities. The recent Mombasa County solid waste management Act, however, does not have any explicit provision on plastic production, use, recycling or disposal. Therefore, the national law takes precedence. Both the Public Health Act and the Mombasa County Solid Waste Management Act also do not have provisions for penalties to be meted out to offenders.

The plastic recycling sector is governed by a stringent licensing regime: compliance and several licenses are required by recyclers in various activities occurring at different levels of the value chain. Recyclers are required to acquire licenses from different departments in the county government, including business licenses, as well as occupational safety and

fire safety certifications. Recyclers pay fees to acquire licenses and to be certified for other compliance requirements.

Some recyclers portrayed an unequal playing field, whereby the legal requirements and permits are more strictly enforced for some operators than others. Cases of recyclers operating without meeting the mandatory requirements were also reported.

Implementation of national level policy and regulatory framework in Mombasa

The legal and regulatory framework on plastic waste addresses issues of production of plastic materials, waste management, recycling and disposal. The Environment Management and Coordination Act (EMCA) is currently the main national law regulating waste management. It is complemented by regulations and guidelines that specify the appropriate waste practices and outlines the penalties for failing to adhere to the stipulated standards.

A number of regulations have been put in place, including the Regulations on Prevention of Pollution in Coastal Zone, the Solid Waste Regulations 2006, and the draft EPR Regulations 2021. The national laws and regulations are enforced by NEMA, which has coordination offices in all 47 counties, and where applicable, by other agencies using various enforcement measures.

The National Sustainable Waste Management Policy recognizes waste as a resource that should be harnessed and exploited through recycling and other forms of value capture. If promulgated, the law is also expected to incentivize accelerated action on waste at the national and county levels, increase compliance, and facilitate increased private investment flows to the waste recycling and sanitary disposal activities (Kaundia & Rosenthal, 2018).

> "The proposed EPR Regulations is going to be the real game changer, especially for the private sector and government, because the 'Polluter Pays' Principle did not have anything that could operationalize it. But now the EPR regulations defines who is a producer and what kind of responsibilities are expected of them, and the categories of materials that are covered by this regulation. So, it's a very exciting period in the recycling sector and I think it will also drive the Eastern Africa region towards also going the same direction once we implement it successfully in Kenya."
>
> KII1 – Representative of an EPR Scheme

It is also noteworthy that the National Sustainable Solid Waste Management Policy is more explicit on the responsibilities of different players. This policy also eases the burden of statutory requirements vis a vis the level of income for every level of the recycling value chain, as there is a particular threshold of income at each level; e.g. an aggregator will not be required to pay the same amount for a license as a processor. The policy also attempts to eliminate the confusion between the roles of NEMA and the county governments when it comes to enforcement for waste management.

Other notable laws in the sector are the ban on the manufacturing and use of plastic carrier bags and flat bags imposed in 2017, which was inspired by the East African Legislative Assembly (EALA) Polythene Materials Control Bill 2012. Bans are also in effect on the use of plastic bottles, straws and other single use plastic in Kenya's protected areas, i.e. national parks, forests, reserves, and elsewhere.

Prior to passing the ban on plastic carrier bags, Kenya passed through a long and winding journey towards regulation of plastic production, use and disposal. Dating back over a decade, many of the regulatory efforts were received by stakeholders with mixed reactions, both against and for certain policies and regulatory instruments. Early interventions focused on regulation of thickness of plastic carrier bags, as well as imposition of excise tax on such plastic items, which failed to achieve the intended reductions of plastic leakage into the environment (Opondo, 2020b).

A general penalty is prescribed for violation of any measure prescribed under the ban on plastic carrier bags; upon conviction by a court of law, one is liable to imprisonment for a term of not less than one year but not more than four years, or to a fine of not less than KES 2 million (approximately USD 20 000) but not more than KES 4 million (approximately USD 40 000), or to both a fine and imprisonment. Penalties have created a high level of deterrence among the general public, as evidenced by the fact that plastic carrier bags are no longer dispensed by business outlets, whether for free or for sale. Streets and public places are obviously free of

"With the proposed EPR Regulations coming to effect soon, it will just take Kenya to the global stage in terms of acceleration towards recycling and that is where we'll need a lot of partnerships and capacity enhancement especially for governments because we realized there is a weak link within NEMA. The success of the [EPR] regulation hinges on good enforcement and follow through and setting of targets for example by companies on the recyclability of their products."

KII 4 – NGO Official

plastic carrier bag litter (Opondo, 2020b). The ban, which was upheld after a petition brought by manufacturers in Kenya's high court, has created new market opportunities for small-scale entrepreneurs who produce jute and cotton bags and baskets from other biodegradable materials (Kaundia & Rosenthal, 2018). Due to the success of these bans, NEMA began weighing options of imposing a similar ban on other single use plastic packaging. The ban on the use of plastic bottles, straws and other single use plastic in protected areas is effectively enforced by forests and game wardens and security officers in the various protected areas.

Other single use plastic packaging may be effectively addressed by the forthcoming EPR Regulations, which seek to put the onus on producers for taking responsibility for their waste through both mandatory and voluntary EPR schemes. In Kenya, EPR is viewed as being a key pillar for policy development and implementation by the national and county governments, in order to prevent waste and to enable reuse and recycling initiatives. The EPR Regulations need to be expedited, since currently, schemes such as PETCO do not have a legal framework under which to be operationalized. The government monitors the activities of voluntary EPR schemes through the lens of the Companies Act (Companies Act, 2015).

Stakeholders acknowledged their input in the proposed regulations through the extensive consultations on the establishment of mandatory EPR schemes in the country, which are widely seen as likely to transform the recycling sector. A stakeholder survey conducted by IUCN ranked EPR as the most appropriate legal tool for tackling marine plastic pollution in Kenya, followed closely by bans on plastic products and economic incentives such as tax exemptions; other tools such as voluntary levies fell lower in the ranking (IUCN Environmental Law Centre, 2020). Following this survey, IUCN commissioned an in-depth policy effectiveness assessment of EPR as a possible legal tool for marine plastic management in Kenya; the assessment made recommendations on what needs to be refined in the proposed EPR Regulations 2021 (Opondo, 2020a). If implemented successfully, it is expected to complement the current stakeholder-wide efforts to spur recycling, stimulate innovation and enhance resource use efficiency.

To foster compliance with the laws and regulations, NEMA officers conduct inspections and issue orders to those who do not have licenses and directs those in contravention of standards to implement the necessary corrective actions. The inspections also serve as mechanisms for creating awareness on compliance issues and to gauge the compliance levels of various regulations. Among others, NEMA also performs the roles and functions listed below (NEMA, 2016):

- promoting public awareness on waste management
- undertaking joint surveillance or inspections with relevant regulators, lead agencies and stakeholders
- monitoring waste management facilities
- advocating for increased waste management receptacles in public places
- enforcing laws on compliance in waste management
- engaging stakeholders on the implementation of the national solid waste management strategy.

Recyclers are required to have a license to operate a waste aggregation yard or a waste processing facility. Before applying for this license, recyclers need to conduct an Environmental Impact Assessment (EIA), as for any other development project. When an EIA is approved, a license from NEMA is issued that sets conditions for waste management, protection of workers on site, and other conditions.

"An ordinary plastic Category I value addition investor would need about KES 250 000 (USD 2500) to spend on NEMA and county licensing and permits. This is a very tall order, especially given that people usually invest using borrowed money. Meeting the statuary requirements for a recycling facility is not a priority and cannot be a priority for someone who is investing using loans. Therefore, they will take the risk of operating without the necessary requirements."

KII 2 – Member of Recyclers' Association

Recyclers also need a waste transportation license for waste trucks. In addition to licenses, NEMA requires waste transporters to keep a record of waste in a tracking document indicating the source and destination of materials. NEMA further imposes a time limitation on transportation of materials at between 6AM and 6PM. Due to the rigorous processes involved in securing licensing and permits, some processors have recruited agents to handle the processes on their behalf with NEMA and the Mombasa County Government.

In addition to paying fees for licenses, permits and compliance, recyclers are also subjected to various levies, e.g. excise duty and Value Added Tax (VAT), which are paid to the Kenya Revenue Authority (KRA), and other levies paid to county governments. Just like other manufacturers, plastic product manufacturers pay excise duties for end products. Penalties for lack of licenses, include fines and suspension from operation or total closure of operations by NEMA inspectors. Penalties for non-compliance with environmental protection include improvement notices, which are usually written directives requiring that statutory standards for environmental protection are complied with and that specify the time period for compliance. Other enforcement measures include restoration orders meant to ensure harmful activities are stopped and the environment is restored back to its original state.

Gaps and challenges in legal and regulatory implementation and enforcement

While the national and county level governments have been involved in efforts to promote effective management of plastic production, use and disposal and to harness recycling, certain provisions in the existing policy and regulatory frameworks constrain the effective implementation of effective plastic management and recycling measures. Contradictions in the policy and regulatory instruments were also identified, coupled with inadequate capacity for enforcement. The gaps and challenges are spelled out in Table 5.

Table 5. Summary of gaps and challenges identified in the implementation of the policy and regulatory framework for the plastic waste value chain.

Policy or regulation issue	Gaps or challenges identified
General	• NEMA is charged with the bulk of the enforcement mandate, but it is still very thin on the ground to conduct this role effectively. Both national and county government lack adequate human and institutional capacity to ensure consistent enforcement of regulations as well as implementation of the plans, hence becoming either ad hoc or neglected. • The gap between policy and regulation and adequate action also observed to be as result of political interference, corruption, lack of political good will or poor governance • Generally, implementing the policy and regulatory framework is often crippled by contradictory or inadequate legislation, e.g. while the importance of roles of various stakeholders and actors in solid waste management is clearly articulated in the policy frameworks, these roles are not well operationalized and coordination mechanisms are not well stated in the policy guidelines (Haregu et al., 2017). • Policy and regulatory implementation and enforcement is also curtailed by governments prioritization of economic growth over environment conservation, e.g. the question of whether to create jobs and incomes for unemployed or to clean up the industries that are providing these opportunities.
Solid waste management/ plastic laws and regulations	• Some laws have been passed without corresponding regulations, making it difficult to enforce. • The cost of litigation both in terms of legal knowledge, finances and time also makes it difficult for potential litigants to take legal measures on polluters. • Existing penalties and rewards are inadequate for deterring offenders or inspiring compliance.
New/upcoming policies and regulations	• Concurrent or parallel promulgation of policy and legislation by both national and county government: e.g. the national government is pushing the National Sustainable Solid Waste Management Law, while some counties have already established their own policies and laws which have gone through rigorous public input and legislative procedures, and still many other counties have solid waste management policies and legislation in the pipeline. Little or no consultation is made between the national and county government during making and implementation of the county solid waste management law and polices and in the event, of inconsistency, the national policy or law takes precedence, confusion or conflict may arise, in this case for plastic waste management and recycling operations.

Policy or regulation issue	Gaps or challenges identified
Proposed EPR Regulations 2021	• Limited representation of recyclers in development of the regulations relating to recycling and lack of recognition in the regulation was also cited. A community waste collection group criticized the draft EPR regulations for lacking recognition of waste collectors and called for an amendment on these issues. • Engagement between recyclers and PROs is set to increase when the EPR regulations come into force, but the regulations have not addressed the need to formalize the informal players in in order engage effectively with manufacturers. • Whereas some forms of EPR, such as take-back schemes, are already in place, public awareness and necessary infrastructure for waste recovery are non-existent (KAM, 2019). Small and medium enterprises do not participate in existing voluntary EPR schemes in the private sector plastic recovery and recycling initiatives. This largely because the legislative landscape in the country does not compel them to participate in schemes such as PETCO. A conflict could thus arise between the large and micro/small enterprises regarding the levelling of the playing field for business vis-à-vis environmental compliance (Opondo, 2020a). • The role of subnational regulatory institutions is not featured at all in the proposed institutional framework under Kenya's draft EPR regulations (Opondo, 2020a).
County government performance on collection and disposal MSW	• As a supervisor and coordinator of the government policy, NEMA does not have the power to compel a county government to perform their waste management mandate.
Bans on plastic carrier bags	• The current ban has been critiqued as lacking adequate consultations with manufacturers, not providing alternatives, and targeting selected plastic types, while the rest (for instance, plastic used in food packaging) continue to be released into the environment. Illegal imports of carrier bags from neighbouring countries such as Somalia, Tanzania and Uganda also maintain the flow of plastic bags entering the Kenyan market.
Licensing and compliance	• EIA is very costly; it may cost a recycler around KES 100 000 (USD 1000) to perform, and then they still may have to pay a bribe for it to be approved. • NEMA imposes a time limitation on transportation of materials, between 6AM and 6PM. • Transporting plastic materials to processing destinations is made cumbersome by the requirement to track waste in transit, which does not discriminate between mixed municipal wastes headed for disposal, and segregated and pre-processed waste materials headed for further value addition, as all are categorized as "waste". This stringent requirement when moving industrial raw materials subjects recyclers to extortion for bribes by police as well as national and county enforcement officers along the transit route. • Recyclers are required to pay a levy in some counties when transiting with segregated or preprocessed plastic materials. This limits the movement of recyclable plastic from one county to another, which is burdensome especially given the fact that it is not viable to set up material preprocessing or conversion plants in all counties due to the economies of scale. • The relationship between the recyclers and enforcement agencies has been called very poor. Interviewees viewed statutory compliance requirements as unaffordable, and said that the regulators tend to criminalize recycling activities. • Some recyclers also circumvent the license and compliance requirements, while still others are unaware that there are legal and regulatory requirements they must meet before they can invest in a recycling enterprise. • Other operators felt unfairly targeted in enforcement of licensing and permits, while their others continue operating without the requisite licenses and permits. • The massive lobbying by the private sector, mainly to protect their business interests, was also cited as having the potential to stifle the drafting, passage and implementation of legal and regulatory instruments.

3.4 Constraints and challenges experienced in plastic waste management and recycling

While there is a great potential for recovery and recycling of various plastic materials of economic value, the plastic waste value chain faces many challenges and hence very little waste is recycled. According to IUCN, EA and Quantis (2020), Kenya generates 503 000 tons of plastic waste and only 7% is recycled. The constraints and challenges illustrated in the following sub-sections were identified by the respondents to the scoping study.

Social and occupational related constrains for recycling workers

Waste collectors – particularly the waste pickers and community groups – tend to be socially and economically marginalized, due to the negative perceptions about recycling in society. As a result, they may be subjected to harassment and other injustices in areas in which they operate.

Engaging in waste collection and recycling activities is usually an adaptive response to chronic poverty, and often, rural immigrants to urban environments in search of livelihood opportunities become waste collectors. Exploitation exists, especially for the collectors, in the form of low and unstable prices offered by processors, and child labour is also common throughout the value chain.

Respondents posited that recycling was experiencing rapid growth and is therefore absorbing job seekers in the county. The exploitation, social stigma and child labour need to be addressed using existing labour laws. However, it may be difficult to regulate pricing of materials in circumstances where it is dictated by the plastic market.

The work environment for individuals in informal waste recycling particularly the collectors and employees in processing activities tends to be deplorable with notable exposure to hazardous, contaminated and toxic materials. Workers in the recycling sector are also exposed to harsh weather conditions, both during rainy seasons and dry sunny periods.

> "When collecting plastic materials at a waste disposal site, a snake slithered out of a disposed piece of plastic pipe where it was sheltering from the hot sun. The snake had its fangs flung out ready for attack and almost bit my arm."
>
> Questionnaire 3 – plastic collector

People undertaking collection and processing do not have appropriate equipment and safety gear and hence suffer risks of injuries during the activities. Handling dirty and smelly materials, and collection of materials in dumpsites exposes them to risk of contamination, as well as skin and respiratory infections. They are also exposed to risks of bites from creatures inhabiting waste disposal areas such as crabs, spiders and snakes. The risk of Covid-19 from the contaminated waste materials was also pointed to as a possibility, although no direct evidence has been established that this can occur.

These vulnerabilities cut across the different levels of the value chain. In addition, the waste collectors (until recently in Mombasa) are not recognized within the frame of waste management and are not considered to be part of it.

Financial sustainability of recycling enterprises

High cost of transportation was cited in our interviews as a major impediment to recycling and one that often causes businesses to collapse. Some materials need to be transported over long distances to where processing plants are located, e.g. PET that is currently only being processed in Nairobi. Unreliable electricity, machine breakdown, material shortage, inadequate knowledge on the plastic processing techniques and inadequate funding for investment were also identified to be key challenges for recycling ventures. At the collection and the aggregation level, the sustainability of collective community recycling enterprises was observed to be a concern, due to lack of proper collective responsibility and ownership of the project by members.

Contaminated materials channelled to recycling

According to Soler (1992), 95% purity is essential for certain types of plastic wastes to be suitable for conversion to pellets and new products. The plastic materials are often segregated from co-mingled waste, particularly waste streams with a high proportion of organic materials that contaminate the recyclable materials. Poor quality materials are also a result of lack of knowledge by waste collectors about the different types of plastic polymers. Unrecyclable plastic such as LDPE materials and other low-grade plastic are mixed with recyclable materials.

The quality of recycled plastic is also affected by the kind of labelling or branding applied on plastic items. Most labels are of a different material from the main product and therefore it takes time to remove the labelling. Some manufacturers use strong adhesives that make it difficult to peel off the labels. Paints that are used for product branding may also affect the quality when the plastic materials are channelled for recycling. Others use aluminium foils for human food-grade packaging, e.g. in dairy products.

"Converters don't pay the preprocessors upfront in order to first examine the quality of the final product before they decide on what amount they are going to pay. It's like going to a shop or grocery and taking some products on credit and you pay after you have ascertained the quality of your meal. This is a critical challenge in the sector that leads to exploitation."

KII2 – Member of Recyclers Association

These branding and product protection films made of other materials compromise the quality of the recyclable materials and eventually the final product. Traces of those materials end up reflecting on the final products, compromising the purity and the value of both raw materials and final products.

These potential contaminants must be identified and removed at the lower levels of the value chain. Converters thus usually transfer the cost of poor quality to the actors in lower levels of the value chain, especially the Category I and II value addition actors, who eventually transfer it to collectors and aggregators.

The KAWR has engaged with the Kenya Private Sector Alliance, which is a private sector membership association also known as KEPSA, and with KAM to discuss ways of improving on their product design. The KAWR also works with the Ministry of Environment and Forestry and NEMA to invoke the "Polluter Pays" Principle for manufacturers that do not ensure that packaging materials for their products are recyclable; however, the issue has not been adequately addressed through existing regulations. The Polluter Pays Principle is likely to become more applicable through the upcoming EPR regulations and may help to ensure that manufacturers enhance the recyclability of their packaging materials.

Lack of suitable sites for waste segregation and processing

Recyclers – especially waste aggregators and those in Category I and II of value addition – are constrained by lack of space and facilities in which to conduct their activities. The places where they store or process materials often do not meet the applicable environment and health regulations. Respondents reported their stocks getting destroyed by accidental fires or through acts of arson.

Unfavourable policy and regulatory framework

Despite having a robust legal and regulatory framework on solid waste management and plastic, inconsistencies and gaps remain with regard to sustainable plastic waste management and recycling in Kenya, as elucidated in Section 3.3 Oguge (2019) further posited that the lack of clear policy or strategy on recycling has sustained informality in the sector. The weaknesses and inconsistencies in the policy and regulatory framework have also resulted in the social constraints experienced by recyclers such as exploitation, as well as the health and safety concerns. KAM (2019) perceives the current biggest hurdle for the recycling value chain as the licenses that are required for moving waste, i.e. secondary materials. Inadequate institutional capacity and financing for effective implementation of the policy and regulatory framework is also a major setback for enforcement.

"We have not had an elaborate rapport with research and academia as we do with the private sector, but I think there is still room for us to initiate a relationship. This is our first engagement with Stockholm Environment Institute and for us, we are open to further engagement for the good of our environment and business."

KII2 – Recyclers Association:

Limited investment in growth of recycling

Little efforts have been made by government to upscale innovative initiatives in plastic waste management and recycling. A representative of a recyclers association pointed out that county government and the Council of Governors (COG) have always been receptive for dialogue with recyclers but there are still no incentives forthcoming.

A subsidy provided by PETCO to be paid to processors for PET materials has not been equitably transferred to the waste pickers at the bottom of the pyramid. Given that the plastic value chain has many players, the subsidy may be split up among many players in the chain, i.e. processor, transporter and aggregator such that very little reaches the collectors at the bottom.

The Kenyan government provided a fiscal incentive in 2019 by way of a tax exception on importation of recycling machines. It was reported during the study that the incentive was

withdrawn even before the next national budget cycle. Except for this tax exception, plastic recyclers have not received any other significant incentive from the national exchequer.

Little investment in research and development

Limited engagement has occurred between academia and recyclers, indicating that researchers have not reached out to recyclers and vice versa. Some of the prescriptions for how to improve innovativeness in the sector are not evidence-based or data driven, but rather informed on what is visible in the environment or by superficial perceptions about the sector.

4. Conclusion

This scoping study outlines the configuration of plastic waste management and recycling in Mombasa, comprised of the stakeholders and activities in the waste recycling value chain, institutional and governance framework, and the legal and regulatory framework. Considerable efforts in plastic collection and processing are spread out across Mombasa, and these have created revenue generating opportunities and employment, as well as reduced the volumes of plastic discarded in the environment. However, while there is a clear opportunity for plastic recycling in the context of the development of a circular economy, the existing ventures are not yet capable of fully dealing with the volumes of plastic waste generated in the county.

Constraints experienced in the plastic recycling value chain, challenges in the institutional and governance systems, and the inefficiencies in policy and regulatory frameworks have prevented the development of a robust plastic waste recycling value chain. Consequently, only a small a fraction of the valuable waste resource is salvaged for recycling; hence an employment and income generation opportunity remains underutilized from plastic waste collection, sorting, and recycling. Ineffective plastic waste disposal practices thus continue to cause environmental degradation and especially accumulation of marine litter in the Indian Ocean.

More actions, innovations and investments in plastic waste recycling in the county need to be promoted to increases the volumes of the recyclable plastic materials and to also harness plastic polymers that have not been incorporated in the value chain. The following recommendations could help rid the environment of plastic waste while creating employment opportunities for the vulnerable members of society in Mombasa County, particularly youth, women and the physically challenged.

5. Recommendations

"We are dealing with a production and a waste management regime, and thus interventions have to happen in production, consumption and waste management. And a series of things are involved that have different dynamics. So, there can't be a silver bullet kind of a solution."

KII 10 - Respondent from academia

Interest is high in Kenya in bringing plastic waste under control, and efforts are already championed by both national and county governments and other stakeholders that aim to unlock the opportunities and value that plastic waste provides as a resource. However, to achieve a circular economy for plastic in Mombasa, more interventions are necessary throughout the entire value chain. The above findings informed the following overarching recommendations for stakeholders in general, as well as recommendations targeted to specific stakeholders.

5.1 Waste segregation with public participation

Palfreman and Clark (2015) posited that the potential to separate greater quantities of waste at its source remains high, but implementing such a system is challenged by low levels of public awareness and willingness to separate, as well as by the lack of coordinated economic incentives to promote source separation. In order to increase the recovery of value from wastes and reduce the health risks from contaminated waste materials, sorting at the source should thus be engrained in the waste management system. The county government and partners such as Hand in Hand need to sensitize the public to environmentally friendly waste management practices, especially through segregation at the source.

The Mombasa County Solid Waste Management Act 2021 proposes to work with waste collection service providers in effecting waste segregation by households, businesses and institutions. This strategy needs to be effectively implemented to address the challenges of shortages of materials and contamination due to mixing recyclable and unrecyclable types of plastic.

Manufacturers can also help to maximize material recovery by employing reverse logistics within their supply chain ecosystem, whereby plastic waste materials are retrieved from consumers and other points of consumption.

5.2 Fair play in the recycling sector

Plastic waste stakeholder platforms need to create mechanisms for addressing responsible conduct in terms of fair pay, occupational health and safety, elimination of child labour, and human rights for recycling actors across the value chain. The processors especially need to adhere to global human rights decrees, the International Labour Organization (ILO) standards, and labour laws and occupational safety and health at work. WWF is in the process of developing responsible business conduct guidelines for the recycling sector. Other stakeholders need to make contributions to the development of codes of conduct, especially through the Mombasa Plastic Dialogue, so that consensus is achieved. The county government should provide social security-like schemes to waste collectors, as well as to low-wage and vulnerable employees working in plastic processing activities.

5.3 Economic incentives for recyclers

Plastic waste recyclers across the value chain need to be supported with investment capital in the form of grants or affordable credit facilities and other financial incentives, in order make recycling an attractive venture. The national government ought to provide subsidies, favourable taxes (e.g. lower taxes or provide exemptions on VAT) for the plastic recycling industry and should reduce power and water tariffs to enable recycling ventures to break even and to enable reasonable income for persons working in the plastic recycling sector. The county government can initiate financial incentives, which may ease doing business, linking recycling enterprises with funding opportunities, and providing business development services, especially for small-scale recycling enterprises.

Both the national and county governments can adopt some good practices on economic incentives for recyclers that have been applied in other countries. The Regional Knowledge

Centre for Marine Plastic Debris (2020) highlighted the different approaches adopted to offer economic incentives to recyclers in the 10 member states and 3 countries of the Association of Southeast Asian Nations Plus Three (ASEAN+3), as shown in Table 6.

Table 6. Approaches adopted to offer economic incentives for recycling in ASEAN+ 3 countries.

Country	Incentives	Enablers
Indonesia	Economic incentives in various schemes as emphasized in Government Regulation No. 46/2017 on Environmental Economic Instruments including Fiscal incentives such as lowering the value-added tax (VAT) from 10% to 5% for recycling businesses Green sukuk, which is conceptually similar to the green bond initiated by the World Bank, meant to raise funds to support projects related to climate change	Incentives should be integrated with other aspects, such as ease of doing business, ease of obtaining loans, and business development services
China	A favourable VAT treatment to recycling industries through Circular No. 115 of State Administration of Taxation in Ministry of Finance in 2011 to support its recycling industries a recycling subsidy policy on the reuse and recycling stage of the product life cycle	Market factor interventions, such as innovation ambience, which attracts manufacturers to use more recycled instead of virgin materials, as well as consumers' awareness of products made from recycled materials, should be considered
Viet Nam	The government issued Circular No. 121/2008/TT-BTC on Guiding Incentive Mechanisms and Financial Supports for Investment in Solid Waste Management, where Article 2.5 states support for research and development of solid waste recycling, reuse and disposal technologies Government commits to support up to 30% of total funding for organizations and individuals who plan to invest in the construction of solid waste disposal facilities as detailed in the guidance of scheme Joint Circular No. 2341/2000/TTLT/BKHCNMT-BTC. Enhanced market development for recycled products by issuing Decree No. 19/2015/ND-CP on Detailing the Implementation of a Number of Articles of the Law on Environmental Protection, which encourages the procurement of recycled products	Article 47 of the decree No.19/2015/ND-CP urges that heads of agencies and units using state budgets must prioritize the public procurement of products manufactured by certified recycling industries

5.4 Quality control

Good quality recycled plastic that is free from impurities and other forms of contamination will fetch higher prices in local and international markets and compete effectively with virgin plastic. Products made with high quality recycled plastic are also more acceptable to consumers in the marketplace. The quality control for recycled plastic thus needs to be a shared responsibility across the value chain and should be achieved in fast, reliable and cost-effective ways.

Plastic manufacturers need to ensure that harnessing of plastic waste begins with responsible production, by improving the recyclability of their packaging. Interviewees cited Coca Cola's PET packaging as an example of good practice in design of plastic packaging items for recyclability: the adhesive used to stick the paper sleeve label on the beverage bottles is easily removable. Other examples were products with labels made of PET materials to minimize contamination during recycling. Because collection and sorting are the primary value extraction points, players at these levels need to maintain standards in order to produce an acceptable grade of recycling material.

5.5 Enabling legal and regulatory frameworks

The gaps and challenges identified in policies and regulations, as well as those encountered during their implementation, need to be addressed in order to support sustainable solid waste management practices. Filling such gaps will make practices more relevant and effective in promoting sustainable plastic waste management and recycling, as well as protecting the environment and health of urban populations.

"In three to five years I foresee a complete value chain loop, given the interest that plastic recycling has generated. A lot of people want to collect, companies want to pre-process, and there [are] also those who can produce products out of the plastics within the county. So [I] am seeing a situation where collection is made efficient, transportation is enhanced through bailing and shredding, and the converters receiving the materials and make products that are marketed within the county."

KII3 – County Government personnel

The licensing requirements and legal provisions at Kenya's national and subnational levels also need to be amended to make them favourable to recycling, the national circular economy, and green growth agenda. Specifically, the study respondents called on NEMA and the county governments to address the following aspects of the compliance and regulatory requirements:

- Promote awareness of the legal and regulatory frameworks for plastic waste management and recycling.
- Reduce or waive fees for licenses and permits with which recyclers are required to comply by both NEMA and county governments.
- Segregated and preprocessed materials should not be categorized as "waste" and need not be subjected to unnecessary tracking requirements and time limitations during transport. These materials should instead be treated as raw materials on transit to the next level of the value chain, just like any other industrial raw material. Moreover, the County Government of Mombasa needs to engage other counties to waive the levies charged for plastic materials on transit across some counties on the way to processing destinations. A respondent further suggested that this issue can also be addressed by the relevant committees at the Council of Governors forum or through the inter-county economic blocks.

5.6 Designate spaces and facilities for recyclers

Infrastructure for waste recycling is an important component for efficient recovery and value addition. The County Government needs to provide suitable areas for recycling and collaborate with other stakeholders to set up facilities such as waste transfer stations and material recovery facilities. Small scale recycling ventures also need yards for sorting and storage of materials, where the workers are not exposed to weather and the elements. The locations of these waste facilities also need to meet the provisions of environment and health regulations.

Mombasa County Government is currently developing a material recovery facility, but stakeholders expressed concern that the location and design of the facility is not convenient for recycling. When developing similar facilities in other parts of the county, the County Government needs to consult with stakeholders on selecting strategic sites, the architectural designs, and the kinds of machines and labour for individual facilities.

5.7 Research and development

"In three or five years to come, our vision is to build a very strong business model that is solidly grounded and proven on the ground with local recyclers, and one that can be replicated across the cities in Kenya and even outside the country."

KII4 – NGO officer

Research and academic institutions and recyclers should initiate collaborations to translate the problems faced by the plastic production, use and recycling sector into research priorities; researchers can harness the much-needed knowledge and innovation for development of the recycling sector. For example, the overseas market for recycled PET granules from Kenya is not well developed. Research and development are thus needed to develop technologies to utilize the increasing supply of PET materials for uses such as in production of yarns (of polyester fibre) that can be processed into apparel in local textile industries.

Implementing these recommendations will put Mombasa – and Kenya – on track to attaining a plastic circular economy through coordinated action by all players, including government, industry, community service organizations and communities. This will ultimately drive innovation and investment towards optimal use of plastic in the economy, compatible with environment sustainability, as well as ways to divert plastic waste from disposal in the environment to recycling.

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