Chapter 5
The Way Forward, Building Up from On-The-Ground Innovation

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Summary This chapter of the African Marine Litter Outlook summarises the previous chapters, their findings, suggestions, and identified barriers to tackling marine litter in Africa. The importance of innovative ground-up solutions tackling waste management across Africa are highlighted in this chapter. The forward approach is then outlined through recommendations. The recommendations are covered in 10 points: 9 of which focus on local sources, with a 10th outlining the global need to tackle transboundary marine plastic litter, originating from sources outside of Africa's control.

Keywords Synopsis · Way forward · Policy solutions

5.1 Introduction

The current average per capita waste production in Africa, not taking into account waste imports, is much lower than the global average (0.78 and 1.24 kg per day, respectively) (Scarlat et al., 2015; UNEP, 2018). Despite this more conservative generation of waste, Africa lacks the infrastructure and service delivery to adequately deal with its current waste production (UNEP, 2018). Across African nations, the waste management sector is underprioritised and lacks investment; the existing infrastructure is poorly maintained and is not being upgraded. Tackling marine litter from a purely waste management perspective is thus unlikely to work in Africa. Although waste management is crucial, waste prevention or waste minimisation should occur alongside. Waste minimisation involves upstream measures, therefore reducing the amount of waste and consequently its management burden. Combining waste prevention attitudes whilst improving management is likely to be a more cost-effective approach and of particular importance to Africa as increasing economic growth (3.7% continental averaged pre-COVID-19 growth) (International Monetary Fund, 2021; United Nations,

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T. Maes and F. Preston-Whyte (eds.), *The African Marine Litter Outlook*,
https://doi.org/10.1007/978-3-031-08626-7_5

2020) and a rapidly growing population (3.5% annual growth (UNEP, 2018; Wilson et al., 2015) is resulting in an acceleration of the overall waste production and per capita waste production. The combination of increasing economic and population growth together with insufficient waste management systems means that Africa is likely to become an escalating source of marine litter, which needs an urgent and adequate response via action planning, infrastructural and financial support (Jambeck et al., 2018; UNEP, 2018). Such response should consider existing, innovative, and successful initiatives set up by the informal and formal sector, small and medium enterprises, and Non-Governmental Organisations (NGOs), which have provided successful responses in the absence of political will or financial support. These existing projects and businesses need to be upscaled in an enabling environment to serve as best practice examples whilst providing future capacity across the African continent.

Implementation and enforcement of legal and policy frameworks regarding waste management remain an issue within Africa, either through limited capacity or limited political will. Nevertheless, where legislation and infrastructure and/or enforcement is lacking, on-the-ground innovative, practical, and cost-effective solutions have been launched. They are driven by a wide range of stakeholders, including informal/formal industries, small and medium enterprises, and NGOs. The best-acknowledged examples are the support of the informal waste pickers for the formal recycling industry and the drive by the formal sector to work with governments or within communities. The innovative industries around reuse and repurpose (sometimes supplied by the informal sector) mostly operate on a local level. As the digital footprint of most informal workers, smaller enterprises, and smaller NGOs is lacking, they are often missed in a broader analysis. However, these existing solutions have been vital in reducing the burden on governments and communities and creating both micro-and macro-economically viable solutions. The sharing of existing systems, upscaling of viable solutions, and continuous support in an enabling environment–institutionally, legally, and policy-wise–are important factors to move forward in tackling marine litter in Africa. Solutions or actions within Africa should integrate an awareness component to support grassroots activities or existing work by governments, industry (both informal and formal sectors) and NGOs. Furthermore, job creation, businesses development, through the recovery of valuable recyclables, and substantial prospects for enhancing livelihoods can be supplied by the waste sector in Africa.

Actions to tackle marine litter are dependent on the litter sources. It should be noted that land-based sources should be tackled on land. For sea-based sources of marine litter, land-based actions (such as adequate and feasible port reception facilities for waste disposal) also play an important role. For several local sea-based sources of marine litter e.g., small scale fisheries, direct action is also needed on land; however, for offshore inputs (from shipping, largely external to Africa) as well as long-distance drift, especially from south-east Asia, as shown by Ryan (2020a) and Ryan et al. (2021) the source is outside the control of Africa. For these transboundary sources, actions are rather required on a global scale.

5.2 Summary of Findings, Suggestions, and Barriers Identified in Previous Chapters

The previous chapters summarised existing information. A summary of these findings is provided below:

- Although the African plastic waste footprint is relatively low in comparison with other continents, marine litter in Africa is a current and rapidly increasing problem, with important implications for the Blue Economy (freshwater and marine) and climate change mitigation (Chap. 1).
- There is a need to address the problem of marine litter with innovative measures (Chaps. 2, 3 and 4), both waste minimisation and management will be required to tackle the issue.
- Overall, there has been limited research on marine litter across the African continent. Most research has been conducted in South Africa, with few studies from other African coastal nations (Chaps. 2 and 3). Although more research is urgently required, enough is known to acknowledge the scale of the problem, to seek solutions, and implement change now.
  - Most data on marine plastic litter focuses on the distribution, characteristics, and sources. These are often limited snapshots that do not consider temporal and other variability (Chap. 2).
  - Very little research has been done to ascertain litter's biological and ecological effects in Africa (Chap. 3).
  - The social and economic impacts are particularly not well documented (Chap. 3).
- There is a misalignment between scientific reporting, solutions, and policy implementation (Chap. 3).
- The review of international and regional legal and policy frameworks shows that the obligation to prevent marine litter from land- and sea-based sources has been established. Less clear, however, is the responsibility to provide sustainable funding for such purposes whilst ensuring a safe and healthy environment and access to tenable livelihoods (Chap. 4).
- The drivers of marine litter in Africa are complex, supporting the need to incorporate a broader range of measures and stakeholders than those included in global and regional frameworks (also referred to as instruments) for the prevention of pollution, management of chemicals and waste, and the protection of species and biodiversity (Chap. 4).
- Public awareness (including environmental education and outreach), consumer behaviour, and industry engagement play a key role in preventing marine litter and must be strengthened across Africa (Chap. 4). It is noted that awareness and education alone are not enough in many cases. Stronger incentives and/or disincentives are needed to drive behaviour change.

- Progress has been made in adopting regulations to reduce problematic plastic items, particularly through adopting plastic bag bans. Enforcement of the law–i.e., legislation as well as regulatory or administrative measures–has remained a challenge for most African countries and, where plastic bag bans have been adopted, illegal trade from neighbouring countries where no ban is in place has sometimes reduced the outcomes of these measures (Chap. 4).
- The use of Extended Producer Responsibility (EPR) schemes to fund waste management infrastructure and services is extremely limited across the continent. Such schemes must consider the effect on the informal waste sector. Improving livelihoods and poverty reduction through the creation of "green jobs" should be a key driver for improving waste management across Africa (Chap. 4).
- There are several existing fora and initiatives to prevent, reduce, or combat marine litter, coordinated at regional and sub-regional levels, including but not limited to the African Union bodies and Regional Seas programmes. However, an overarching coherent and harmonised continent-wide approach is lacking. Most of the existing initiatives cover a broad spectrum of strategies and implementation plans, such as the Blue Economy, Circular Economy, and plastic pollution more broadly, which touch on, but are not primarily focussed on marine litter prevention and reduction, nor are the efforts consolidated. The few marine litter-focussed initiatives are geographically concentrated on coastal regions, neglecting the involvement of landlocked states (Chap. 4).
- Several international legal instruments—i.e., legally binding international treaties or conventions—have been implemented into national law as necessary and, in some cases have had direct effect or primacy as soon as ratified. However, there are shortcomings in their enforcement at the national level. These shortcomings are mainly due to a lack of resources and/or of capacity. International mechanisms, such as the new Global Treaty to End Plastic Pollution, are meant to offer capacity support; however, this support may be insufficient or not fulfilled until quite some time. Some instruments have been recently amended, such as the Basel Convention concerning plastic waste. Still, there has not been enough time for such amendments to be adequately implemented at the national level to properly address plastic waste issues (Chap. 4).

The previous chapters highlighted important findings and knowledge gaps about marine litter in Africa. Based on these knowledge gaps, important chapter-specific suggestions about marine litter in Africa are outlined below:

- From a mitigation perspective:
  - Comparable datasets and baselines, combined with long-term monitoring studies, are required across the continent to measure the change in the state of the environment/leakage and mitigation effectiveness (Chap. 2).

  - To support this, knowledge transfer and capacity building in certain areas of expertise is required e.g., polymer identification (Chap. 2).

- From a research perspective:
  - There is a need for more field studies quantifying litter inputs across the different size ranges to facilitate more effective interventions targeting different sources (Chap. 2). As a priority, as > 99% of the mass of plastics comes from the macro scale, to develop mitigation and measuring actions, research is needed primarily at the macro scale.
  - To provide a more robust understanding of leakages and its drivers, studies should be encouraged to compare the rate of accumulation to the rate of waste generation (Chap. 2).
  - More studies on distribution and underlying mechanisms (e.g., burial, transport, and fragmentation processes), specific to African conditions, are required (Chap. 2).
  - Despite current efforts, greater effort is needed across Africa to understand the broad spectrum of waste plastic impacts, including effects on human health, environment and ecosystems, economic implications, and social factors (Chap. 3).
  - To strengthen evidence-based policy interventions, additional studies and models to better understand the drivers for abundance, distribution, pathways and sinks of plastic pollution in the environment at scale, and underlying mass balance processes are required (Chap. 2).
  - Although there appears to be a solid foundation on distribution and sources research, there needs to be a more concerted effort to synchronise work and compatibility between studies to better understand multi-national, transboundary environments. This will assist with continent-wide solutions. Although existing studies do not necessarily focus on the drivers nor impacts, these provide a foundation and a positive future trajectory for understanding the impacts of marine litter in Africa (Chap. 3) and monitoring mitigation measures (Chap. 2).
  - Coordinated research efforts will further help to standardise sampling and data collection (Chaps. 2 and 3). Research is still conducted in silos, even amongst researchers in the same field. More workshops and fora for researchers across Africa are needed.

- From a science-policy interface perspective:
  - More cross-field engagement is needed regarding planning to mitigate the effects of marine litter (e.g., between researchers, law, and policymakers) (Chap. 3).
  - There is a need for a central database nationally and regionally to use all research efforts for decision-making purposes.
  - Continent-wide data collection, monitoring, and reporting may assist in developing a continent-wide, dedicated approach to tackling marine litter (Chaps. 2, 3 and 4).

  - Evidence-based policy is vital for countries that can little afford to deal with unintended consequences of legislation. Sharing best practices in legal and policy measures that include stakeholder engagement, design, implementation, and enforcement could provide valuable insights from African and other countries. This is particularly important for African countries that struggle to raise funds for financing waste management services and infrastructure and as such could benefit from experiences in other countries where EPR schemes have been adopted (Chap. 4).

- From a policy perspective:
  - Strengthening the social outcomes of policies to improve the living conditions of those most impacted by the accumulation of waste in the environment and those who work in hazardous conditions, amongst others, can provide co-benefits for society and the environment whilst working towards achieving several SDGs (Chap. 4).
  - Consolidation of existing initiatives, action plans, and resources are needed (Chap. 4).
  - The advantages of the inclusion of marine litter interventions in the Blue Economy and Circular Economy strategies provide a focus on socio-economic development and sustainable livelihoods, whilst more can be done to elevate the need for marine litter/pollution interventions in sub-regional economic development community strategies and action plans (Chap. 4).
  - The region needs to endorse the new global plastic treaty aimed at eliminating all discharges of plastic into the marine environment. It is expected to present a legally binding instrument, which would reflect diverse alternatives to address the full lifecycle of plastics, the design of reusable and recyclable products and materials, and the need for enhanced international collaboration to facilitate access to technology, capacity building and scientific and technical cooperation. However, such an agreement would require behaviour change across virtually the entire population. To be effective, there is a need to strengthen implementation of related action, including through adequate and sustainable financial support, transfer of technology, and capacity building (Chap. 4).
  - Governments and businesses across the value chain will need to shift away from single-use plastics, as well as to mobilise private finance and remove barriers to investments in research and in a new circular economy.
  - The Basel Convention, Stockholm Conventions, and other relevant regional and international instruments can play an important role, such as in sharing information, building capacity, etc. (Chap. 4).

The previous chapters of this report identified several important barriers to dealing with marine litter in Africa:

- There is a lack of sustainable funding mechanisms for mitigation (Chap. 4).

- There is a lack of sustainable funding for implementation and enforcement (Chap. 4).
- Although African countries are signatories to international agreements, Africa has no platform to centralise strategies/protocols that are supposed to be implemented. Coordination and centralisation should reduce unnecessary replication of work and so reduce required funding.
- Research and policy decision funding is centred on localised proposals which are sometimes not aligned to national and international needs.
- Providing the evidence to inform law and policy design requires data of long-term temporal and wide geographic scale.
- The linkage of marine litter interventions and related socio-economic benefits should be highlighted in socio-economic fora and platforms such as the sub-regional economic communities (Chap. 4). A combination of lack of awareness on the numerous opportunities presented by international instruments, mechanisms, and initiatives, including their recent changes and amendments, and a general lack of prioritisation and/or resources to act (Chap. 4).

It is noted, both in this body of work and previous, that enough knowledge exists on marine litter, both globally and in Africa, to act now and drive mitigation measures. As such, resources need to go into reduction and prevention of leakage, with scientific data measuring the effectiveness of such measures.

5.3 Discussion of Report Findings

Data availability in Africa is generally poor, and the continent's contribution to the overall global scientific knowledge base was estimated at 2.8% in 2020 (Diop & Asongu, 2021). Taking into account country wealth and comparing percentages of GDP invested in research and development in 2018, African countries are not highly ranked, with Egypt appearing highest on the list—number 38 at 0.72% of GDP, compared to the global average of 1.17% of GDP invested in research and development (The Global Economy, 2021). Nevertheless, with effective use of resources and targeted studies in relation to marine litter in Africa, as outlined in Chapters 2 and 3, a substantial foundation of key knowledge on marine litter has been developed. Importantly, enough is known "*about the impacts on marine systems to justify implementing policies to reduce the leakage of waste plastic into the environment, certainly enough to start implementing mitigation measures now*" (Ryan et al., 2020a, 2020b). Methods and best practices will need to be aligned and finetuned towards the needs of the African continent. Dedicated research and monitoring will be needed to promote the development of sustainable, affordable, innovative, and cost-efficient approaches, to show effectiveness and success to funders and to fulfil policy requirements.

There is general inadequacy of waste management and infrastructure across the African continent—depending on the country, this is linked to an absence of

supporting legislation or, more often, a lack of effective implementation and/or enforcement of legislation (UNEP, 2018; see Chap. 4). Implementation and enforcement of efficient waste management across Africa is exacerbated by: lack and misapplication of sustainable funding, geographical and transport challenges, educational gaps, the social stigma of working with waste, and historical disadvantages at some national and community levels, all of which delay the development of the necessary technological infrastructure to keep pace with the increasing amounts of persistent wastes such as plastics. The lack of prioritisation of funds to waste management on both national and municipal levels supports the need for waste prevention measures (reduction, circular economy, and material lifestyle approaches) and has driven existing prevention policies (primarily focusing on reduction). Despite, or maybe because of the challenges faced, Africa has been at the forefront of some innovative policy approaches. For example, South Africa was the first country in the world to introduce a plastic bag tax in 2003. It should also be acknowledged that where enforcement exists, Africa has some of the harshest law and policy enforcement measures related to plastic pollution, with Rwanda issuing up to six months jail sentences for those smuggling plastic bags in non-compliance of the country's ban (Behuria, 2021). Rwanda and Sierra Leone have also implemented requirements to communities to clean their environments regularly. Both campaigns have been shown to have early successes and are believed to be more effective in creating long-term positive behaviour change than legal punitive measures (Dessouky et al., 2016; Wilson, 1996).

Waste also holds a value, thereby creating an opportunity for job creation, illustrated by a thriving informal sector driving collection and recycling across Africa. Approached correctly, with an enabling institutional, legal, and policy environment supported by sound and credible scientific assessment and data, Africa has the potential to achieve progress, building on the existing informal networks to create a unique and innovative waste management system. There is a need for EPRs to help incentivise this process as only materials with value are collected. To prevent leakage, value (through mechanisms such as EPRs) needs to be built into all plastic items. Following the waste hierarchy, prioritising reduction strategies coupled with a circular economy approach is key to reducing the amount of waste generated and therefore needs to be appropriately managed. For the waste hierarchy to be followed successfully strong behaviour change is required, which can only occur with successful communication strategies. Concurrently, service delivery needs to increase dramatically; this can be supported by recognising the value of waste, both in mandatory and employment terms. On a policy level, a circular economy needs to be approached regionally within Africa, ensuring circularity through the necessary reduction strategies through the redesign, phasing out or elimination of unsustainable products and materials, introduction of reuse models, and regional recycling hubs. Cohesive harmonised legal and policy frameworks are needed concerning inter and intra transboundary movement of waste into and within Africa, with adequate external border laws and regulations as well as sufficient monitoring to ensure that Africa does not become the dumping ground for waste masquerading as second-hand goods from high-income countries–as is

happening with e-waste (Amoyaw-Osei et al., 2011; Grant & Oteng-Ababio, 2016; GRID-Arendal, 2020; Odeyingbo et al., 2017; Maes & Preston-Whyte, 2022).

The environmental impact of mismanagement of waste in Africa adds additional stress to an environment already pressured by climate change, agriculture, urbanisation, overfishing, and invasive species. Localised waste's social and economic impact close to urban areas adds an additional strain of reduced mental and physical well-being and economic costs. Africa's Blue Economy (freshwater and marine) holds vast untapped potential for economic growth (see Chap. 1). Whilst the principles of the Blue Economy promote sustainable development and livelihoods, protecting freshwater and marine environments is also a priority principle of this approach and should be strengthened across Africa (AU-IBAR, 2019). Climate change, biodiversity loss, and other pressures such as land use already create pressure on aquatic systems. Underpinning the Blue Economy with a green approach, thus creating a Blue-Green economy, could be a sustainable outcome for Africa's increasing population.

Marine litter is often seen as an issue for countries with coastlines. However, rivers are a conduit for marine litter (Chap. 2). Given that many African rivers are transboundary (Fig. 2.1, Chap. 2), landlocked countries have a role in tackling marine litter. But more than that, regional support and action are necessary for tackling waste production and mismanagement in Africa. The porosity of borders and plans to further open internal African borders to encourage economic growth (Gordon, 2021) means that waste needs to be tackled on a regional level to prevent further transboundary issues. Furthermore, the oceans contain a value for all nations across Africa, not only coastal countries. They act as a climate regulator, a food and nutrient source, and the regional importance of the Blue Economies (both freshwater and marine) is recognised (see Chap. 1). Marine litter is an indicator of the leakage of waste into the environment. Tackling both land-based and sea-based sources of marine litter reduces litter in upstream environmental compartments such as freshwater systems, and the terrestrial environment whilst also protecting the oceans, directly impacting environmental and human health and well-being and livelihoods. Thus, marine litter in Africa is an issue for both coastal and landlocked countries. Each country is best positioned to understand its own national conditions, including its stakeholder activities, related to addressing plastic pollution.

It is acknowledged that limited foreign investments for waste management in Africa are available. Still, these are often only at a national level, and such investment (especially long-term investment) rarely reaches the industries or NGOs working on-the-ground or the institutions responsible for local services. The reasons for this are complex but can include donors' stipulations and restrictions, which are created through a high-income country understanding of the approach to waste, rather than adjusting to specific and tailored needs in different parts of Africa. Additionally, foreign investments may only cover infrastructure investment but not sustainable finance for maintenance, operational costs, nor capacity building (EPA, 2020). The new Global Plastic Treaty acknowledges the requirement for a financial mechanism to provide for the functioning of the agreement, including the possibility of a committed

joint fund. Some legal obligations arising out of a new international legally binding instrument will require capacity building and technical and financial support in order to be effectively applied by developing countries and countries with economies in transition.

Marine litter can be tackled by strengthening political will. Political will is strengthened by raising awareness of the issues caused by mismanaged waste to society and the ecosystems they rely on. Such awareness needs to be raised in a variety of fora and platforms, including economic development communities. Educating law and policymakers and enforcement authorities on possible solutions and on development of financial roadmaps can help promote regulatory frameworks that incentivise private sector investment and lower their risk. Public acceptance and engagement in prevention, reduction, reusing, and recycling strategies can be better achieved through raising public awareness of the benefits of reducing waste in the environment. However, awareness is fruitless without alternative and viable behaviour choices. Investigating and implementing economic incentives and sustainable financing strategies appropriate to Africa should be made a priority.

It is important for African countries (through regional mechanisms) to stand together to prevent the entry of plastics that are not easy to recycle or repurpose after their initial use and to redesign, phase out, ban, and minimise the entry of hazardous plastics and those with toxic additives. There is a need to strengthen custom standards and procedures to minimise rampant Harmonised System (HS) miscoding of plastic products across all African countries. HS coding refers to the internationally standardised system of names and numbers to classify traded products as set out by the HS Convention (1988) developed by the World Customs Organization. HS miscoding has been highlighted as an issue in Africa regarding waste imports. In addition, there is a need to not over-emphasise conventional recycling as a viable solution for Africa but instead promote reduction and substitution of more sustainable products through appropriate legislation and behaviour. As legislation requires adequate enforcement, additional approaches using sufficient incentives should be used to affect behaviour change. Incentives such as EPR schemes add value to waste and drive behaviour change without costly enforcement of punitive measures.

There is a need for policies to address mismanaged plastic waste, uncollected waste, street littering, the thousands of illegal and unregulated dumpsites (through their recognition and formalisation), as well as stopping practices such as open burning. The success of mitigation measures, and awareness should be monitored and underpinned with scientific assessments. Cross-field and cross-border scientific collaboration are needed to support such change, with co-ordinated and comparable research methods. The African Marine Waste Network is one such network working towards this. The African Marine Litter Monitoring Manual (Barnardo and Ribbink, 2020) provides practical guidance on monitoring different environmental compartments and size fractions. However, more coordination is needed on a regional level regarding implementing of adopted actions and measuring the success of such actions through scientific research. Additionally, successful piloted

actions should be scaled up using existing and new resources, ensuring that proven sustainably financed enterprises reduce and ultimately prevent marine litter.

5.3.1 A Note on the COVID-19 Pandemic and Marine Litter in Africa

Globally, the COVID-19 pandemic has led to an increase in production and consumption of single-use plastics especially personal protective equipment (Prata et al., 2020), as well as plastic packaging for food and plastic bags (Filho et al., 2021). Benson et al. (2021) estimated that over 12 billion medical and fabric face masks are discarded monthly during the pandemic in Africa, equating to 105,000 tonnes of face masks per month, which without proper management might be disposed of into the environment. COVID-19 has led to an observed increase in marine litter in Africa through higher consumption levels of COVID-19 related products (Okuku et al., 2021)—explicitly referring to the following COVID-19 related products: masks, gloves, sanitiser containers, soap wrappers, wet wipes, and liquid hand wash bottles. Research on the change of behaviour patterns during lockdowns has highlighted the importance of foot traffic to the levels of both beach (Okuku et al., 2021) and street litter (Ryan et al., 2020a).

The tough lockdowns, seen at the beginning of the pandemic in countries such as South Africa, Uganda, and Sierra Leone, and the corresponding enforced restriction on movement, were seen to have a devastating impact on waste pickers and thus negatively affected the recycling industry. For example, in Sierra Leone, the general cleaning exercises conducted between 5.00 am and 12.00 noon on the last Saturday of every month were discontinued during this COVID lockdown. However, as lockdowns were implemented with great variety across Africa (Haider et al., 2020), the impact of such measures across the continent is largely unquantified. The pandemic has negatively impacted economic growth on the continent (African Development Bank Group, 2021; Inegbedion, 2021). The COVID-19 pandemic has caused the worst economic recession in Africa in half a century (−2.1% real GDP in 2020). Though initial analysis by the African Development Bank Group (2021) expects rapid recovery in the years to follow, the United Nations (2022) predictions are more cautious showing slow recovery for Africa, below pre-pandemic predictions. Recovery is expected to be driven through the "resumption of tourism, a rebound in commodity prices, and the rollback of pandemic-induced restrictions". The outlook is, however, subject to great uncertainty from both external and domestic risks. Given this projection, though acknowledging the uncertainty of the COVID-19 pandemic in forecasts, the African Marine Litter Outlook considers planning for waste management based on future projections an absolute necessity.

Data on the short-term and long-term impacts of the COVID-19 pandemic on waste management and marine litter is currently difficult to quantify, especially in Africa. The pandemic has, however, caused a short-term shift in priorities to focus

on COVID-19 relief and corresponding redirection of funds and efforts. Long-term effects on waste production through population and as a result economic growth impacts, as well as waste infrastructure investment and policy impacts are difficult to quantify.

5.4 Overall Recommendations

The Africa Waste Management Outlook (UNEP, 2018) provides in-depth recommendations for improving waste management across Africa. The authors of this African Marine Litter Outlook recognise the broad coverage of the Africa Waste Management Outlook and have focused the recommendations within the African Marine Litter Outlook on measures related specifically to marine litter, from local sources, with a touch on national and international needs. Several African groupings exist, but hardly deal with marine issues, they rather tackle terrestrial and freshwater issues e.g., The African Ministers' Council on Water (AMCOW). There are also multiple regional economic communities e.g., The Economic Community of West African States (ECOWAS), The United Nations Economic Commission for Africa (ECA), the Southern African Development Community (SADC), The Intergovernmental Authority on Development (IGAD), however most of these communities lack ocean mandates which would be relevant to tackle marine litter.

The recommendations put forth in this outlook should not be seen as static but rather should be routinely updated with an evidence-based approach, as shown in Fig. 5.1. Mitigation measures, approaches or actions should be monitored. Their effectiveness measured, and their implementation revised every few years to ensure a cohesive, efficient approach. This will ensure that ineffective measures do not continue, and new actions can be brought in as needed.

For every action, implementation should be approached to ensure that the action becomes autonomous and self-funded in the long term. The cost of funding should be borne by the polluters through schemes that add value to the waste—which in turn creates a continuous and sustainable funding mechanism whilst creating long-term behaviour change on individual and industry levels. EPR's and polluter pay's principles are two examples out of many such mechanisms. Positive incentives that drive behaviour change are more likely to drive change in an environment like Africa, where enforcement and funding are often an issue.

The recommendations outlined below are not listed in order of priority.

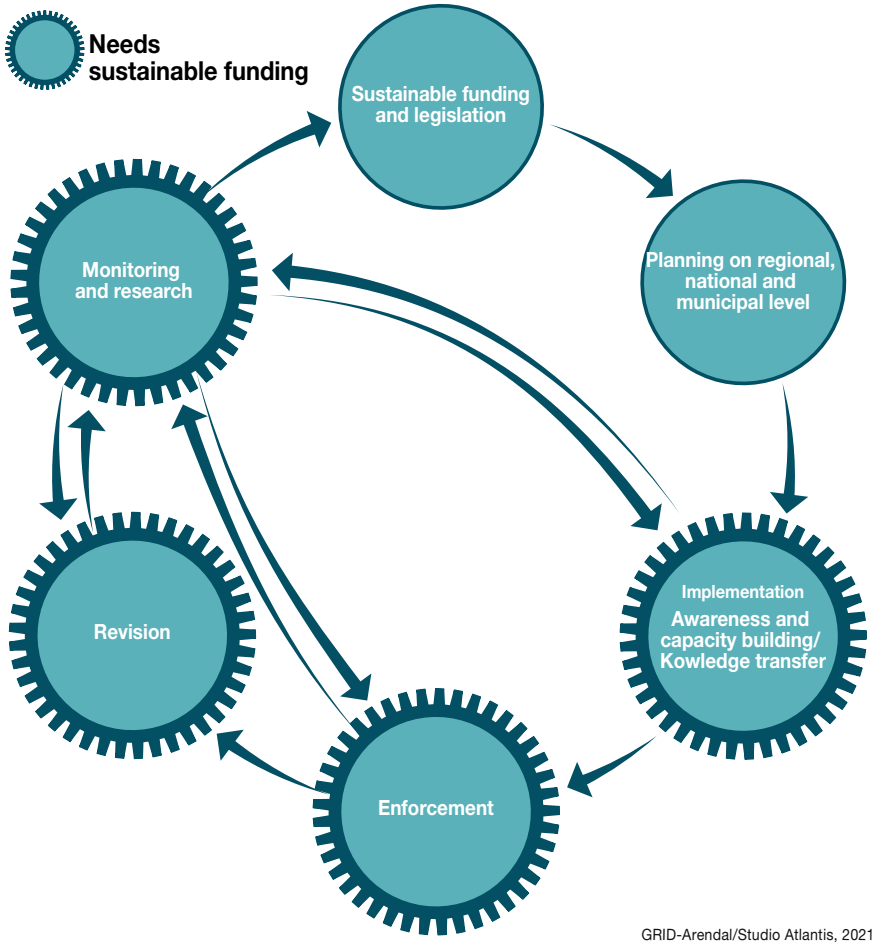

Fig. 5.1 Circular evidence-based approach

5.4.1 Prioritise and Finance Innovative Waste Management in Africa

The current "traditional" waste management systems employed globally (household waste collected by a local authority and recycled, incinerated, or landfilled) have shown to be mostly ineffective in Africa. However, at the grassroots level, informal systems, industry, and NGOs tend to fill some of the gaps, creating innovative waste management systems across Africa. Innovation in waste management in Africa needs to be prioritised and financially supported. There is a need to develop African-centric solutions through an enabling institutional, legal, and policy environment. Developing and sharing best practices

within African environmental and social conditions is essential to ensure that inappropriate solutions are not imported.

Regular collection and cleaning are needed in urban areas, with strategic investments committed to litter control. Currently, the informal sector plays a crucial role in the collecting of recyclables in urban areas across Africa. These informally set up systems and workers should be supported.

Separation at source, and especially the removal of organics from the waste stream at source, needs to occur. This, combined with the creation of sorting centres, will assist the informal recycling industry and waste recovery industry. The combination of these two steps will allow for industrial composting of organic waste (creating value, jobs, and compost for agriculture) and allow for the clean removal of recyclables in a safe environment. Separation at source and sorting centres will greatly reduce the amount of waste that then needs to be landfilled. So, investments can occur in sanitary, well-run landfills systems for the remaining waste.

Innovative financial mechanisms can help share the load between government and industry. At the same time, a dedicated (ring-fenced) increase in funding within national budgets for marine pollution prevention and control should be introduced by governments. These should include support for heightened local expertise and technical capacity building concerning pollution and water quality management. If the sources of marine litter, and marine plastics specifically, are tackled, then the marine system will be protected from this threat.

International support of financing waste management in Africa is important. Regarding international financing, funders need to work inclusively with African stakeholders, instead of dictating developed-word centric concepts that are inefficient (or less efficient) in an African environment (including institutional and economic settings). A practical awareness of legacy issues, running costs, and existing working systems (formal or informal) is vital for international financiers to consider in order to make investments in efficient and sustainable systems.

5.4.2 Create an Enabling National Environment Through the Adoption of Adequate National Institutional, Legal and Policy Frameworks

There is a need for adequate national legislation or regulation or other legal and policy measures to enable institutions properly and to support innovation in the circular economy and waste management and allow for the development of regional support.

Multi-sectoral institutional and other mechanisms need to be strengthened and established; partnerships between relevant stakeholders need to address waste management. The broader context of national legal and policy and planning

frameworks requires to integrate terrestrial and marine pollution prevention and control measures and policies.

5.4.3 Strengthen and Harmonise Existing Regional Governance to Support Cohesive Homogenised National Institutional Structures, Policies, as Well as Legislative and Regulatory Measures Aligned with International Mandates and Commitments

A cohesive, harmonised regional approach is needed concerning the transboundary movement of waste, both with regards to inter and intra movement in Africa. This needs to cover imported waste, second-hand products, and charitable donations. Harmonised, strong commitments to reduce and/or eliminate where possible the production and consumption of common and persistent litter items are needed across Africa.

Sharing knowledge and resources will save time and resources regionally. It is acknowledged that support from existing regional and international instruments (such as the Abidjan Convention, Basel Convention, Stockholm Convention, etc.) can, and should, be fully harnessed. Using existing frameworks saves resources, however, little will be achieved without focused aims, development and binding commitments focused on reducing waste formation, improving waste management, and preventing marine litter. Work within existing frameworks needs to focus specifically on preventing marine litter. The current development of a regional legal framework against plastic pollution and national marine litter action plans through the Abidjan Convention is a good example of knowledge and resource sharing.

5.4.4 Investment in Implementation and Enforcement of National, Regional, and International Legal and Policy Frameworks

The duty to prevent marine litter has been clearly established in international and regional frameworks, however, there is a lack of clarity on several key aspects in local and national implementation of regional and international commitments as subscribed under legally binding international legal instruments. Better cooperation, coordination, and collaboration of interventions between relevant stakeholders in the circular economy and the Blue Economy is also necessary. Additionally, the responsibility of obtaining sources of sustainable funding is not clear. Clarity at a local and national level is needed and investment in implementation and enforcement. Systems such as EPRs for national level law and policy can ensure accountability and financing. Other market-based instruments such as container deposit schemes

may allow for the development of sustainable financing. Capacity building through training and technical assistance offered by instruments like the Basel Convention should be fully utilised.

In the best practices for developing countries, EPA (2020) outlines that "Prioritising solid waste management, researching cost-cutting strategies, incorporating pay-as-you-throw programs or taxes, and partnering with international investment organisations are all options for funding viable solid waste programs. Although some programs, taxes, or fees will face resistance when introduced, finding a sustained source of funding for solid waste management is an integral part of a successful program". Public awareness and communication are essential regarding both systems, whether requiring behaviour change or an increased cost born by citizens to pay.

5.4.5 Raise Public Awareness About the Importance of Waste Management, Water Quality, and Marine Ecosystems to Induce Behavioural Change

There is limited and ongoing need to increase awareness of the relationship between development and environmental protection. Similarly, there is limited awareness between ecosystem health and the production of ecosystem services and the Blue Economy. In addition to regular waste collection, changes in perception about the value of waste, waste mismanagement, and the environment are needed to induce positive behavioural changes regarding reduction, improper solid waste disposal, littering, separation at source and recycling. Behavioural changes regarding upstream interventions are needed to reduce plastic production, reduce waste, and support reuse (through product take-back schemes) and circularity, thus reducing waste overall. Education and awareness strengthen implementation and support existing initiatives.

Public education (including through formal education systems), awareness campaigns, and targeting specific user groups (e.g., fishers) all play an important role in minimising the impact of marine pollution. Public education plays an important role in creating support for any behavioural change needed to support policy (such as separation at source). Globally, few studies have assessed the effectiveness of education campaigns on long-term behavioural change regarding marine litter. To establish their effectiveness, education campaigns should be accompanied by studies including integrative actions and respective long-term methodological triangulation evaluations (Bettencourt et al., 2021).

5.4.6 *Improve the Analytics and Knowledge Base on Marine Pollution and Water Quality Throughout the Region Using Common Monitoring Approaches and Guidelines*

Africa has a scarcity of comparable quality-assured environmental data. Academics and NGOs are working to ensure the application of methods for comparable data sets on macro and micro marine litter across Africa (Barnardo and Ribbink, 2020; CEFAS, 2020). Comparable data sets, resulting from the same or equivalent methods, allow for regional and global comparisons. Such data sets are currently focused on developing baseline assessments (where lacking) and quantifying sources and hotspots. This will ensure that legal and political decisions can be based on scientific information. And can measure how efficient mitigation measures are effective at both a local and regional level. Regarding marine litter, additional comparable data sets also need to be built upstream of the environmental observations, such as household waste audits, port reception facility audits, transboundary datasets of waste or second-hand goods movement, and social economic and perception studies to understand behaviour change over time.

Monitoring efforts should be integrated into relevant regional assessments and reporting efforts, particularly the Abidjan, Nairobi, and Barcelona Conventions. For this reason, the Abidjan Convention Secretariat, in partnership with GRID-Arendal, has been working in three pilot countries (Sierra Leone, Benin, Côte d'Ivoire, and Ghana) to build capacity to develop a state of the marine environment report. Such programmes should be extended to other countries in the Abidjan Convention area. Marine litter, and corresponding data, should be integrated into SDG matrices. This will encourage cross-sector collaboration in mitigation measures. The Abidjan Convention is currently developing National Marine Litter Action Plans, of which monitoring is a part. Monitoring marine litter through earth observation is a developing field (Biermann et al., 2020) which, given its ability to track litter over large geographical ranges, Africa should consider it.

5.4.7 *Measure the Economic Impacts of Marine Pollution, and Quantify the Costs Associated with Pollution Prevention and Management, as Well as the Costs Associated with Doing Nothing*

The economic impacts of waste mismanagement, and the resulting pollution need to be better understood, especially in context of the Blue Economy and sustainable development. This should include clean-up costs (regular clean-up and disaster clean-ups) of streets, beaches, and ports and any economic losses in industries such as tourism and fisheries (cost of lost or abandoned gear). The social and health impacts should also be assessed to inform law, policymakers, and the public.

Industrial analysis to support regional solutions is also needed, as well as analytics on incentives, disincentives, and standards.

5.4.8 Implement Integrated, High-Priority Interventions to Reduce the Discharge of Untreated Sewage and Nutrients and Promote Wastewater Resource Recovery

Proper wastewater management is key to ensuring human and ecosystem health, economic and environmental benefits. Proper sanitation and wastewater treatment can tackle marine litter (through the removal of both macro and microplastics) and eutrophication and human health issues. The occurrence of microplastics in sludge or biosolids used in agriculture is an emerging field of research, especially in Africa (Okoffo et al., 2021). Africa's continued population and economic growth is placing pressure on the existing wastewater and stormwater drain networks—specifically in densely populated urban settlements (African Development Bank et al., 2020). From a marine litter perspective, wastewater management removes both macro litter and between 88–94% of microplastics, depending on the level of treatment (Lyare et al., 2020). Whilst significant efforts have been made across Africa to ensure better sanitation, many places still have inadequate sanitation and wastewater management (African Development Bank et al., 2020).

Nutrient enrichment of coastal and marine waters is the primary cause of eutrophication that leads to the formation of algal blooms. Eutrophication leads to hypoxic and anoxic conditions in water, extreme turbidity, and threat to marine life (Malone & Newton, 2020). Nutrient input to the marine environment can be derived from the discharge of untreated sewage and industrial/domestic wastewater into river courses. In Africa, due to the poor state of water and sanitation facilities (Yasin et al., 2010), a significant proportion of the nutrient input originates from sewage disposal. Nutrient enrichment of coastal and marine waters is the primary cause of eutrophication that leads to the formation of algal blooms. As such, eutrophication is probably a good proxy for microplastic presence and distribution in Africa, hotspots might be more readily identified by using available water quality information. Several eutrophic coastal areas now affect countries around the African continent, namely Côte d'Ivoire, Egypt, Ghana, Kenya, Mauritius, Morocco, Nigeria, Tanzania, Tunisia, Senegal, and South Africa (Diaz et al., 2011).

In Africa, viable wastewater-based resource recovery initiatives are emerging with public–private partnerships (African Development Bank et al., 2020), which follow a circular economy approach. Implementing integrated wastewater treatment improves sanitation (and associated benefits), protects freshwater resources, contributes to agriculture and energy needs, and tackles an important source of marine litter.

5.4.9 *Improve Chemical and Industrial Pollution Control Through Targeted and Cost-Effective Measures in Priority Issues*

Industry generates a substantial amount of wastewater. Although significant industrial hubs are limited to a few countries in Africa such as South Africa, Egypt, Morocco, and Tunisia. Mining, paper mills, tanneries, textiles, food, and beverage production, sugar refineries, oil production, and pharmaceutical production have been flagged as major contributors to the discharge of toxic wastewater (African Development Bank et al., 2020). Wastewater reuse and treatment for industry have several benefits, including pollution (including microplastics) reduction.

Eutrophication, as discussed under point 8 is driven by nutrient input into the marine environment. It is primarily derived from land-based sources, mainly through stormwater runoffs over agricultural land where nitrogen, phosphorus, and potassium (N–P–K)-based fertilisers are applied.

Chemical and industrial pollution control go further than wastewater. With adequate pollution control, marine litter, and chemical pollutants (that can be sorbed and transport by plastics), can be greatly reduced.

5.4.10 *International Responses are Needed to Deal with Transboundary Waste*

Within Africa, there is a strong signal that litter found close to urban centres originates from local sources (Ryan et al., 2018; Weideman et al., 2020). However, on the eastern boundary specifically, transboundary plastic litter from south-east Asia and ship sourced waste has been identified as a further source (Duhec et al., 2015; Ryan et al., 2021; Ryan, 2020b; van der Mheen et al., 2020) (see Chap. 2 for further details). Though Africa can tackle its local sources, the long-distance drift of marine litter through currents is beyond African intervention. Global solutions, such as the Global Treaty to End Plastic Pollution, are needed to support Africa in tackling international sources of marine litter.

Global solutions for reducing plastic marine litter are welcomed. These include reduction and circularity of design in all products. But more than that, a coordinated global response is necessary through this global agreement that practically reduces waste formation and stops leakage into the environment.

5.5 Steps to Consider for Local Sources

Stakeholder engagement is central to preventing marine litter through reduction, waste minimisation, reuse, recycling, and waste management. In Africa, with many

stakeholders successfully operating in the reuse and recycling space specifically, stakeholder engagement becomes pivotal when planning on, and implementing changes or new concepts. Figure 5.2 indicates the stakeholders generally found in the waste management space.

First and foremost, waste minimisation through reduction, reuse and recycling should be considered. This is particularly pertinent in Africa, where funding is an issue.

Considering plastics specifically, the plastic flows and leakage assessments carried out by IUCN/UNEP in Kenya (IUCN et al., 2020a), Tanzania (IUCN et al., 2021a), Mozambique (IUCN et al., 2020b), and South Africa (IUCN et al., 2021b)

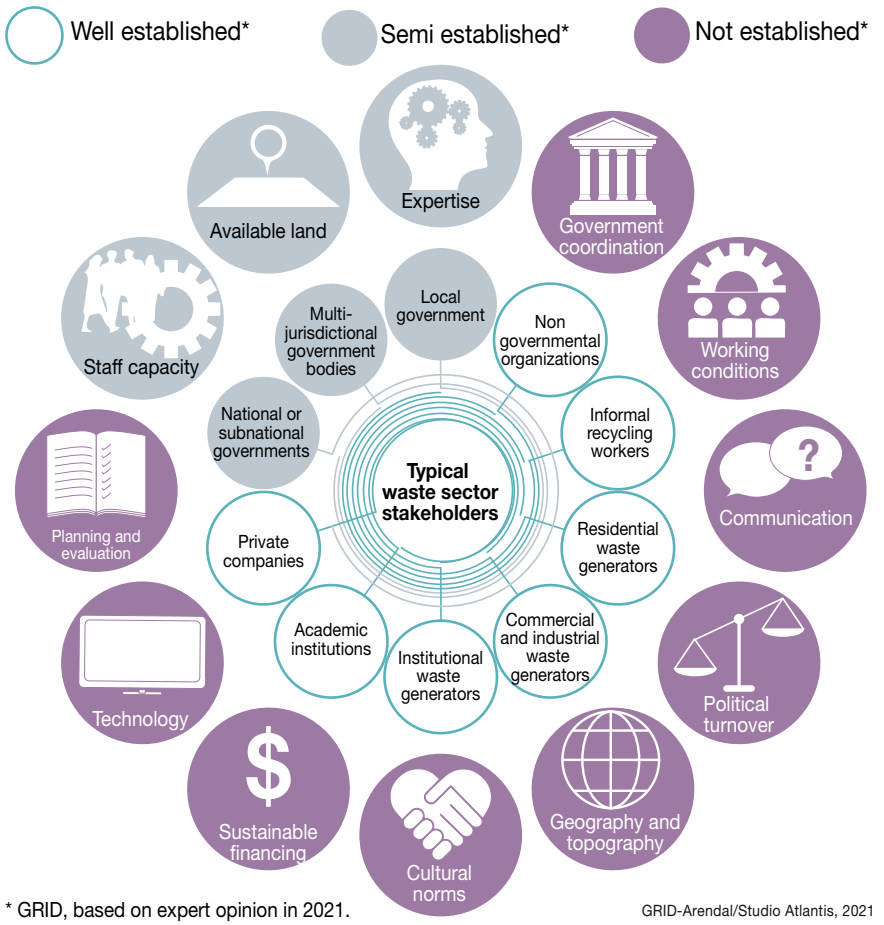

Fig. 5.2 Considerations in tackling marine litter through waste management—African stakeholder engagement, on average. Adapted from EPA (2020)

outline priority interventions across all lifecycle stages of plastics to minimise leakage potential.

Once waste is reduced, waste management planning should consider the following factors (see Fig. 5.2) (EPA, 2020):

- Social-economic factors:
  - Costs of not taking action on e.g., tourism, human health
  - Operational costs
  - Sustainable financing of implementation, enforcement, and monitoring
- Technical and staff capability:
  - Equipment and solutions that suited to environmental and social conditions
  - Technical capacity required for equipment and solutions
  - Staff capacity and expertise (or sustainable finance needed for training)
- Political changes:
  - ensuring systems and initiatives can survive administrative changes
  - establish long-term, sustainable systems that continue across administrations
  - work towards long-term staff and industry commitments
- Planning and evaluation on regional, national, and municipal levels
- Coordination between stakeholders, frameworks, and government departments
- Improving working conditions for skills retention (in the informal and formal industry)
- Stakeholder engagement (as highlighted above)—especially with existing working informal and formal sector and NGO projects
- Availability of space—including adequate space for the informal and formal private sector and government sector to work safely with economically viable distances
- Climatologic, geographic, and topographic conditions influence the availability and cost of equipment, the feasibility of technologies, and operating costs.
- Cultural norms:
  - Changing consumption and waste disposal patterns
  - Projections on waste production linked to population and economic growth
- Behavioural aspects of individual people, and the reasons behind them

5.6 Concluding Remarks

Africa has a predominantly young population. A young population is indicative of a dynamic, innovative population with huge potential to implement change. Despite limited resources, Africa has shown innovative solutions to waste management, resource recovery, and new solutions in tackling marine litter. These solutions are

predominantly driven by the industry (informal and formal sectors) and NGOs. These existing solutions should be supported, and where financially sustainable, scaled up to cover new and more extensive areas (where economically viable through the economics of scale) or integrated into the implementation of adequate institutional, legal, and policy frameworks.

Given the diversity of the African continent, there is a need to develop a decision framework for local, national, and regional actions to feed into global commitments. This will assist African nations to implement the best measures for their unique social and economic situations. Each country is best placed to appreciate its own national solutions and limitations. This includes stakeholder involvement, financial and technical capacity needs related to addressing plastic pollution issues.

Mitigation actions need to target different sources of marine litter. The actions required to target local sources occur on land before the litter enters the African waters. Tackling sea-based sources, where the ships stop (or are based) at African ports, requires both sea-based (behaviour) and land-based (port reception facilities) approaches. However, to tackle offshore inputs of marine litter into Africa, both sea-based sources and transboundary sources e.g., originating from south-east Asia, Africa needs the international communities to support in implementing actions across boundaries and regions.

Regarding local sources, tackling marine litter and waste mismanagement in Africa has the potential to both create new jobs and protect existing jobs, in particular those related to the Blue Economy. By successfully dealing with this issue, Africa can contribute to better pollution control, mitigate climate change protect biodiversity, and achieve other SDGs.

Additionally, nature-positive solutions are still extensively utilised across Africa and have the potential to grow and to enhance partnerships between industry and government. Nature-positive solutions have the potential to grow and enhance the sustainable growth of the Blue-Green and circular economy, tackle climate change, mitigate climate change, improve sanitation and wastewater management, and reduce marine litter.

With limited resources, African researchers have developed substantial research, focusing on characterisations, amounts, and distributions. Even with the existing knowledge gaps, the scale of the current problem is clear. The status and future projections mean that its paramount to implement mitigation now, without waiting on further research on the scale of marine litter or impacts.

Monitoring mitigation effectiveness is needed to support the science-policy interface. The development of the science-policy interface in Africa can bring about rapid, sustainable change regarding the circular economy, waste management, and marine litter. This can occur provided a cohesive and homogenised enabling institutional, legal, and policy environment is created to support innovation and public–private sector partnerships at national and regional levels. Existing frameworks and networks within Africa can support such change, helping to implement reduction, resource recovery, and service delivery, monitored with comparable techniques to measure long-term mitigation effectiveness.

Acknowledgements We would like to acknowledge the valuable insights proved by Clever Mafuta, Morten Sorensen, Peter Ryan, Anham Salyani, Salieu Sankoh, Tony Ribbink, Abdoulaye Diagana, Alison Amoussou, as well as Jost Dittkirst and the Plastic Task Force of the Secretariat of the Basel, Rotterdam and Stockholm Conventions in peer-reviewing this chapter. We would also like to acknowledge Nieves López and Federico Labanti (Studio Atlantis) for creating the illustrations.

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