



INDIAN OCEAN
COMMISSION

**PREVENTION, REDUCTION AND CONTROL
OF MARINE PLASTIC POLLUTION IN AFRICAN
AND INDIAN OCEAN DEVELOPING
ISLAND STATES (AIODIS)**

BACKGROUND DOCUMENT



WORLD BANK GROUP



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Acronyms and Abbreviations

3RI	3R Initiative	EoL	End-of-life
\$	US dollar	EPR	extended product responsibility
ABNJ/ BBNJ	areas beyond national jurisdiction/ biodiversity beyond national jurisdiction	ETS	European Trading System (for carbon credits)
AC	Abidjan Convention	EU	European Union
AIODIS	Africa Indian Ocean Developing Island States	FAO	Food and Agriculture Organisation
AIR	avoid, intercept, redesign	FP	focal point
ALDFG	abandoned lost or discarded fishing gear	GEF	Global Environment Facility
AMCEN	African Ministerial Conference on the Environment	GESAMP	Joint Group of Experts on the Scientific Aspects of Marine Environmental
APEC	Asia-Pacific Economic Cooperation	GG	Gulf of Guinea
AU	African Union	GAIA	Global Alliance for Incinerator Alternatives
BAU	business-as-usual	GPA	Global Programme of Action for the Protection of the Marine Environment from Land-based Activities
BRC	Basil and Rotterdam Conventions	GPML	Global Partnership on Marine Litter
CBD	Convention on Biological Diversity	GRP	glass-reinforced-plastic (fibreglass)
CE	circular economy	HDPE	high density polyethylene
CGF	Consumer Goods Forum	IEA(s)	international environmental agreement(s)
COMESA	Common Market for Eastern and Southern Africa	IMO	International Maritime Organisation
COP	Conference of the Parties	IOC	Indian Ocean Commission
ECCAS	Economic Community of Central African States	IORA	Indian Ocean Rim Association
ECOWAS	Economic Community of West African States	IOTC	Indian Ocean Tuna Commission

IPR/IP	intellectual property rights	REC(s)	regional economic commission(s)
ISO	International Standardisation Organisation	RSC(s)	Regional Seas Convention(s)
LBS/LBSA	land-based sources / land-based sources and activities	SADC	Southern African Development Community
LBSMP	land-based sources of marine pollution	SCM	WTO Subsidies and Countervailing Measures Agreement.
LCA	life-cycle assessment/ analysis	SDGs	Sustainable Development Goals
LDC	Less developed country	SIDS	Small Island Developing State(s)
LDPE	Low density polyethylene	SUP	single use plastic(s)
MARPOL	The International Convention for the Prevention of Pollution from Ships	SWM	solid waste management
MoU(s)	Memorandum(a) of understanding	TBT	WTO Technical Barriers to Trade Agreement
MPP	marine plastic pollution	tons	metric tons
MR	Mechanical recycling	UN	United Nations
MSFD	Marine Strategy Framework Directive (EU)	UNCED	United Nations Conference on Environment and Development
MSW	municipal solid waste	UNCLOS	United Nations Convention on the Law of the Sea
NC	Nairobi Convention	UNDOA-LOS	United Nations Department of Ocean Affairs and Law of the Sea
NGO(s)	non-governmental organisation(s)	UNEA	United Nations Environment Assembly
NIMBY	not in my backyard	UNEP	UN Environment Programme/ UN Environment
NMP	Nano-Microplastics	UNESCO	United Nations Educational, Scientific and Cultural Organization
OECD	Organisation for Economic Co-operation and Development	UNFCCC	United Nations Framework Convention on Climate Change
PA	polyamide	UNGA	United Nations General Assembly
PAH	polycyclic aromatic hydrocarbon	UNIDO	UN Industrial Development Organisation
PBTs	bioaccumulative and toxic compounds	WEEE	Waste electrical and electronic equipment
PC	polycarbonate	WEF	World Economic Forum
PCB	polychlorinated biphenyl	WFD	Waste Framework Directive (EU)
PE	polyethylene	WHO	World Health Organisation
PENAF	Ports Environmental Network-Africa	WIEGO	Women in Informal Employment: Globalizing and Organizing
PET	polyethylene terephthalate	WIO	Western Indian Ocean
POPs	persistent organic pollutants	WIOMSA	Western Indian Ocean Marine Science Association
PP	polypropylene	WTO	World Trade Organisation
PPHMN	Port Harbour Masters Network		
PS	polystyrene		
PSMA	Port State Measures Agreement		
PBTs	persistent bioaccumulative and toxic compounds		
PTER	private transnational environmental regulation		
PVC	polyvinyl chloride		

Foreword

By Dr. Charlotte de Fontaubert, World Bank

We are pleased to be associated with the publication of these reports on the circular economy in the island states of Africa and of the Indian Ocean, which aim at accelerating a development that respects the environment and that is resilient to climate change. These documents, produced by the Indian Ocean Commission (IOC) as part of the implementation of the sub-component AIODIS of the second project on the Governance of fisheries and shared growth in the South-West Indian Ocean (SWIOFish2), deal with three important aspects of circular economy in the AIODIS countries: (i) the state of the circular economy, (ii) the questions of intellectual property with regard to innovative projects and (iii) the prevention, reduction and control measures of marine plastic pollution.

The World Bank has supported, since 2015, the countries of Africa and of the South-West Indian Ocean to meet the Sustainable Development Goals (SDGs) of the United Nations. To this end, we help several countries in their transition to a more sustainable ocean economy (SDG 14). The principle of blue economy is precisely a sustainable use of marine resources to stimulate economic growth, livelihoods and employment, while preserving the health of the ocean ecosystems. In that sense, the World Bank finances regional programmes on fisheries management in the islands of the Pacific, the Caribbean, West Africa and South-West Indian Ocean. It is in this context that lies our SWIOFish2 project in coordination with the IOC.

The first objective of the project is to assist these States to grasp and to increase the economic, social and environmental advantages of blue economy. This can be achieved by improving the management of their marine resources, namely by limiting the depletion of the fish stocks. This is also possible through an increase in alternative livelihood activities for targeted fishermen, and a reinforced regional cooperation in this sector.

With the sustainability of these resources under serious threat, addressing the sources of these multiple and interconnected threats requires us to rethink our entire economy. From the World Bank's perspective, this is why we are committed to supporting these states in their journey towards a circular economy that is best described as a restorative or regenerative industrial system by intent and design.

We are confident that by pooling their experiences and their initiatives through the AIODIS cooperation mechanism, these States will be able to better face their common challenges. Overcoming these challenges will require the use of sufficient technical and financial means coming from institutional frameworks and infrastructure conducive to the development of a circular economy. Thus, it was essential to identify them for each country, so as to set up the foundations of a framework that is adapted to different socio-economic contexts. Endowed with this new knowledge, we can henceforth move forward together towards a circular economy that brings sustainable and inclusive growth opportunities.

Foreword

Plastic: a marker of our times and a responsibility for action

By Prof. Vêlayoudom Marimoutou,
Secretary General of the Indian Ocean Commission

**“The obligation to suffer gives us the right to know.”
Jean Rostand**

Biologist Commoner draws our attention on one of the characteristics of human action: *"its capacity to produce materials that cannot be found in nature"*, and therefore *"to introduce in the system substances that are utterly unknown to it"*. The great circular economy of nature, in which *"nothing is lost, but everything is transformed"*, is more and more upset and disturbed by human manoeuvres.

The Modern world is also a world of pollution and, as Barnosky said in 2014, today *"there are few places on earth that are not affected by man-made environmental pollutants. It is common to find traces of pesticides and industrial pollutants in samples of soil and tree bark of any forest in the world, in whales' fat, in the body of polar bears, in fishes of most of the rivers and oceans"*. Pollution has become one of the major problems of our times; local or global, of agricultural, industrial or urban origin, it contaminates the lands, the waters and the atmosphere, jeopardising the health of the ecosystems and thereupon that of humans.

Plastic is emblematic of pollution in general

In 2016, J. Zalasiewikz and his colleagues propose to use plastic as an emblematic signature of the general pollution of the Earth's ecosystem characterising the Anthropocene epoch. Plastics are polymers manufactured from petrochemicals, although some are made from cellulose (8% of petrol extracted on the planet, half as raw material). Adapted to multiples uses, plastic impresses with its theoretical capacity to infinite recycling and to the promise of saving natural resources, and because of its hygienic qualities which led to its adoption in pharmacies and hospitals. From the 1950s onwards, it has grown with mass consumption, on the back of synthetic materials and on the rising production of disposable items. It has rapidly become an essential component of electronics and informatics.

Despite its theoretical infinite recycling capacity, we are far from the mark: it is estimated that 50% is recycled or converted into energy (pyrolysis), the proportion recycled being 15% to 25% in Europe and less than 5% in the USA. We therefore have an idea of the amount of plastic debris dispersed each year, in the form of fragments smaller than 5 mm, or even nano plastics, in the environment. Lightweight, easily transported by wind or water, plastic debris has invaded the entire planet, including the oceans, where it is dispersed from the surface to the bottom of ocean basins. The lightest plastics form areas of highest concentration around the 5 major ocean gyres. They represent a total of 25,000 tonnes of floating debris on the sea surface.

Invasion, resistance and toxicity

The problem posed by this pollution is two-fold.

The first is its resistance. Depending on their composition, the degradation of plastics takes between 50 years and 5 centuries, or even millennia for debris to sink to the deep seabed. If we take into account both this resistance to degradation and the 5 to 13 million tonnes of debris that reach the world's oceans each year, we can see the scale of the problem we are building. And according to B. Montsaignon, 'bioplastics' cannot provide a real solution: their manufacture from plant materials does not guarantee the biodegradability of polymers, and moreover it increases industrial pressure on agricultural land; as for those that are claimed to be compostable or fragmentable, they are still derived from petrochemical products.

Second is its toxicity: 50% of the chemical components of plastics are classified as hazardous by the United Nations classification system for chemicals. Studies have also shown the ability of additives used in PVC to pass into the human bloodstream, as well as the carcinogenic risks of certain components of PVC, polystyrene, polyurethane and polycarbonate. Similarly, biologists have warned of the risks that plastic debris poses to fauna, from micro-organisms to whales or seabirds, which are part of the food chain right up to our plate.

Rethinking the models, blue and circular

So, what should we do?

Regeneration, reinvention and restoration form a new framework for action to (re)think our strategies, to innovate and to provide solutions to this global challenge, which raises significant local issues in island territories. It is not a question of going to war against plastic, which has proved to be a useful, practical and inexpensive material. It is a question of analysing our relationship with this material, of defining new ways of consuming and producing it, and of developing innovative ways of disposing of it and reducing the pollution generated on our coasts and at sea.

To address the multifaceted challenge of marine plastic pollution in the islands of Africa and the Indian Ocean, the IOC and the World Bank, through the AIODIS component of the IOC-SWIOFish2 project, are publishing three studies on i) the state of the art of the circular economy, ii) intellectual property issues on innovative projects and iii) measures to prevent, reduce and control marine plastic pollution. We hope that they will prove useful to policy makers, entrepreneurs, and developers in the blue and circular economy sectors.

Introduction

This is a background study for prevention, reduction and control of marine plastic pollution in Africa Indian Ocean Developing Island States (AIODIS). The AIODIS included in the study are: Cape Verde, Comoros, Guinea Bissau, Madagascar, Maldives, Mauritius, São Tomé and Seychelles. La Réunion is a member of the AIODIS group, but is not included in the study. The study has a particular focus on development of sensitisation strategies and the role of the circular economy.

Part I summarises global and regional characteristics of marine plastic pollution (MPP). It describes the complexity of the MPP problem and the challenges facing governments, industries and consumers. It describes the scale of the problem, the nature of plastics, the structure of the plastics economy and global trade in plastics. It quantifies the impacts on economies and on the environment and on biodiversity. Part I sets out the problem of MPP in the context of international law, describes initiatives to build an international convention to prevent, reduce and control plastic waste, and briefly describes actions under two regional seas conventions.

Part II addresses marine plastic pollution in AIODIS and builds on inputs from AIODIS stakeholders through Country Working Papers.

Part III describes the range of approaches and initiatives to prevent, reduce and control marine plastic pollution, with specific reference to the circular economy, to building awareness and to the challenges in AIODIS and small/ island economies.

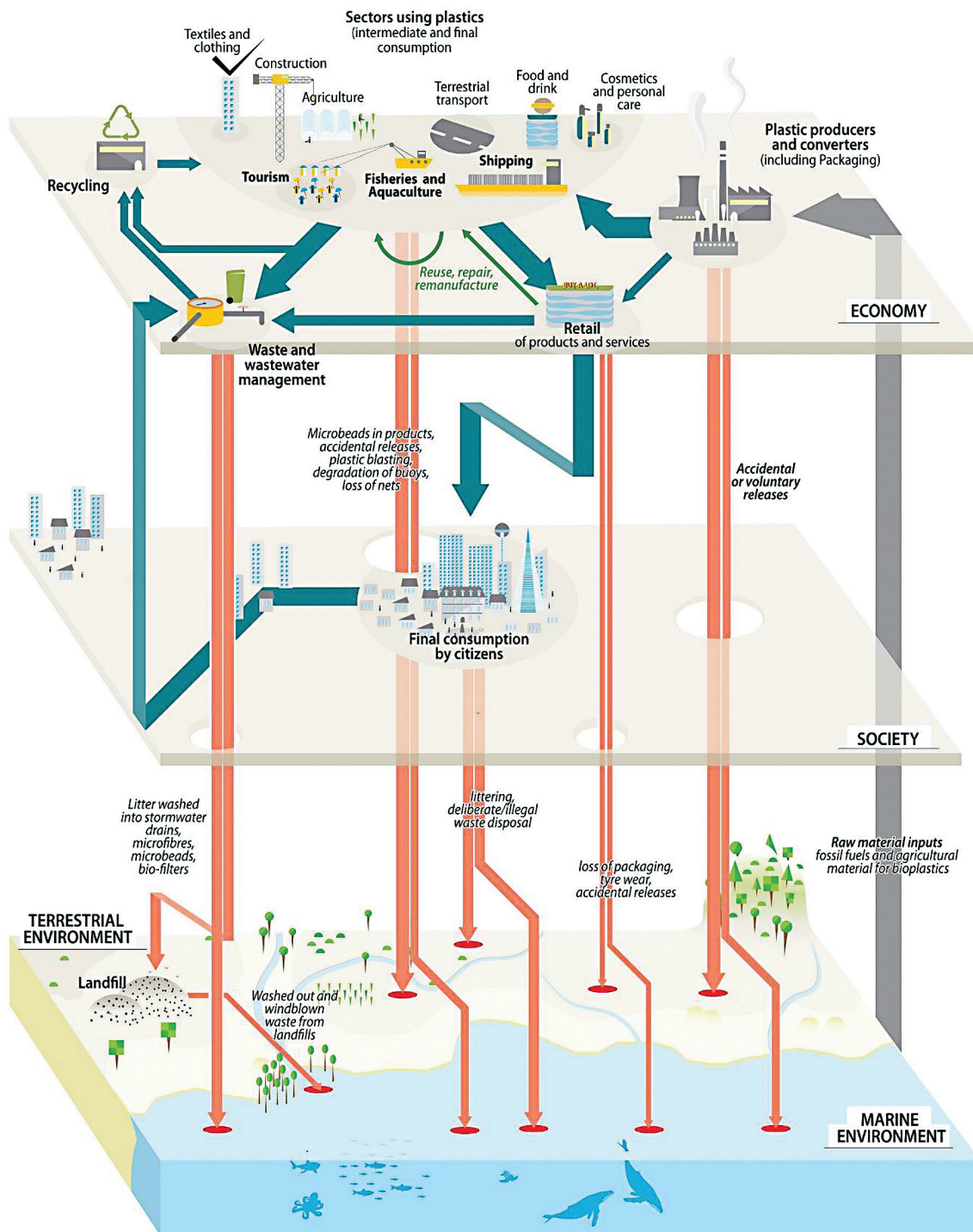
The report sets out and builds on several conclusions:

- a clear understanding of the integrated nature of the problem of MPP is important for development of a national action plan to combat MPP
- public awareness of the problem is fundamental to building the political willingness for actions, as actions can incur costs for consumers, for businesses, for local authorities and to public finance
- consumers and businesses need to be engaged through stakeholder consultation and participation
- MPP is part of a more general waste management problem, in particular, the management of urban solid waste and waste generated by shipping and fisheries activities
- governments will require coherent policies, regulatory measures, public support for waste management, incentives for changes in consumer and business behaviours and support for innovation in and adoption of the circular economy in the business community
- in the AIODIS, national resources and efforts may need to be supplemented by external financial resources, including for private sector investment and technologies
- national actions should ideally be complemented with regional and global actions to be effective, as the problem of MPP is global, requiring actions across sectors and economies
- given the small size of many AIODIS economies, actions to combat MPP can benefit from a regional approach on trade in plastics and plastic waste which may generate the economies of scale and opportunities for a circular economy approach.

This report is a companion report for other reports to be prepared under this project. These other reports will examine the role of the circular economy in addressing plastic waste and plastic pollution in more detail and will also examine intellectual property rights, particularly those associated with circular economy technologies and initiatives.

This work is financed by the World Bank under the 'Promotion of African & Indian Ocean Island Developing States Blue Economy' component of the regional 'South West Indian Ocean Fisheries Governance and Shared Growth Project' (SWIOFish2). The component is managed by the Indian Ocean Commission.

Figure 1. How plastic pollutes the marine environment



Source: Grid Arendal, Riccardo Pavettoni

EXECUTIVE SUMMARY

Key Messages

The **objective** of the study is to compile and present information on key aspects of marine plastic pollution to enable AIODIS to consider national and regional actions to combat marine plastic pollution with particular emphasis on awareness and the circular economy.

A. What is the Marine Plastic Pollution problem?

1. Marine Plastic Pollution (MPP) is growing in AIODIS and worldwide. There are numerous social, economic and environmental impacts. The impacts are complex, cumulative, largely irreversible and difficult to quantify.
2. MPP results in estimated global losses of over \$2 billion/year. The losses are disproportionately suffered by island economies. Losses for AIODIS have not been estimated but are considered significant, particularly for tourism, public health and the cumulative loss of ecosystem function.
3. MPP is part of a more general solid waste management (SWM) problem, in particular the management of urban solid waste and waste generated by shipping and fisheries.
4. Global, regional and national actions are not significantly halting or reversing global MPP.
5. Multiple actions across the entire plastics value chain with greater commitments by business stakeholders and concerted international actions are considered fundamental to effectively prevent, reduce and control MPP.

B. How are AIODIS combatting Marine Plastic Pollution?

1. Countries are developing increasing awareness of 'the plastics problem'. All AIODIS have introduced restrictions on single-use-plastic bags. All countries have beach clean-up activities.
2. Only one country has a comprehensive action plan on MPP.
3. Only South Asia has a regional action plan on marine debris.
4. There are no regionally binding measures on MPP and no regional agreements facilitating sustainable trade in plastic waste.
5. The implementation and effectiveness of the two existing regional protocols on land-based sources of marine pollution has not been evaluated in relation to MPP.
6. All countries face technical, resourcing and institutional fragmentation challenges with respect to SWM. Deficient solid waste management (SWM) is the major cause of MPP.
7. There is limited business engagement in combatting MPP. Circular economy initiatives and extended producer responsibility schemes are in their infancy.

C. What more can be done to prevent, reduce and control MPP?

National actions

1. Countries can develop implement comprehensive national MPP action plans.
2. The plan should be an integral part of the national SWM plan, engage stakeholders across the plastics value chain, link to the national vision, the SDGs, and to relevant national environmental, social and economic initiatives.
3. The plan should have a strong regional cooperation component and address trade issues.

Regional actions

1. MPP requires global and regional cooperative efforts, as the problem and the solutions are beyond the capabilities of single countries.
2. Actions at all levels will benefit from enhanced regional cooperation.
3. Ideally, regional action plans should be prepared with effective engagement of the regional economic communities and organisations.
4. A regional action plan should include a trade dimension, help access resources and finance, and help establish a regional position on MPP.
5. Ideally, the action plan should foster development of a binding agreements on measures to combat MPP.

5 Madagascar

5.1 Marine plastic pollution in Madagascar

Madagascar does not currently have a comprehensive national strategy to address marine plastic pollution (MPP).¹³² This report is a first step to estimate the scale of MPP, to describe the sources of MPP and to develop a national dialogue and action plan on MPP with particular emphasis on use of the existing solid waste management initiatives, developing awareness among key stakeholders and identifying practical steps to combat MPP.

5.1.1 Sources of marine plastic pollution

There are three main sources of MPP in Madagascar:

- mismanaged, or unmanaged solid waste, which is by far the most important
- marine sources are mainly fishing activities, shipping, offshore oil and gas platforms and a minor contribution from marine tourism
- plastics may also be transported by ocean currents from other countries.

The different sources are discussed in more detail below. Plastic waste is part of a much broader waste management problem, one of a range of sustainable development challenges faced by Madagascar. This note provides a preliminary estimate of marine plastic pollution (MPP) in Madagascar and provides a synthesis of available information on MPP.

5.1.2 Estimate of marine plastic pollution and its basis

MPP is estimated primarily as a function of mismanaged land-based solid waste in Madagascar with some additions to reflect the marine sources.¹³³ The estimate of MPP relies on several assumptions based on population, solid waste generation, the proportion of plastic in the waste and the amount of mismanaged plastic waste that is transported into the marine environment. The basis for these assumptions is set out below. Alternative estimates of mismanaged plastic waste have not been explored at this stage.¹³⁴

The country has a population of over 27 million (about 87 percent of the total IOC-member country population) and a population density an order of magnitude less than most of the IOC countries. Less than 40 percent of the population is 'urban' and about 60-70 percent live in unplanned/informal housing or 'bidonvilles' which are often in small high-density plots and which are not effectively serviced by any formal solid waste collection or management.¹³⁵ Of the urban population, 5 percent live in coastal areas.¹³⁶ It is assumed that a similar proportion of rural dwellers live in coastal areas. For the purposes of the MPP estimate, the population is divided into four groups: urban coastal, rural coastal, urban inland and rural inland.

¹³² MPP is generally considered to account for about 80 percent of marine litter or debris.

¹³³ See Jambeck et al., 2014 for a description of the methodology.

¹³⁴ Cordier, M. et al, 2020. Plastic pollution and economic growth: the influence of corruption and the lack of education. 2020. <https://hal.archives-ouvertes.fr/hal-02862787..>

¹³⁵ Urban 37.9%, 10.2 million (2019) <https://data.worldbank.org/indicator/SP.URB.TOTL.IN.ZS?locations=MG>; ONU-Habitat, 2010.

¹³⁶ http://geodata.grid.unep.ch/mod_table/table.php

Madagascar's topography is highly variable such that most of the populous highland areas are drained to the eastern coast (Mozambique Channel). The topography of the eastern estuaries, combined with the high soil erosion means that a substantial proportion of the waste plastic waste that is washed into the lower catchments is likely to get 'trapped' and buried in the estuarine mudflats and become a 'coastal plastic sink'. The estimate of MPP is adjusted to reflect this assumption, as it is considered that this a coastal plastic sink is not MPP. The tidal range varies widely around the island with a range of 1-5m which suggests that waste dumped on the shoreline could potentially be washed into the marine environment and result in MPP, particularly when flooding or storm surges occur.¹³⁷

The collection and disposal of household solid waste varies widely by municipality, or city. There is little or no collection in the 'bidonvilles', while collection can be 50 percent or greater in quartiers where households pay collection fees either to private contractors or to the local council (mairie). Although many municipalities have plans for managed landfills, few are effectively controlled and there is a general lack of sanitary landfills. The mismanagement of solid waste means that the waste plastic can be leaked or transported into the ocean by rainfall and flooding, by dumping directly into rivers or the sea, by dumping on the shore, or by wind which carries plastic from dumps, or plastic particles from burning plastic.

Household solid waste generation is estimated at 0.37 kg/person/day.¹³⁸ Other studies provide a range of estimates. In 2016, household waste was estimated at 680,850 tons (28 kg/person/year, or <0.1 kg/person/day), a likely underestimate as it is an order of magnitude less than several other IOC countries.¹³⁹ For the purposes of the estimate, it is considered that 60 percent of urban solid waste and 90 percent of rural solid waste is mismanaged. While this value differs from that used in preparation of the 2014 global estimate, it reflects a common practice of dumping waste directly into the sea, on the shore, or into rivers and waterways.¹⁴⁰

Plastic comprised 5.79 percent of urban solid waste in a 2003 survey at the Antananarivo landfill, an increase from 2 percent in 1996.¹⁴¹ A 2014 study indicated that 10 percent of the waste was plastic and the municipality of Moramanga estimated 12 percent in 2010.¹⁴² As all the assessments were done on urban waste, a value of 5 percent is used for the estimate, as plastic generally comprises a lower proportion of rural waste.

The estimate of microplastic marine pollution is based exclusively on tyre abrasion and is estimated at 22 tons/year. The estimate, its basis and assumptions made are described below. The import of fishing nets is used as a proxy for generation of MPP from fisheries. In 2019, the imports were 604 tons and 50 percent of this quantity is considered to be lost or abandoned nets and gear and effectively MPP.¹⁴³ Comprehensive information on MPP from shipping and from non-Madagascar sources is not available and the values in are placeholders which can be replaced with estimates based on future assessments.

MPP from solid waste mismanagement, from fisheries, from shipping and from non-Madagascar sources (e.g., ocean currents) are briefly discussed in other sections.

¹³⁷ Risk of cyclones, river and coastal flooding in Madagascar is considered 'high'. <https://thinkhazard.org/en/report/150-madagascar/FL>

¹³⁸ World Bank, 2018. What a Waste 2.0. The Ministère de l'Environnement, indicated a rate of 0.35 kg/perons/year at a séminaire du 18 juin 2019 à Maurice. Randrianasolo, A. provided an estimate of 0.4 kg/person/day in 2019 Table ronde 6: L'implication des CUA.

¹³⁹ COI, 2019. Plan d'action de réduction et de gestion des déchets dans les pays de la COI. Janvier 2019. A 2014 study provided an estimate of 0.6 kg/person/day (Artelia Madagascar, 2014).

¹⁴⁰ Jambeck et al., 2014 consider that 10-20% of mismanaged waste in the coastal area leaks into the marine environment. The 5% value used here appears consistent with direct observations made in some African countries.

¹⁴¹ Service de Maintenance de la Ville d'Antananarivo (SAMVA), 2003.

¹⁴² Naldéo (2014).

¹⁴³ Comtrade, HS codes 5404 & 5608.

MPP in Madagascar is estimated at about 3,480 tons per year (Table 9). The sources and assumptions are provided in the table or in the text. As additional or more accurate information becomes available, this preliminary estimated should be adjusted accordingly.

Table 9. Estimated marine plastic pollution in Madagascar

Item	Total	Urban			Rural			Source/ Assumption
		Total	Coastal	Inland	Total	Coastal	Inland	
Population total (million)	27,691,018	10,211,000	1,384,551	8,826,449	17,480,018	1,384,551	16,095,467	World Bank 2020 (projection); coastal 5% see text
Total waste (tons/year)	3,768,759	3,807,456	516,268	3,291,187	6,517,912	516,268	6,001,643	World Bank, What a Waste 2.0; see text
Waste average (kg/person/day)	0.37	0.37	0.37	0.37	0.37	0.37	0.37	calculation (MEEF estimates 0.35)
Plastic (%) of waste	4.0%	4%	4%	4%	2%	2%	2%	assumptions, see text
Plastic waste (tons/year)	150,750	152,298	20,651	131,647	130,358	10,325	120,033	calculation
Mismanaged plastic waste (%)		60%	60%	60%	90%	90%	90%	assumptions, see text
Mismanaged plastic waste (tons/year)	208,701	91,379	12,390	78,988	117,322	9,293	108,030	calculation
Transport to marine environment (%)			5%	1%		5%	1%	assumptions
MPP from mismanaged solid waste (tons/year)	2,954	1,409	620	790	1,545	465	1,080	10% of mismanaged plastic waste
Shipping (tons/year)	100							Shipping 100 tons (assumed)
Fisheries (tons/year)	302							Net imports 604 tons x 50% + shipping 100 tons (assumed)
Microplastics	22							see table on microplastics (car tyres only)
Non-Madagascar sources	100							assumption (from ocean sources)
Estimated MPP (tons/year)	3,478							calculation

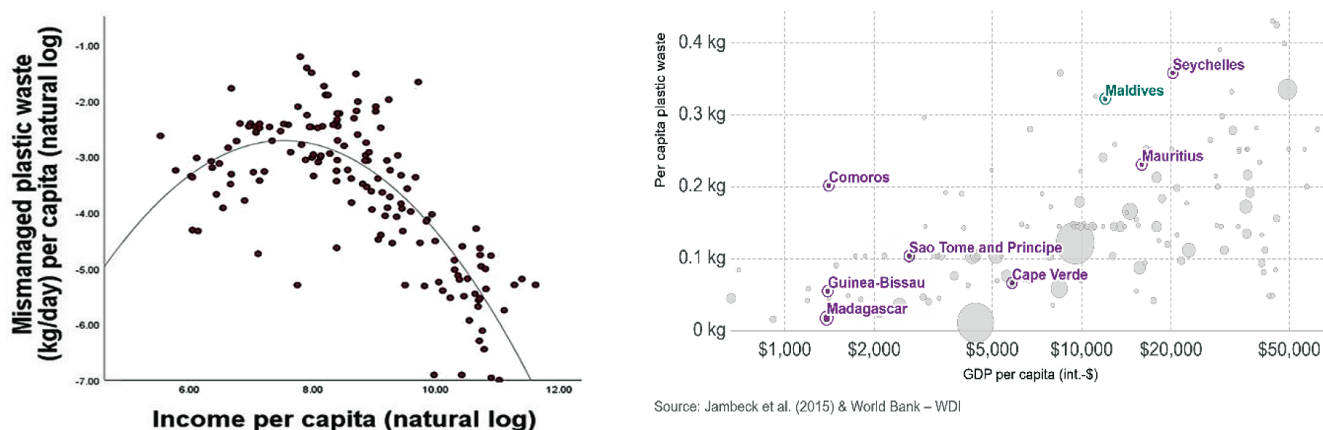
5.1.3 Urban plastic waste

A number of different studies estimate the percentage of plastic in household waste, or collected waste (which may include waste from restaurants or other businesses). A 2012 study estimates 5.8 percent plastic in Antananarivo household waste.¹⁴⁴ A different study on Antananarivo estimated that 68,985 tons of waste plastic is produced annually on the basis of GDP/person, that 48 percent of urban household solid waste is collected and that 10 percent of the collected waste is plastic.¹⁴⁵

In general, the studies indicate that plastic waste is increasing from <2 percent of household waste in the late 1990s to 4-10 percent in 2020; that the percentage of plastic varies by area (quartier, maire, or other unit of waste collection); that plastic waste in rural areas may be lower than in urban areas; and that informal collection of PET bottles and other reusable/ recyclable plastics may reduce the percentage of plastic in household waste that is formally collected or appears in waste surveys.

There is a relationship between plastic waste and income levels (Figure 21).¹⁴⁶ The current decrease in Madagascar's GDP/capita may temporarily reduce plastic consumption, although this may be slightly offset by the increase in the use of plastics to combat the pandemic.

Figure 21. Relationship between income and mismanaged plastic waste



Source: Jambeck et al. (2015) & World Bank – WDI

Sources: Barnes, 2019; Jambeck, et al. 2015.

5.1.4 Management of solid waste

It is estimated that only about 10 percent of household waste is disposed of at authorised sites, about 40 percent at unmanaged or inadequate sites and 50-70 percent is illegally dumped. Urban solid waste collection rates vary widely by municipality and current collection levels have increased substantially from 2011 when 21 percent of urban solid waste was collected. Technical and financial resources to manage waste are often deficient at national and municipal government levels as solid waste management has generally been a relatively low priority and tends to rely on external development assistance for capital expenditure. However, a growing number of private enterprises are engaged in

¹⁴⁴ UN –Habitat Gevalor, 2012. Identification des opportunités de recyclage et évaluation rapide du secteur de la gestion des déchets solides à Antananarivo (Madagascar). Mai 2012. <https://documents.plateforme-re-sources.org/wp-content/uploads/2020/12/A43-Diagnostic-des-possibilites-de-recyclage-des-dechets-a%CC%80-Antananarivo-Gevalor.pdf>.

¹⁴⁵ COI, AFD, Seureco, Naldeo, 2014. Etude de diagnostic pour une gestion optimisee des dechets dans l'Ocean Indien. Commission de l'Ocean Indien. COI/AO/2013/007. The estimates of collection and percentage plastic appear high. Some of the information is sourced from AGETIPA. See also: WIOMSA, 2007. A Regional Overview & Assessment of Marine Litter Related Activities in the West Indian Ocean Region. UNEP and Lwandle Technologies Pty Ltd.; In 2016, plastic was 13.3% of collected waste and 9% of market waste in Moramanga. Ramandraiarivony, M.A.F., 2016. La gestion des dechets solides dans la Commune urbaine de Moramanga. Université d'Antananarivo.

¹⁴⁶ Barnes, Stuart J. 2019. Understanding plastics pollution: The role of economic development and technological research. Environmental Pollution 249, December 2019. <https://www.sciencedirect.com/science/article/abs/pii/S0269749119306505>

plastic waste management and recycling.¹⁴⁷ Many of the relevant laws are either not enforced, or poorly enforced.¹⁴⁸ There are numerous inter-related causes of mismanaged solid and plastic waste (Box 3).

Box 3. Causes of mismanaged plastic waste and solid waste in general

Uncontrolled urban expansion is a primary cause.

Policies. There is a lack of comprehensive waste management policies, plans, or strategies. These weaknesses contribute to weak budget management; lack of a comprehensive approach based on economic analyses (including on economic losses attributable to disease, contaminated water and air pollution); poor development of fiscal incentives; and weak enforcement of regulations.

Governance weaknesses ranging from an inability to collect fees for waste services to irregularities in private contracts for waste services, and lack of clarity with regards to overlapping jurisdiction and financial responsibilities.

Laws. Lack of coherence in the regulations and general lack of awareness and application of laws.

Economies of scale in reuse/recycling. Decentralised waste management responsibilities to municipal level fragments the value chains for recycling of plastics and accentuates the high transport costs for low value waste.

Awareness. There is a general lack of awareness of environmental issues and impacts of mismanaged waste. There are difficulties in translating awareness among consumers and households into sustainable practices such as sorting of waste.

Technical capacity is weak, particularly in relation to policy, planning, governance and financing of waste management.

Financial resources are lacking. The waste management responsibilities given to the local authorities are not matched by either central government budget allocations, by local taxes, or revenues from user charges for waste collection. Households also have limited ability to pay for services. This results in dependence on development assistance for capital investment in infrastructure such as design and construction of managed landfills and failure to maintain and replace assets (garbage trucks, bulldozers, compacters, incinerators).

Sources: Ramandrairivony, 2016, Randrianasolo, 2019, UN Habitat, Gevalor.¹⁴⁹

¹⁴⁷ Groupe Adonis Environnement is understood to be involved in recycling of PET bottles.

¹⁴⁸ UN Habitat, 2012. Madagascar: Profil Urbain National. Gevalor, 2015. Valorisation des déchets fermentescibles à Antananarivo. Rapport de terrain n°2. 5/10/2015. Projet ORVA2D.

¹⁴⁹ Ramandrairivony, M.A.F., 2016. La gestion des déchets solides dans la Commune urbaine de Moramanga. Université d'Antananarivo; Randrianasolo, A. Table ronde 6 : L'implication des CUA

Figure 22. Plastic waste in coastal and urban areas



Nosy Komba



Tamatave



Tamatave



Figure 23. Informal and formal waste management



5.1.5 Plastic pollution on beaches.

Although there have been numerous beach clean-ups, there has been little systematic assessment of MPP or marine litter. One coastal city is reported to generate 100m³ of plastic waste per day. Preliminary data from an ongoing beach litter monitoring project notes that plastic beach litter in inhabited areas is six times that in uninhabited areas. The coastline is often seen as a “free” for waste disposal and benefits from a ‘free tidal removal service’. There is a widespread use of open dump sites, open air burning, dumping in waterways, mangrove areas or on the shore.

Table 10. Quantities of plastic collected in beach litter surveys (kg)

Location	Un-inhabited beaches	'Urban' beaches	Un-inhabited : Urban
Nosy Be	7	270	1:39
Sainte Marie	136	452	1:3
Tuléar	16	120	1:8
Fort Dauphin	24	169	1:7
Total/Average	183	1011	1:6

Presentation. Suivi et évaluation des déchets marins à Madagascar (2019-2021).¹⁵⁰

Fisheries. As there is no direct information on MPP from fisheries in Madagascar, the estimate given in should be considered as a 'place-holder' until such time as further information is available. Both local small-scale and large-scale fisheries and foreign fishing are potential sources of MPP through lost gear and garbage disposal.¹⁵¹ Losses are generally related to the type of gear and location where the fishing takes place. The import of fishing nets is used as a proxy for generation of MPP from fisheries. It should be noted that small-scale coastal fisheries, inland fisheries, industrial trawl and tuna fisheries and aquaculture all use nets. In 2019, the imports were 604 tons and 50 percent of this value is assumed to represent the MPP generated.¹⁵²

Shipping. Galley waste from shipping can be a source of MPP, particularly if the waste disposal arrangements at ports are inadequate. Madagascar has a network of 17 ports.¹⁵³ Only five ports (Antsiranana, Toliara, Vohémar, Toamasina, Tolagnaro) are considered to have adequate port facilities and 75 percent of freight goes through Toamasina port. The 12 remaining ports provide regional service for smaller vessels and have limited facilities. The Agence Portuaire Maritime et Fluviale is responsible for port management and the relevant MARPOL implementing arrangements appear to be in force under the law.¹⁵⁴

Figure 24. Fisheries and shipping are sources of MPP



Images: beche-de-mer pens, Tomasina port, gillnets

Most major ports have waste reception facilities and implement the controls required under MARPOL Annex V. There are no reported irregularities regarding the access to waste disposal in AIODIS main ports. Arrangements for disposal of ships garbage in smaller ports or landing sites in Madagascar may

¹⁵⁰ GRET e RanEau, 2019. Déchets : Quelles solutions pour nos villes Malagaches? Atelier, Nov 2019. Institut Français de Madagascar

¹⁵¹ FAO, 2016. Abandoned, lost and discarded gillnets and trammel nets: methods to estimate ghost fishing mortality, and the status of regional monitoring and management. FAO Technical Paper No. 600. Rome. Italy.

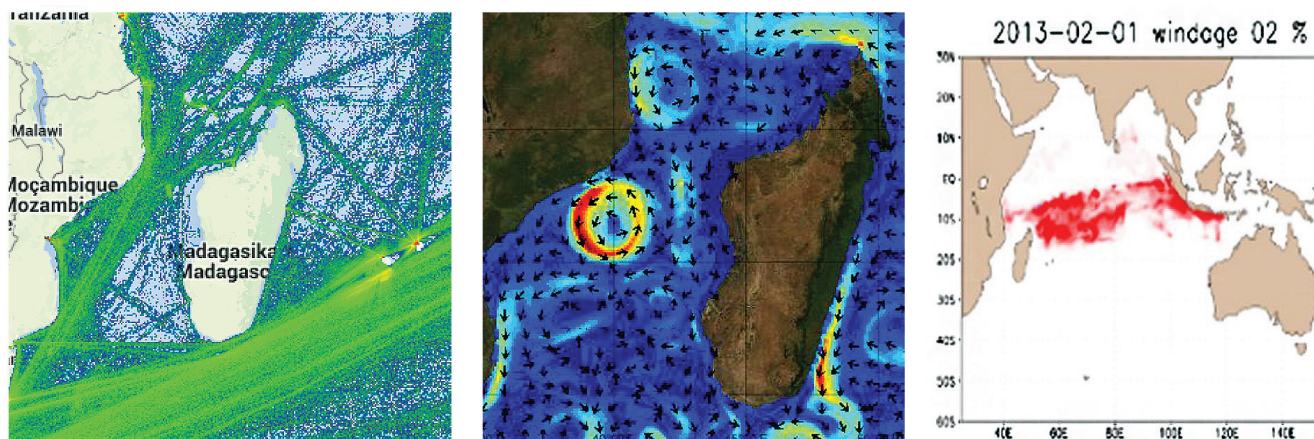
¹⁵² Comtrade, HS codes 5404 & 5608.

¹⁵³ Toamasina, Antsiranana, Nosy Be, Mahajanga, Toliara, Antalaha, Vohémar, Morondava, Tolagnaro, Port Saint-Louis, Morombe, Manakara, Antsohihy, Maintirano, Sainte Marie, Maroantsetra and Antalaha.

¹⁵⁴ <https://www.apmf.mg/en/apmf>. See, e.g.: Decret No. 2017- 920.

need attention. In addition, growing offshore oil/gas exploration activities can be a source of MPP and effective waste management may require to be specified or included in any revisions of the legislation on marine pollution or in the terms and conditions of concessions.

Figure 25. Shipping traffic density, current eddies and plastic carried by ocean currents (model)



Images : AIS shipping, surface currents, model of plastic transport

Foreign sources of MPP. It is likely that the Agulhas current can transport some MPP originating from the East African mainland to Madagascar. However, the surface current systems appear to form eddies rather than act as a major carrier of marine debris.¹⁵⁵ Shipping traffic is relatively light in the Northern Mozambique Channel compared to off the southeast corner of Madagascar (Figure 25). However, specific information on the quantities of MPP arriving in Madagascar is not available and beach clean-up activities do not sort debris by possible origin. The current study on beached marine debris (Table 10) may enable a determination of different sources. Studies of beach debris in South Africa suggest a useful approach to determining origins.¹⁵⁶ In particular the analysis of plastic in beach litter at Fort Dauphin, in comparison with other sites, is of particular interest given the proximity of a major shipping lane.

Microplastics. The level of marine microplastic pollution depends on a wide range of factors. Population, density of housing and the type of treatment of waste water are important. In Madagascar, slow-moving rivers and extensive estuaries means that microplastics are less likely to get flushed into the ocean. The main sources are likely to be untreated waste water (cosmetics, cleaning agents, laundry); road runoff of rainwater containing microplastics from car tyre abrasion; and air-borne microplastics resulting from burning and breakdown of macroplastics by wind and sun. As the area of surfaced/tarmac road is relatively small in Madagascar, microplastics from tyre abrasion are likely to be trapped in the soil before reaching the sea. The preliminary estimate of microplastic marine pollution is set out in Table 11. It is provided as a basis for more accurate future estimates.

¹⁵⁵ Collins, C., J. C. Hermes, and C. J. C. Reason (2016), First dedicated hydrographic survey of the Comoros Basin, *J. Geophys. Res. Oceans*, 121, 1291–1305, doi:10.1002/2015JC011418; Quartly, G.D., et al. 2013. Mozambique Channel eddies in GCMs: A question of resolution and slippage. *Ocean Modelling* Volume 63, March 2013, Pages 56-67

¹⁵⁶ Ryan, P.G. 2019. Rapid increase in Asian bottles in the South Atlantic Ocean indicates major debris inputs from ships. 20892–20897 *PNAS* October 15, 2019 vol. 116 no. 42. www.pnas.org/cgi/doi/10.1073/pnas.1909816116.

Table 11. A. Estimate of microplastic marine pollution from car tyres in Madagascar

	A. tyres	B. vehicles	source/ assumptions
A. Madagascar car tyres 2019 (tons)	10,145		UN Comtrade, imports 2019
B. Vehicles in service (numbers)		236,979	2015 data (who.it/gho/data)
A. Annual microplastic loss (tons)	1,014		10% Kole et al.
B. Weight loss all /vehicles/year (tons)		435	1.84 kg/vehicle/year based on India
Retention in soil/ river beds	913	391	90% retention by soil (Kole)
Transport to the ocean (generic)	101	43	10% (generic)* (Kole)
Adjusted by -50% (Madagascar)	51	22	unsurfaced roads/ river topography

Source Kole et al.¹⁵⁷ *Adjustment of -50% is made because the 10% transport estimate is from countries with widespread surfaced roads and urban areas which facilitate tyre microplastic runoff. Most recent data available: <https://apps.who.int/gho/data/node.main.A995?lang=en>

5.2 Existing and potential measures to combat MPP

5.2.1 Policy and planning

Policies. There is no overall policy or plan to combat MPP. In 2010, Madagascar prepared a national strategy on pollution management, and while several municipalities have solid waste management plans, there does not appear to be either a national policy or strategic plan on integrated solid waste management. However, a variety of policy instruments have direct relevance. Some sectoral waste management policies and plans exist, e.g., for medical waste, for dangerous chemicals, and for implementation of obligations under international conventions (e.g. Basel, Bamako, mercury) and some ministries and municipalities also have detailed plans at various stages of implementation.¹⁵⁸ A comprehensive information system on waste quantities, on composition, or on waste disposal, upon which to effectively plan initiatives, is lacking. In 2015, the health costs associated with pollution were estimated at \$117-166 million, or a loss of productivity equivalent to 1.2-1.7 percent of GNP.¹⁵⁹ Key policy instruments include:

- Charte de l'Environnement Malagasy. Loi n°90-033 du 21 Décembre 1990 (CEM), décret d'application n°99-954.
- Politique et Stratégie Nationale de l'Assainissement (la PSNA) adopté par le décret N° 2008 -319 du 28 Février 2008
- Politique Nationale Environnementale (PNE) de janvier 2010
- Ministère de L'environnement et des Forets, 2010. Stratégie nationale pour la gestion des pollutions, Madagascar, 2010
- Programme Environnemental Pour le Développement Durable, 2016.¹⁶⁰

¹⁵⁷ Kole. P.J. at al. 2017. Wear and Tear of Tyres: A Stealthy Source of Microplastics in the Environment. Int. J. Environ. Res. Public Health 2017, 14, 1265; doi:10.3390/ijerph14101265.

¹⁵⁸ Min. de la Sante Publique, 2017. Politique Nationale de Gestion des Déchets Médicaux et de la Sécurité des Injections à Madagascar. Edition 2017.

¹⁵⁹ MEEF, 2018. Plan d'action en Matière de Santé et de Pollution de Madagascar. Ministère de l'Environnement, de l'Écologie et des Forêts de Madagascar.

¹⁶⁰ MEEF, 2016. Programme Environnemental Pour le Développement Durable. Document de référence pour les liens entre le développement durable et les dimensions environnementales. Août 2016.

The 2010 environment strategy was based on three pillars: (i) prevention (reduction, monitoring, capacity building); (ii) reduction of impacts; and (iii) effective management (policies, coordination). Following adherence to the Manila Declaration (2012), additional efforts were made through a plan of action which included attention to marine debris and a project which established some managed landfills.¹⁶¹ The waste management problem, and the resulting marine pollution and its impacts are recognised at national levels.¹⁶² However, implementation of the various policies and plans have experienced difficulties as a result of the deeper systemic structural problems of governance, the institutional arrangements, resourcing and finance and regulation.

Box 4. Extracts from the national environmental reports (2012, 2016)

"...from a legislative and regulatory point of view, the existing texts do not suggest an easy application because of the absence of implementing decrees for many laws. From standpoint of infrastructure, those needed for disposal and treatment are quasi-inexistent in all the country's larger settlements. From the perspective of institutions, those involved in the concerned domains are numerous but very compartmentalised. Coming to monitoring and control, the activities are often carried out on a one-off basis, not a systematic one. As regards policy, Madagascar doesn't have any yet to manage pollution.

« Generally speaking, access to water and waste management tend to deteriorate in line with an increasing demographic concentration in towns. At present, Antananarivo is ranked among the dirtiest cities in the world, with its heaps of waste.

« As yet, there is no sorting facility in Madagascar and, in general terms, waste is not treated in view of transformation or recycling or any form of value recuperation.

Sources.¹⁶³

Regulation. Selected legislation of relevance to MPP is listed below (Box 5).

¹⁶¹ E.g., Gestion Intégrées des Déchets Solides (closure of Andralanitra).

¹⁶² République de Madagascar. 2014. Stratégie Nationale de Gestion des Risques et des Catastrophes 2016 – 2020.

¹⁶³ Ministère de l'Environnement et des Forêts, 2012, Rapport sur l'état de l'environnement de Madagascar; Programme Environnemental Pour le Développement Durable (2016) ; MEEF, 2016. Programme Environnemental Pour le Développement Durable. Document de référence pour les liens entre le développement durable et les dimensions environnementales. Août 2016. See also: Carret, Jean-Christophe, 2013. Madagascar - Country Environmental Analysis (CEA): taking stock and moving forward (English). Washington, D.C. : World Bank Group. <http://documents.worldbank.org/curated/en/599641468054534317/Madagascar-Country-Environmental-Analysis-CEA-taking-stock-and-moving-forward>.

Box 5. Selected legislation of relevance to MPP

Environment and pollution

- Law n° 2015-003 of January 20, 2015 establishing an updated Malagasy Environment Charter ;
- Framework-law n° 99-021 of August 19, 1999, setting the policy to manage industrial pollution ;
- Decree n° 2008-319 of February 28, 2008 establishing the adopted national sanitation policy and strategy. portant adoption de la politique et stratégie nationale de l'assainissement (PSNA).

Plastic bags

- Decree n°2017-010 prohibiting the production, importation, stockpiling and use of plastic sacks and bags on the national territory (thickness above 50 microns is authorised) <http://www.cnlegis.gov.mg/>

Urban management

- Law n° 95-035 of October 3, 1995, setting the charges for urban sanitation, amended by law n° 2013-002 of August 2, 2013 ;
- Decree n° 63-192 of March 27, 1963, setting town planning and habitat codes, modified in 1969 by decree n° 69-335 ;
- Law n° 95-035 enacted in 1995, allowing the creation of bodies entrusted with urban sanitation and empowered to set charges for the latter (also known as SAMVA law).
- Decree n° 96.173 reorganising Antananarivo's Urban Maintenance Autonomous Service (SAMVA Decree, 1996) ;
- Decree N° 2008-881 organising Urban Sanitation within the urban limits of Antananarivo, in 2008
- Decree n° 2009-1166 reshuffling and reorganising Antananarivo's Urban Maintenance Autonomous Service (SAMVA)

Water

- Law n° 98-029 enacting the Water Code, on January 20, 1999, followed, in 2003, by 13 implementation decrees.

Institutions. The main responsibilities are split.¹⁶⁴ The communes are responsible for the organisation, management and implementation of waste services and cleaning of public areas, collection, transport, handling and disposal of solid wastes. The central government is responsible for dangerous wastes, for legislation, for setting norms and for any international cooperation required. Service contracts may lack clarity and performance measures, but as budget management is weak, contractors also risk late payment.

A national MPP strategy? A national effort to combat MPP needs to be seen in the context of overall waste management in Madagascar, the level of poverty, the governance challenges, the competing national development priorities, and the scarcity of human and financial resources and cost-effective solutions which can be adapted to the local conditions. Within the context of a national integrated solid waste management strategy a national strategic plan on MPP could be prepared. A specialised MPP working group could be established with a national solid waste task force. The key actors could include, e.g., environment ministry, municipal authorities, finance ministry, chamber of commerce, the media and concerned NGOs, and representatives of the waste-pickers, or 'benes'. The MPP working group could include the fisheries administration, marine and port authorities, tourism stakeholders and enterprises involved in the plastics and retail industries.

¹⁶⁴ For details see: See UN Habitat 2012 p. 76

5.2.1 Fisheries

Over 100,000 small-scale fishers catch about 135,000 tons of fish per year. About 78 percent use boats, mainly dugout canoes and fish with gillnets, lines and traps.¹⁶⁵ There are also industrial shrimp trawl and tuna fisheries. There are about 18,000 inland fishers and an aquaculture industry that also uses nets and other plastic-based products.

Given the nature of the small-scale fisheries, comprehensive marking of fishing gear and 'fishing' for lost gear may not be practical, except near marine parks or prime tourist/ dive sites, or where volunteer divers can be used.¹⁶⁶ Designation of sites for collection of waste fishing gear, possibly through the fisheries associations and EPR arrangements with importers for responsible disposal could be of value in addressing fisheries MPP. Pilot schemes could be considered in areas where there are existing fisheries management plans.¹⁶⁷ EPR initiatives could be initiated at a regional level through the Fédération des Pêcheurs Artisans de l'Océan Indien, (FPAOI).

FADs are likely to be a source of marine debris from the tuna fleet, which also fishes in other WIO countries. Analyses of beach litter from other WIO countries suggest that garbage from Asian fishing vessels can contribute significantly to MPP, even if not fishing in the Madagascar EEZ.

For larger, 'port-based' vessels, reception facilities based on MARPOL Annex V requirements can be applied to fishing vessels.¹⁶⁸ Recycling of nets and ropes may require the economies of scale which may only be feasible through regional schemes (e.g. catalysed by SWIOFC or IOC), through close engagement with businesses and possibly with economic support from EPR arrangements with importers.

There are a range of guidelines available to prevent marine debris from fishing vessels. Workshops have been held, but it is unclear to what extent best practices are implemented in Madagascar, or regionally. A 2019 African regional workshop indicated a generally low level of awareness on the scale of lost or abandoned gear and nature of appropriate solutions.¹⁶⁹

Reduction of MPP from foreign fishing vessels requires a regional approach, particularly as foreign vessels may land catches elsewhere (e.g., Port Louis, Victoria, Durban) and may not make port calls to Madagascar. This could start with resolutions by IOTC and SEAFO, possibly phasing in MARPOL Annex V requirements for vessels; introducing measures with respect to marking gear and FADs; and specifying responsibility for recovery of lost gear. Enforcement could be through the PSMA. Appropriate requirements could eventually become part of minimum terms and conditions of access, included in licenses for vessels and could be an approved regional management measure. Fisheries support vessels could be included in such a scheme. FAO could be requested to provide support for design of a phased approach and the issue could be raised in the context of any future EU fisheries access agreement.

Although many small-scale fishing vessels are wooden, fibreglass (GRP) fishing vessels and other GRP vessels are progressively reaching the end of their useful life. Abandoned GRP vessels present

¹⁶⁵ Fisheries represents 5% of GDP and 13% of exports and provides about 20% of animal protein consumption.

¹⁶⁶ Small-scale fishers often create local or 'proprietary' systems of marking fishing gear to prevent theft, or help in the recovery of lost gear.

¹⁶⁷ E.g., Ambaro, Antongil Bay, and Androy and Atsimo-Atsinanana areas.

¹⁶⁸ Huntington, T.C., 2016. Development of a best practice framework for the management of fishing gear. Part 2: Best practice framework for the management of fishing gear. Confidential report to World Animal Protection; Also see the Global Ghost Gear Initiative.

¹⁶⁹ Macfadyen, G., Huntington, T., and Cappell, R. 2009. Abandoned, lost or otherwise discarded fishing gear. UNEP Regional Seas Reports and Studies No.185; FAO Fisheries and Aquaculture Technical Paper, No. 523. Rome, UNEP/FAO. 2009. 115p.; FAO 2020. Report of 2019 FAO Regional workshops on best practices to prevent and reduce abandoned, lost or discarded fishing gear in collaboration with the Global Ghost Gear Initiative. Port Vila, Vanuatu, 27–30 May 2019. Bali, Indonesia, 8–11 June 2019. Dakar, Senegal, 14–17 October 2019. Panama City, Panama, 18–23 November 2019. FAO Fisheries and Aquaculture Report No 1312. Rome. <https://doi.org/10.4060/ca9348en>.

a growing plastic waste problem and are likely to progressively degrade to marine microplastics if abandoned on beaches. Most countries have no provision for appropriate disposal of GRP vessels. Rules for their disposal are required and the responsibilities specified. Measures could include a requirement that the annual vessel registration fee is paid until appropriate disposal is certified. EPR schemes may be difficult to design given the life of these boats.

5.2.2 Shipping and tourism

Ensuring that Madagascar meets its obligations under MARPOL Annex V is the key action. Engagement between vessels operators and agents, port officials and waste disposal enterprises can help to ensure compliance on ships garbage disposal. Clarity on responsibilities for control, for inspection of ship's waste management logbooks and monitoring of practices at smaller ports may require agreements between port authorities, responsible ministries and municipal waste management authorities. Dialogues could also help in separation of recyclables in ship's garbage.¹⁷⁰ Possible dialogues with IMO and regional port authorities could ensure coordinated measures to prevent dumping of waste by shipping in the region and to foster codes of conduct for regional shipping lines.¹⁷¹ MARPOL Annex V also applies to the disposal of garbage from fixed or floating platforms engaged in the exploration or exploitation of seabed oil and gas and should be stipulated in the relevant authorisations.

Tourism is not considered a significant driver of MPP and may provide an incentive to maintain the cleanliness of beaches and waterfronts.

5.2.3 Circular economy

There are a number of companies that manage or recycle plastic waste. They are concentrated in the larger cities and several NGOs are engaged in supporting awareness raising, organisation of waste pickers (locally termed 'bennes'). Madagascar's Rural Access Index shows that only 11.4 percent of the population have access to a good road network and the mountainous terrain also means that Madagascar has one of the highest transport costs in Africa (\$0.14/km/ton), both of which constrains scaling up of waste collection. Consideration could be given to the organisation of waste pickers and development of EPR in relation to major waste items, such as PET bottles. About 19 percent of Tana households sort waste, of which 70 percent sort plastic bottles. There are over 20 companies involved in plastic manufacture and/ or recycling (Box 6). In addition to plastic recycling, there is a thriving market for reuse of wastes (*Figure 26*).

¹⁷⁰ A wide range of IMO guidelines are available: Prevention of Pollution by Garbage from Ships <https://www.imo.org/en/OurWork/Environment/Pages/Garbage-Default.aspx>; Resolution MEPC.220(63) Guidelines for the Development of Garbage Management Plans; 2017 Guidelines for the implementation of MARPOL Annex V. <https://www.wcdn.imo.org/localresources/en/OurWork/Environment/Documents/MEPC.1-Circ.834-Rev.1.pdf>; IMO, 2018. Consolidated guidance for port reception facility providers and users. <https://www.wcdn.imo.org/localresources/en/OurWork/Environment/Documents/MEPC.1-Circ.834-Rev.1.pdf>.

¹⁷¹ UK Chamber of Shipping, 2020. Best Practice on combatting Single-Use Plastic in Shipping; Carnival Corporation & PLC, 2019. Sustainability from Ship to Shore FY2019 Sustainability Report.

Box 6. Enterprises involved in plastic manufacture and / or recycling

- Groupe Adonis Environnement, Antananarivo. Cleaning and milling of various plastics for resale, >80 tons/year
- Madacompost, Mahajanga. Recycling of plastics (LDPE/PEBD), manufacture of bricks and pavement, 80 tons/year.
- MGETHAN Mi Harisoa, Antananarivo. Recycling of plastics (LDPE), manufacture of bricks, tiles and pavement (sand, cement, plastic).
- Plastik 2000 Ankadimbahoaka. Sorting, washing, milling and granulation of plastics collected by informal waste collectors. Resale for local manufacture (e.g. PET bottles)
- Société SMTP Antananarivo. Plastic manufacturer (sandals, many other products). Recycling of PET and industrial plastic packaging, 160 tons/year.
- SVITAPLAST Antananarivo. Manufacture of plastic items, buckets, bottle tops.
- Star. About 800 tons of waste plastic processed (2012), including for export.
- Le Relais Madagascar provides a public waste sorting service in Fianarantsoa and sends the products to various enterprises.
- SARL Madacompost, Majunga sorts about 7,000 tons of waste per year.
- Others include: Vohitra Environnement, CNRIT, Plastim'at (Antananarivo)

Sources: Charbuillet and others.¹⁷²

Figure 26. Plastic reuse in Madagascar



Images : PET bottle wall; Tana 'marche des bennes'; hot sauce, Diego Suarez

About 9,000 tons of plastic packaging are imported annually. This is a significant market – about 0.6 percent of imports with a value of over \$24 million and average import value of \$2.7/kg.¹⁷³ Madagascar benefits from a number of strengths and opportunities to expand the circular economy for plastics:¹⁷⁴

- increase in household waste collection and increased sorting of waste by households
- gradual establishment of coordination mechanisms between solid waste management stakeholders
- existing plastics industry and local markets for reuse and recycled plastic; possible opportunities for incineration for energy

¹⁷² Charbuillet, C. et J.-M. Meurville, 2018 Etude de la gestion des déchets plastiques de la zone COI. Arts et Metiers, ParisTech, AMValor, Inst, Carnot; UN-Habitat, 2012; Gevalor, 2015. Valorisation des déchets Antananarivo; Gevalor, 2012. Identification des opportunités de recyclage et évaluation rapide du secteur de la gestion des déchets solides à Antananarivo (Madagascar). Mai 2012. <https://documents.plateforme-re-sources.org/wp-content/uploads/2020/12/A43-Diagnostic-des-possibilites-de-recyclage-des-dechets-a%CC%80-Antananarivo-Gevalor.pdf>

¹⁷³ Comtrade, HS code 3923 for 2017-19 period.

¹⁷⁴ UN Habitat; Gevalor et al., 2015. Valorisation des déchets fermentescibles à Antananarivo. Rapport de terrain n°2 5/10/2015. Projet ORVA2D.

- low labour costs and an important (if disorganised) informal collection, sorting and resale services. Opportunities to help organise waste workers on a business footing with improved health and labour conditions.¹⁷⁵
- opportunities for entrepreneurs and innovators (but limited support)
- wide range of NGOs and local associations with experience of the sector
- potential to access financing from a range of projects which target SDGs (see below).

5.2.4 Awareness of MPP

While Madagascar has ratified the Nairobi Convention's LBSA Protocol, MARPOL Annex V and enacted national legislation on plastic bags, there is generally a low level of awareness of MPP and of the impacts of mismanaged solid waste on wellbeing.

A useful first step is to develop a national waste management plan upon which a strategy to combat MPP can be developed. Generic approaches to developing a MPP strategy and awareness initiative are described in the main report.

In the absence of a 'master plan' for MPP, awareness initiatives can target major sources of MPP. These would need to be clearly identified, but could include major coastal cities, ports and fisheries. Generic awareness products, such as materials for school curricula (see main report) could be adapted to local conditions and local MPP plans developed as 'add-on' to municipal and port solid waste management plans. At community level, awareness initiatives may need to be channelled into practical actions, such as the separation of plastic waste, access to sources of funding for recycling, possibilities with regard to EPR schemes and development of a business case for 'valorisation' of waste streams. It is important to acknowledge that targeting plastics in isolation from other solid waste value chains may not be a viable strategy. Campaigns can also focus on voluntary actions and procurement policies, e.g.: elimination of SUPs and reduction of plastics in public procurement, beach cleaning in tourist areas, codes of industry conduct to reduce SUPs and plastic waste, and EPR schemes to improve markets for waste products.

Although awareness of MPP is low, there is a growing awareness of the waste management problem and experiences in finding solutions which are adapted to local conditions.¹⁷⁶ NGOs and community organisations are often closely engaged in organising waste separation, waste collection services and payment schemes, raising awareness and community pride in cleanliness of streets and informal markets. NGOs are also engaged in studies of waste value chains, recycling and reuse initiatives.

Madagascar has a relatively high literacy rate (about 75 percent) so that mandatory labelling of plastic products to encourage recycling could be useful. The low rural population density presents a challenge to awareness raising as media such as radio has limited power. Awareness campaigns could potentially be associated with other initiatives on health, water, sustainability, or conservation in order to lower costs and link messaging to community priorities or projects.

¹⁷⁵ See, e.g.: Sonia Dias, Sonia. Integrating Informal Workers into Selective Waste Collection; The case of Belo Horizonte, Brazil. http://www.inclusivocities.org/research/BN6_Dias.pdf.

¹⁷⁶ GRET e RanEau, 2019. Déchets: Quelles solutions pour nos villes Malagaches? Atelier, Nov 2019. Institut Français de Madagascar.

5.2.5 Possible regional initiatives

Prevention, reduction, or control of MPP from foreign sources requires regional (and global) action. In cooperation with other countries, Madagascar could consider several initiatives:

- preparation of a joint strategic plan on MPP under the Nairobi Convention
- a COP resolution on monitoring and reporting on MPP and marine microplastic pollution as part of the implementing arrangements for the Nairobi LBSA Protocol
- preparation of a funding submission by the Nairobi Convention secretariat for a regional MPP monitoring programme, including from distant sources, collating information on beach clean-ups through existing initiatives, and preparation of a strategic plan on MPP
- further use of the regional projects supported by the IOC and Cap Business (e.g. in relation to recycling of PET bottles).

In conjunction with other countries, Madagascar could also consider initiating a dialogue in the regional economic commissions (COMESA, SADC) on trade issues related to MPP and plastic waste management in general. In particular, regional arrangements on trade in plastic waste (and other recyclable waste) would be useful to enable economies of scale in recycling. Regional measures to reduce or eliminate un-necessary plastics, such as microbeads in household products and selected SUPs would also foster innovation in development of local substitutes. Regional initiatives could also underpin a dialogue on EPR with regional suppliers, such as agents for fishing nets, soft drinks (e.g., development of regional deposit return schemes). Regional measures also invoke market power in relation to the behaviour of major users of plastics (e.g. PET bottles), can underpin dialogues with major corporate sources of MPP (see main report), and inform discussions within the WTO.

At the level of AIODIS and Africa, Madagascar could consider contributing to a common AIODIS position on MPP, possibly with a view to consolidating actions and positions through existing AMCEN and SIDS initiatives. Such engagement could also contribute to the oceans agenda of UNGA and UNEA. A regional action plan could also enable access to resources, including from global partnerships on plastic waste (see main report).

5.2.6 Resources

In Madagascar the political decentralisation is not matched with the budgetary decentralisation. The budget allocation from the central government is rarely over 15 percent of local recurrent expenditures on solid waste management.¹⁷⁷ Revenues collected by the local authorities rely heavily on sale of services, such as vendor fees from public markets. Local authorities face a range of structural difficulties in collecting local taxes from commercial establishments or residents, due to unclear land title, or deficient business registration. In the case of Antananarivo, the budget expenditure was 0.04 percent of GNI compared to expenditure of 0.2 percent on average for developing countries.¹⁷⁸ Antananarivo spends €0.6/person/year on solid waste management compared to €5.8/person/year in Lomé.¹⁷⁹

Given that the financial resources are not available, lessons from some Malagasy local authorities and from other island countries could be more widely applied (Box 7). In the absence of major funds for infrastructure investment, lower-cost interventions, including awareness raising and use of incentives

¹⁷⁷ UN Habitat, 2012. Madagascar: Profil Urbain National.

¹⁷⁸ Charbuillet, op. cit.

¹⁷⁹ AFD, 2018. Les déchets, combien ça coûte? Synthèses des Études et Recherches de L'AFD. <https://documents.plateforme-re-sources.org/documents/a285-les-dechets-combien-ca-coute/?res-country=76&res-theme=0&res-type=0&res-search&res-page=1&res-options=0>.

to improve consumer and household behaviour on waste management could be targeted.¹⁸⁰ Catalytic interventions could be identified as part of projects that address the relevant SDGs (Figure 27). In particular, community initiatives to manage waste and improved synergies between any existing public and private efforts could be targeted. Lessons could possibly be learned from experiences in organising informal waste-pickers to sort, collect, reuse, or recycle wastes generated by households, commercial establishments, hospitals, markets and other producers of wastes.¹⁸¹ Further studies could be prepared possibly as part of university theses, but organised in such a way as to target gaps in understanding of waste management, to identify options for waste valuation or for production of local products to substitute imported plastics.¹⁸² Some reports indicate a shortage of plastic waste for recycling suggesting opportunities to improve collection and sorting.

Box 7. Low-cost urban waste management. Lessons from Haiti

Tested approach

- Local skills' consolidation, raised awareness : waste characterisation and presentation of results at a public meeting ;
- Clean neighbourhood competition to help search for leading neighbourhoods ;
- Collaboration with a youth association & involvement with civil society (monitoring committee) ;
- Search with the municipality for a landfill site ;
- Development of economic activities and jobs (pre-collection - sorting - composting - recyclables' sales - handicraft).

Outcomes

- Better knowledge of the reservoir ;
- Pre-collection enterprise, sorting and value recuperation bring about numerous trained local players ;
- Population and schoolgoers sensitised ;
- Accredited landfill site, in the process of being acquired.

Which lessons ? The needs :

- a leader, from the community or the municipality, to shoulder such a project ;
- rope residents in as much as possible as their participation will be required to reduce costs ;
- start at a small scale, a pilot stage ;
- insist to obtain players' interest, on the experimental, scientific side of the pilot operation ;
- place the municipality in front of its responsibilities while helping it to find means to act, training the staff ;
- train interested players to manage small enterprises : de petites entreprises
- place the required means in marketing efforts upon materials recoverable value.

Source : Gaston, Jean. 2018.¹⁸³

¹⁸⁰ Solid waste management is not generally included in the programmes of major development partners. See e.g.: World Bank, 2020. Madagascar Country Economic Memorandum: Maximizing the Upturn to Foster a More Resilient Economy. February 2020. Where support is provided, it is often in a disjointed manner where studies and plans are not followed up with coherent institutional support and capacity building for implementation over an extended period.

¹⁸¹ Informal Economy Monitoring Study (IEMS). Pune's Waste Pickers: Realities & Recommendations.

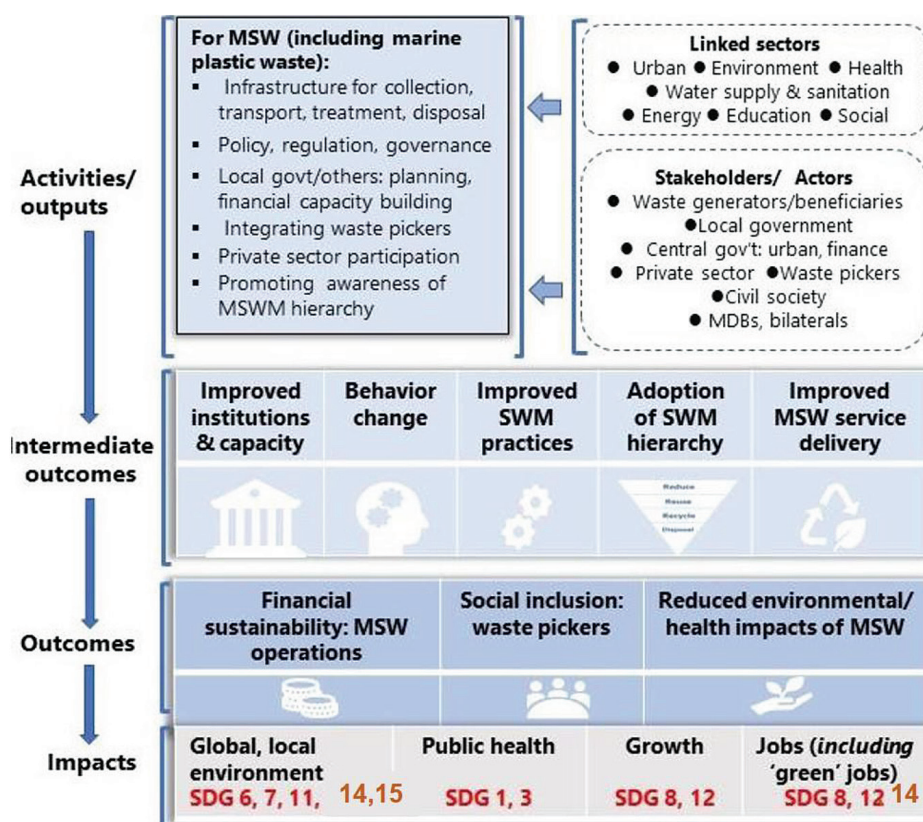
¹⁸² Accelerating the Circular Economy in Africa – Lessons from Algeria, Ethiopia, and Rwanda. <https://vimeo.com/484171717>; Angola. Desburocratização do mercado do lixo. <https://www.angop.ac/noticias/ambiente/jomo-fortunato-quer-desburocratizacao-do-mercado-do-lixo/>

¹⁸³ Gaston, Jean. 2018. Gestion intégrée des déchets à bas coût. Exemple de Gros-Morne en Haïti Conference de Dakar 23-25 Novembre 2017 (Université Quisqueya (Haïti), CEFREPADE, AOG).

Resources, motivation and scale. Waste management is generally a local responsibility and financing the costs involved is a primary concern. Contracts for collection and disposal are often granted on the basis of least cost and do not include provisions for recycling as the local authority is generally unable to obtain a direct benefit from reuse and recycling. The economies of scale for recycling often requires regular supply over an area larger than that of the local authority (e.g. several mairies) and coordination on such initiatives between the local authorities is rare. Local authorities lack of responsibility for waste management in unplanned settlements, particularly when no local taxes or service charges are paid by these 'bidonvilles'. In order to create incentives for manufacturing based on raw material from recycled plastic, any additional costs of recycling (such as internal recycled waste transport costs) may need to be offset by tariffs on imported raw materials, at least until such time as the local supply of recycled raw material is assured.¹⁸⁴ Import tariffs on SUPs or products with microbeads could be 'ring-fenced' and directed to managing plastic waste.

Investments could possibly prioritise the various forms of community actions, including beach clean-ups, deployment of youth groups, innovation in reuse and recycling and partnerships with business with a view to the use of unskilled labour to add value to waste. Greater community engagement could potentially secure the resources which are not available to municipal authorities through voluntary efforts or through labour paid by adding value to waste.

Figure 27. Links between management of municipal solid waste and the SDGs



Source: World Bank, Independent Evaluation Group.

Note: MSW = municipal solid waste; MDB = multilateral development bank; MSWM = municipal solid waste management; SWM = solid waste management.

The main project report provides greater detail and discussion of option for recycling of plastic waste and resourcing and financing opportunities. Reference can also be made to companion reports on the circular economy (in preparation under a separate consultancy).

¹⁸⁴ Baud, I. and Post, J. 2016. Between markets and partnerships: Urban Solid Waste Management and contributions to sustainable development. GBER Vol. 3 No.1 pp 46-65.



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