METALS AND PLASTIC RECYCLING IN MALDIVES

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Notes:
In this publication, "$" refers to the United States dollars and "Rf" refers to Maldives rufiyaa.
ADB recognizes "China" as the People's Republic of China.

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ABBREVIATIONS

3R	–	reduce, reuse, and recycle
COVID-19	–	coronavirus disease
DRS	–	deposit refund system
EBIT	–	earnings before interest and taxes
EPA	–	Environmental Protection Agency
EPR	–	extended producer responsibility
g	–	gram
HDPE	–	high-density polyethylene
HMS	–	high melting steel
IBC	–	International Beverages Company
IBM	–	Island Beverages Maldives
kg	–	kilogram
L	–	liter
LDPE	–	low-density polyethylene
MAWC	–	Malé Aerated Water Company
ml	–	milliliter
MOECCT	–	Ministry of Environment, Climate Change and Technology
MWSC	–	Malé Water and Sewerage Company
NGO	–	nongovernment organization
PET	–	polyethylene terephtalate
STELCO	–	State Electric Company
SWM	–	solid waste management
WAMCO	–	Waste Management Corporation Limited

EXECUTIVE SUMMARY

Maldives is a small island nation and faces growing challenges in managing more than 1,000 tons per day of solid waste generated across the country. Only a small proportion of this waste is managed sustainably due to the lack of adequate solid waste management (SWM) infrastructure, low awareness, and limited institutional capacity for sustainable SWM. As a result, most solid waste generated is dumped in the open, often ending up in the ocean, or burned without any control measures, causing environmental pollution and loss of valuable resources.

The reduce, reuse, and recycle (3R) approach sits at the backbone of both Maldives' SWM policy and sustainable SWM strategy. However, the recycling rates remain low despite the high volume of recoverable waste (e.g., plastics, metals, and paper) generated in the country. Knowledge of the market size and understanding of constraints for further recycling improvement in Maldives is limited. **This paper intends to fill this knowledge gap and provide recommendations to policy makers and SWM industry stakeholders on opportunities to further strengthen this sector, where viable.** A stronger recycling industry may contribute to improve overall SWM system efficiency and sustainability. It can also provide further business and employment opportunities and contribute to the green growth.

Recycling Sector in Maldives

Recycling in Maldives is not developed, and the efforts are scattered and unsystematic. Although both the National SWM Policy and the Waste Management Regulations have 3R as a core element, they have not succeeded in effectively promoting or incentivizing recycling business at a large scale. It is difficult to determine the recycling rate precisely, but a rough estimate based on plastics may conclude that this is below 2%. Because of the lack of a modern waste collection system including source segregation, the Waste Management Corporation Limited (WAMCO)—the state-owned company for solid waste management in Maldives—nongovernment organizations (NGOs) and informal players collect recyclables materials ineffectively and inefficiently. Recyclables are then transported to yards for training or for interim storage before they are exported abroad.

Almost 100% of demand for recyclable materials is abroad. There are no reprocessing industries (e.g., steel or paper mills, plastic resin production facility) in Maldives. The country's unique context as a small island nation does not appear to provide sufficient economies of scale for the establishment of such activities, except for polyethylene terephthalate (PET) bottle production which is currently estimated at 3,500 tons per year (no recycled PET is used, however). The main economies for export of recyclables between 2017–2019 include India, Sri Lanka, and Taipei,China.

Recycling in Maldives is very costly and challenging. Although there is a substantial difference across materials driven by waste availability, quality, and transportation requirements, the major challenges that recycling businesses face are (i) high shipping or transportation cost, (ii) logistics given Maldives' scattered geography, (iii) lack of modern solid waste collection and transfer system for segregated waste, and (iv) increasing restrictions on waste imports and quality from several surrounding economies where materials are reprocessed.

The report analysis focuses on two waste streams: metals and plastics.

Metals

Collecting and exporting metals from Maldives is a viable business. The scrap metal collection industry appears to be growing in Maldives. In 2019, the volume of scrap metals exported amounted to approximately 20,000 tons at a value of $3 million (Rf46 million), up from approximately 13,000 tons in 2017. The ferrous metals collected and exported include steel and cast-iron products, while the nonferrous metals include aluminum, copper, and brass. Scrap metal exporters also recovered and exported used batteries. Approximately 97% of the exported scrap metal was steel and iron. India appears to be the main destination of the exports followed by Sri Lanka, the Republic of Korea, and Malaysia. This is not surprising because India is the second largest steel producer in the world and given its proximity to Maldives, shipping costs are lower.

Our analysis shows that the existing business model of collecting and exporting potential metal recyclables to India is financially viable, considering the raw material high price (even before the pandemic) and contained cost and logistics given low quality and import requirements, and the relative proximity to the country. Most metal exports to India are usually sent through *dhonis* (local boats), which are used to import general goods and perishables to Maldives and would otherwise return to India empty. This arrangement results in low shipping costs, improving the business viability of recovering and exporting metals for recycling. The export price on steel and iron is also lower than the price of the commodities in India.

Plastics

Recovering and exporting of plastic materials is expensive, logistically challenging, and viable only at a high selling price. In 2019, annual volumes were estimated at approximately 280 tons. The export volume of plastic waste has been reduced by half since 2017. Despite this reduction in volume however, the overall export value (derived from free-on-board prices) increased by approximately 47% from $55,000 to $80,000 between 2017 and 2019. This suggests a significant change in the price that in the recycling business is typically driven by demand variations but also by the value chain the recyclable plastics are used for. For example, prices offered by a company in Taipei,China—where sportswear are made from plastic bottles—has been greater than the prices offered by Indian clients who do not produce upscale products.

The overall amount of plastic exported and recycled is estimated to amount to approximately less than 2% of the total plastic waste generated. More than 75% (by weight) of the plastics exported for recycling is PET bottles.

Parley Maldives, the local branch of the international NGO Parley for the Oceans, appears to be the only exporter that was able to sustain plastic exports over the years, probably also because of its strong community engagement activities and international partnerships. The bulk of the material that Parley exports is mostly PET bottles, which it collects directly at source, especially in communal establishments such as schools, and during clean-up campaigns from beaches. Parley's export destination for PET is Taipei,China at a sportswear manufacturing facility. Some scrap metal exporters had attempted to venture into the PET recycling business but did not continue their exports after a few attempts. It is estimated that approximately 5%, by weight, is recovered out of the 3,500 tons of PET bottles locally produced in Maldives annually, most of the remaining PET and other plastics end up in the Thilafushi dumpsite or in the ocean.

Collecting and recycling plastics has proven to be lower in value and more challenging compared to metals, given higher logistics efforts that the material requires; plastics are less dense, thus needing compression (baling) and containerization for long haul transfers. Also, since 2018, major

plastic recycling and reprocessing countries in Asia, including India and the People's Republic of China, stipulated import bans on plastic waste from abroad. This caused the exporting countries to look out for alternatives, potentially farther destinations for their recyclable materials that resulted in a significant change in trading patterns—and therefore, higher logistics costs—across the world.

Our analysis of the commercial viability of plastic recycling showed that the existing business model of collecting and exporting plastic waste from Maldives may be sustainable only if a minimum tonnage of plastics (i.e., 120 tons per month) can be sold at a high price (between $470–$580 per ton). This is often difficult to maintain constantly as commodity markets like plastics fluctuate considerably, and this may be one of the reasons why several businesses including metals exporters who tried to venture into the plastics recycling business have not succeeded.

Parley's business that manages approximately 20–40 tons per month is able to continue thanks to the high selling (subsidized) price for recovered plastic.

Opportunities to Improve Material Recovery and Recycling

To improve material recovery, especially plastics in Maldives, three key factors would need to be considered given the challenges and constraints identified above: (i) lower logistics costs, including collection and transport; (ii) maintain a stable high selling price for plastics to make business viable; and (iii) partner with the private sector and nearby countries with reprocessing infrastructure.

To achieve these, the following five key steps are recommended:

(i) **Establish a modern waste collection and transportation system across the country** that includes segregation of recyclable materials coupled with continuous behavior change campaigns. This should aim to reduce recyclables leaking into the environment, improve their quality by reducing contamination, and decrease costs through economies of scale for collection. Successful initiatives in Maldives, which promote recycling and collect PET bottles and other rigid plastics through community engagements in islands, schools, and resorts (e.g., Parley Maldives) should be replicated across the country.

(ii) **Introduce an extended producer responsibility (EPR)** scheme to help cover the high cost of recycling in the country and stabilize the fluctuating selling prices of materials such as plastic. In countries where EPR schemes are well-designed and recycling rates are high, most separate collection and processing or treatment costs are financed through contributions paid by producers. EPR schemes could encourage the design for material recycling, help improve the efficiency of the recycling process, reduce littering, and promote better cooperation among manufacturers, local governments, the public, and the recycling or reprocessing industry. The regulatory environment must assign clear roles and responsibilities to all stakeholders involved in any recycling business. As a special component of an EPR, import taxes on virgin materials can be imposed that can support domestic recycling to mature.

(iii) **Establish public–private partnerships with exporters and recyclers** and improve business viability through viability gap contributions or subsidies. For example, the government may provide land for sorting, storing, and baling; and/or subsidizing electricity prices in return for performance requirements (i.e., minimum amount of waste recycled/exported per year) to be met. This would result in improved environmental benefits at little cost and effort for the government. For example, Parley, as a key private stakeholder, is interested to finance, build, and operate a sorting line on Thilafushi and explore local recycling options for upscale products (see also item [v]) so that a pilot circular economy approach can be established. WAMCO, as a core public stakeholder, may then act as supplier of the input material at Thilafushi free of cost.

(iv) **Explore preferential freight prices to key recycling destinations with shipping companies**, and international cooperation agreements with countries with major reprocessing facilities (subject to quality requirements) given the high transportation costs and the limited in-country demand of a small island country like Maldives.

(v) **Incentivize domestic market demand and innovative waste reprocessing facilities for recyclables** through partnerships with international industries or players (i.e., PET pelletization for PET bottling plants or advanced 3D printing in Maldives), although this may be limited only to a niche market or application.

Considerable challenges to substantially expand recycling in a small island context like Maldives will remain in the short to medium term because of the limited economies of scale, high transportation costs, and very low starting point. The transition into a circular economy promoting innovative recycling and material applications has the potential to transform the recycling outlook and minimize waste of valuable materials worldwide. However, this will take years if not a decade. While recycling maximization should be pursued together with waste minimization initiatives , **it is crucial to continue concentrating efforts to establish a sustainable and holistic SWM systems for Maldives that can treat and sustainably dispose all the waste generated that cannot be recycled because of current technical, behavioral, and commercial limitations. This remains a crucial milestone to preserve Maldives' pristine environment, ocean health, and make its blue economy thrive.**

I. INTRODUCTION

1. Maldives faces growing challenges in managing more than 1,000 tons of solid waste generated daily across the country. Only a small proportion of this waste is managed sustainably due to the lack of adequate solid waste management (SWM) infrastructure, low public awareness, and limited institutional capacity. As a result, most solid waste is dumped in the open, often ending up in the ocean, or burned without any control measures, causing environmental pollution and loss of resources.[1]

2. With the launch of the *Saafu Raajje* (Clean Maldives) initiative in 2015 and the introduction of the Strategic Action Plan 2019–2023, the national government began developing the required infrastructure, building institutional capacity, and raising public awareness aimed at achieving sustainable SWM across Maldives' seven administrative zones.[2] These initiatives have been supported by several development partners such as the Asian Development Bank, Asian Infrastructure Investment Bank, the World Bank, and Islamic Development Bank.[3]

3. The reduce, reuse, and recycle (3R) approach is the backbone of both Maldives' SWM legislative framework and its sustainable SWM strategy.[4] There is also a growing public awareness on the 3R concept. However, the recycling rates remain low in Maldives despite the high volume of recoverable materials (e.g., plastics, metals, and paper) generated. It is difficult to determine the recycling rate precisely, but a rough estimate based on plastics indicates that the rate is below 2%.[5] Recycling appears to be driven largely by the market demand for raw materials and is often led by the private sector, rather than driven by policy and regulatory instruments. The knowledge of the market size and understanding of constraints for further recycling improvement in Maldives is limited.

4. This study aims to get a better understanding of the current situation of solid waste recycling in Maldives and provide concrete recommendations to policy makers and SWM industry stakeholders on opportunities to further strengthen this sector.

5. The report is divided into eight Chapters. Chapter 1 includes an introduction and discussion of the study methodology and its limitations (Chapter 2). Chapter 3 summarizes the legislative and institutional framework related to SWM and recycling in Maldives. Chapter 4 describes the current situation of the recycling in the country and focuses on the main types of recyclables and their export destinations. Chapter 5 analyzes the viability of business models for plastic and metals exporters. Chapter 6 sets out the potential of PET recycling in Maldives. Chapter 7 summarizes the local initiatives, challenges, and opportunities for the recycling industry in Maldives. Chapter 8 concludes the report and presents the key findings of the study.

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1 Government of Maldives, Ministry of Environment and Energy. 2017. *State of the Environment 2016*. Malé.

2 Government of Maldives. 2019. *Strategic Action Plan, 2019–2023.* Malé.

3 ADB. 2020. *Report and Recommendation of the President to the Board of Directors: Proposed Loan, Grant, Technical Assistance Grant, and Administration of Loan and Grant to the Republic of Maldives for the Greater Malé Waste-to-Energy Project. Sector Assessment (Summary).* Manila.

4 Government of Maldives, Ministry of Environment, Energy and Water. 2015. *National Solid Waste Management Policy for the Republic of Maldives.* Malé.

5 This assumes about 22,000 tons per of plastic waste is generated in the country (Royle et al., 2022) and only 300 tons per year (average between 2017–2019 data reported in Chapter 4) are exported for recycling.

II. METHODOLOGY AND LIMITATIONS

A. Research Questions

6. To achieve its objective, this study aims to answer to the following research questions:

(i) What are the major recycling activities and what is the size of this industry in Maldives?
(ii) Who are the major players in this industry and on which business model do they operate?
(iii) Which is the policy framework (national and international) for recycling?
(iv) What are the key constraints for recycling in Maldives?
(v) What are the key opportunities to develop this industry further?
(vi) What is the viability of metal and plastic recycling businesses, and under which conditions?
(vii) Would recycling solve the SWM problem in a country like Maldives in the short to medium term?

B. Methodology

7. The study used both primary and secondary, quantitative, and qualitative data and was based on a combination of desktop and interactive research methods. The national and international legislative framework was reviewed to understand how it targets the recycling of valuable materials and what additional elements on the national level would allow an increase in the recycling rates, for example, through source segregation activities and/ or development and strengthening of local recycling businesses in Maldives.

8. The potential for recovery of recyclables and recycling in Maldives was assessed through literature review, interviews, site visits, and primary data analysis. This assessment involved representatives of key stakeholder groups (including collectors of recyclable materials, operators of junk yards, and exporters) and the challenges they face, the types and volumes of recyclables collected and exported, the supply chain arrangement, prices, destinations of exports, costs associated with the export activities, and factors that could potentially affect the future export of recyclables in Maldives.

9. The interviews were carried out in a structured format using a questionnaire that was prepared in advance. The questionnaire was used for both face-to-face and telephone interviews. Initially, the questionnaire was emailed, where possible, to recipients to be completed. However, this approach was not effective as only one filled questionnaire was received back via email.

10. The initial round of interviews helped identify other stakeholders who were then approached for information and clarifications. They included Tafe Steel, Secure Bag, Parley, Newtown Inn, Multiway, Build Trade, Waste Management Corporation Limited (WAMCO), Malé Water and Sewerage Company (MWSC), Island Beverages Maldives (IBM), Malé Aerated Water Company (MAWC), and Happy Market Trading Company. The manufacturing companies were contacted to get estimates of their production levels, any recycling activities planned or implemented, and the challenges they face.

11. Anonymized export data were retrieved from the Customs Services to get a better understanding of the volumes, export prices, and destinations of recyclables. The assessment was carried out using the available data for the period from January 2017 to October 2019. The 2020 and 2021 data were not collected and used to avoid data distortion due to potential coronavirus disease (COVID-19) impacts.

12. The research evaluated the potential demand from the recycling industries in the neighboring countries to absorb the exported recyclables from Maldives through reviews of literature, respective legislations, and regulations, and also through interviews with SWM professionals.

13. As part of the study, the site visits were carried out to the junkyards to understand the prevailing business models through direct observations of collection operations. The site visits were also used as an opportunity to interview street collectors working at the junkyards to get a better understanding of their operations and market prices of the recyclables. Several junkyards (located in Malé, Thilafushi, and Hulhumalé) were visited more than once during the study period with an attempt to capture a full cycle of collection.

C. Limitations

14. When preparing this report, every attempt was made to obtain reliable data and information. However, the quantitative outcomes of the study shall be treated with caution due to data availability and consistency of the data presented by different sources (for example, exports data for only 3 years (from 2017 to 2019) was retrieved from Customs Services. Data related to 2020 and 2021 was not collected given the exceptional challenges of the COVID-19 pandemic.

15. The language barrier was also a constraint for obtaining primary data on types and volumes of materials processed in some junkyards. Junkyards are substantially operated by foreign workers and communication with them was difficult. Some private collectors and local dealers were reluctant to share the information on volumes or prices of recyclable materials as they considered this to be business-sensitive.

16. Due to the limited data available, this study focuses primarily on recyclable materials that have a "high value" and currently represent the largest export market size, such as metals and plastics.

17. It has been initially envisaged that plastic waste generation will be estimated using plastic import data. However, Customs Services maintains its records based on harmonized system codes that do not allow information on specific product packaging to be obtained. Products such as soft drinks and personal hygiene products are wrapped in different types of packaging materials, not only in plastics, which make the assessment more difficult. Finally, the measurement units used for these products are often shown in liters and/or numbers of products. Due to these factors, it was not possible to make plausible estimates on plastic waste generation by using import data only.

III. LEGISLATIVE AND INSTITUTIONAL FRAMEWORK RELATED TO WASTE MANAGEMENT AND RECYCLING IN MALDIVES

A. Overview of the National Legislative and Institutional Framework

18. The solid waste management legislative framework in Maldives is based on the National Solid Waste Management Policy (2015) and the Waste Management Regulation (No 2013/R-58), which complement the general Environmental Protection and Preservation Law (Law No. 4/93) (footnote 4). This strongly promotes the 3R approach.

19. The National SWM Policy and the Waste Management Regulation set out key strategic, governance, and legislative principles to meet worldwide statutory objectives for waste management, including (i) the waste hierarchy approach to SWM, prioritizing waste minimization and resource recovery; (ii) proximity principle and self-sufficiency, requiring waste to be dealt with as close as possible to where it is generated; (iii) the "polluter pays" approach, reflecting the environmental and health costs of waste generation, treatment, and disposal in the price of products and SWM fees; and (iv) the best practicable environmental option as a major tool for decision-making (footnote 3).

20. **The National SWM Policy 2015** intends to harmonize the waste management guidelines, regulations, standards, and waste management plans across the nation. There are 10 policies and 16 objectives articulated in the national policy. In essence, the policy (i) defines the responsibilities for SWM, assigning the regulatory role to the Ministry of Environment, Climate Change, and Technology (MOECCT) and the monitoring role to the Environmental Protection Agency (EPA); (ii) divides Maldives' territory into seven administrative zones, mandating a regional waste management facility in each of them; (iii) focuses on 3R and raising citizen awareness; (iv) mandates the development of island waste management plans and systems, including equipment and facilities (island waste management centers), on all inhabited islands; (v) specifies mechanisms for SWM fee collection; and (vi) mandates residual waste from islands to be transferred to regional waste management facilities.

21. The National SWM Policy mandates the Waste Management and Pollution Control Department in the MOECCT to ensure safe waste disposal, cost-effective, and environmentally responsible waste management, and pollution controls on all inhabited islands. The department is also in charge of drafting national strategies and action plans to implement national policies, while the Utility Regulatory Authority (URA) is the regulatory body that enforces the national provisions for SWM, and the EPA is the environmental body taking care of environmental compliance. Both bodies are subordinated to MOECCT. In 2010, the government formulated a national decentralization program under which island councils are mandated to provide key municipal services, including SWM. In 2016, WAMCO, a state-owned operator and the major SWM player in the country, was contracted to provide solid waste collection and transfer services in large and populated areas such as the Greater Malé region.

22. The policy includes specific provisions on recycling in the ninth policy statement, which aims to facilitate and encourage earning from waste resources and use the earnings for waste management in the islands. These are shown in Table 1.

23. In 2016, WAMCO was contracted to provide solid waste collection and transfer services in large and populated areas such as the Greater Malé region.

Table 1: Clauses in the National Solid Waste Management Policy Relevant to Recycling

Policy	Policy No. 9: Facilitate and encourage earning from waste resources and use such earnings for waste management in the islands where feasible
Objective	Objective No. 1: Promote the concept of 3R in Maldives to reduce waste
Strategies	• Revise the laws and regulations to accommodate and foster the practice of 3R concepts • Regulate the reuse and recycle industry and facilitate the commercialization of reusing and recycling • Research on measures to reduce waste generation • Encourage and assist producers of waste to reduce waste • Public awareness on waste reduction

3R = reduce, reuse, and recycle.

Source: Environmental Research Center, Ministry of Environment and Water (today MOECCT), National Solid Waste Management Policy for the Republic of Maldives.

24. **The Waste Management Regulations**, in line with the National SWM Policy, aim to (i) implement measures to minimize impacts on the environment and human health; (ii) define waste management standards; (iii) formulate an integrated framework and establish a sustainable waste management system; (iv) promote waste reduction, reuse, recycle, and recovery; (v) implement polluter pays principle; and (vi) introduce extended producer responsibility (EPR). The regulations define the approval permits, procedures, and standards for collection, transfer, treatment, and disposal of waste. Clause 15 of the regulations is specific for recycling and requires the entities interested to conduct recycling and recovery businesses to obtain a permit from enforcing authorities (e.g., URA and EPA). The required information to be included in the proposals is also clearly stated within the regulations. In October 2021, the government approved the fifth amendment to the regulation (2021/R-109) mandating provisions for source segregation of recyclables, food waste, and residuals (all other materials) with the objective to strengthen 3R.

25. **The government's strategic action plan (2019–2023)** continues to recognize SWM as the most visible and pressing environmental issue and details policy actions to promote waste as a valuable resource, including strengthening waste collection and management in the country, establishing regional waste management facilities, and expanding waste-to-energy (footnote 2). The plan also includes key actions to introduce EPR, apply the polluter pays principle, and ban the use and sale of single use plastic over the long-term period.

26. In December 2020, the government ratified an amendment to **the Export–Import Act of Maldives** (Act No. 31/79).[6] The amendment confers the authority to the President of Maldives to compile a list of single-use plastics to be banned from importation. The objective is to phase out single-use plastics by 2023. The items as shown in Table 2 had been declared by the presidential resolution, 8/2020, as prohibited to import starting from the specified dates. The presidential decree is specifically applicable to imports and not to locally manufactured plastic products.

Table 2: List of Plastic Items Prohibited to Import

Prohibited to import from 1 June 2021	Prohibited to import from 1 December 2022
• Drinking straws • Plastic plates, cutleries, and stirrers • Styrofoam lunch boxes • 30x30 cm carrier bags • Betel nuts in plastic wrapping • Below 250 ml coffee cups • Cotton wool buds • 50 ml and smaller toiletry bottles • Below 500 ml PET beverage bottles	• Carrier bags below 50-micron thickness • 50–200 ml toiletry bottles • 1 l-PET beverage bottles

cm = centimeter, l = liter, ml = milliliter, PET = polyethylene terephthalate.

Source: Government of Maldives, Ministry of Environment and Energy. 2021. *The Maldives bans single-use plastics effective from today.*

27. There are six specialist policies (with strategies) that aim to strengthen national waste data and EPR. The two policies that are most applicable to recycling activities are as follows:

(i) Policy 1: Ban on import, production, and sale of specific single-use plastic products; and
(ii) Policy 2: Market base instruments.

[6] Government of Maldives, Office of the President. 2020. President Declares List of Single-Use Plastics Prohibited to Import from June 1, 2021. *Press release.* 30 December.

28. These two policies intend to implement market instruments to drive the ban on single-use plastic. The accompanying strategies include increasing tariffs for single-use plastics, setting a zero percentage tariff for alternative products or products made from reused materials, providing incentives, and business facilitation.

29. The Maldives legislative framework does not have an effective EPR scheme yet although EPR is part of the National SWM Policy. In countries where EPR schemes are well-designed and recycling rates are high, most separate collection and processing and/or treatment costs are financed through contributions paid by producers. EPR systems could encourage design for material recycling, help improve the efficiency of the recycling process, reduce littering, and promote better cooperation among manufacturers, local governments, the public, and the recycling and reprocessing industry.

30. The MOECCT launched a United Nations Development Programme-funded project, which aims to elaborate a road map for an EPR scheme for plastics and packaging waste that will facilitate the MOECCT to transpose it into the national law.[7] The time horizon of this project is from March 2021 to February 2023.

31. The government is also considering a new SWM legislation to further strengthen the current legislative, regulatory, and institutional framework on waste management.

B. International Conventions Regulating Waste Movements

32. Maldives is a signatory to **the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal (Basel Convention)**, which is a multilateral environmental agreement that restricts the movement of hazardous waste between countries.[8] The Basel Convention also provides a regulatory framework for the transboundary movements of waste in cases it is permissible. Maldives signed the Basel Convention in April 1992 and is obliged to follow its protocols in exporting waste, including for recycling purposes. Since 2018, importers of recyclable materials have been faced with further restrictions and quality requirements that affect imports.

33. Despite some uncertainties on how the recently imposed new Basel Convention procedures (as per Annex IX) will impact exporters of mixed recyclables, it is very likely that they will be required to formally undertake a notification for all mixed plastic wastes. Most likely, single material exports will continue being exported as before but they may face more rigorous inspections in the future to verify that the shipment delivers the declared quality and contains a single type of material.

IV. STATUS OF RECYCLING IN MALDIVES

34. Based on the analysis of data collected as part of the desk study and the primary data obtained through interviews of key market players and stakeholders in the country, there is no developed waste recycling industry in Maldives. Reprocessing industries (e.g., steel or paper mills, plastic resin production facilities) do not exist in the country. Its unique context as a small island nation does not appear to provide sufficient economies of scale for the establishment of such activities, except for Ministry of

[7] United Nations Development Programme. 2021. *An EPR Scheme for Plastic and Packaging Wastes.* Malé.

[8] United Nations Environment Programme. 1989 and 2020 (revised). *The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal – Revised in 2019*. Basel.

Environment, Climate Change and Technology polyethylene terephthalate (PET) bottles production which is currently estimated at 3,500 tons per year (no recycled PET is used). As a result, almost 100% of the demand for recyclables is abroad.

35. Recycling efforts in the country are limited to collecting and sorting recyclable materials, with a number of small key players operating in the market. Although both the National SWM Policy and the Waste Management Regulations have 3R as a core element, they have not succeeded to effectively promote or incentivize recycling at a larger scale. It is difficult to determine precisely, but a rough estimate based on plastics may conclude that the recycling rate is below 2%.[9]

36. Collection activities are scattered and often not being carried out transparently. Unlike other countries, Maldives cannot rely on a huge informal sector due to several reasons, of which the general affluence level in the country does not stimulate informal activities for unattractive materials like plastics. Street collectors targeting metals, instead, intercept these unsystematically and bring them to junkyards for trading and/or for interim storage before they are ready to be exported. Only one player focusing on plastics (Parley Maldives) has established a systematic approach to intercept recyclables across different islands in the country. This consists of promoting source segregation, separating collection through jumbo bags and compressing plastic into bales to reduce storage and transportation cost.

37. Key export destination, data, and analysis on metals and plastic recycling are as follows.

A. Export Destinations

38. Based on the analysis of the export data, it emerged that India; Sri Lanka; and Taipei,China, are the major importers of recyclable materials from Maldives and other countries in Asia (e.g., Indonesia, the Philippines, Thailand, and Viet Nam).

39. Triggered by the People's Republic of China (PRC) banning plastic imports as of 2018, the other importing economies (as listed above) stipulated similar import bans. This required the exporting countries to look out for alternative destinations for their recyclable materials that resulted in a significant change in the trading patterns across the world (footnote 9). As of 1 January 2021, the PRC prohibited the import of any type of waste materials except for some types of scrap metals that may lead to additional import restrictions by other economies.[10]

40. India—a key reprocessing market and importer for recyclables—barred the import of any scrap plastics beginning October 2019.[11] India has also tightened its quality standards for the import of mixed paper, only allowing a contrary content of 1% as verified through more rigorous inspections.

41. Following the example of its neighbor, Sri Lanka also suspended the importation of a range of plastic products (including polymers of ethylene in primary forms, builder's ware, sanitary ware, kitchenware, and packaging material made of plastic).

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[9] W. Zongguo et al. 2021. China's Plastic Import Ban Increases Prospects of Environmental Impact Migration of Plastic Trade Flow Worldwide. *Nature Communications* 12. 425.18 January. https://www.nature.com/articles/s41467-020-20741-9; and C. Zao et al. 2021. The Evolutionary Trend and Impact of global Plastic Waste Trade Network. *Sustainability*. 13. https://www.mdpi.com/2071-1050/13/7/3662/pdf.

[10] *Recycling Magazine*. 2021. Navigating the Latest Changes in Waste Legislation. 10 March. https://www.recycling-magazine.com/2021/03/10/navigating-the-latest-changes-in-waste-legislation.

[11] P. Jestin. 2019. India Plugs Loopholes in Import Ban of Plastic Scraps. *Independent Commodity Intelligence Services*. 18 October. https://www.icis.com/explore/resources/news/2019/10/18/10431546/india-plugsloopholes-in-import-ban-of-plastic-scraps.

42. Indonesia and Malaysia also apply a stricter import control on their plastic imports and barred containers from being unloaded, even requesting exporting nations to take back the waste material.

43. Further efforts to impede trade in recyclables are expected to be undertaken by both exporting and importing entities once the new Basel Convention procedures are applied (as discussed in Chapter 3).

B. Types of Exported Materials and Key Market Players

44. The analysis of export statistics for the period January 2017–October 2019 has shown that 23 legal entities exported recyclable materials from Maldives to Sri Lanka; India; the Republic of Korea; Malaysia; and Taipei,China. The types of exported recyclables during this period included the following:

(i) heavy melting steel (HMS) (steel and wrought iron);
(ii) brass;
(iii) copper;
(iv) aluminum;
(v) acid battery;
(vi) paper;
(vii) fishing net; and
(viii) plastic, including PET, high-density polyethylene (HDPE), and low-density polyethylene (LDPE).

45. Table 3 and Table 4 show the list of 23 companies that exported scrap metals, paper, and plastic materials from 2017 to 2019. Due to possible sensitivity issues around the export market, the companies are presented in these tables as consecutive numbers rather than their business names.

Table 3: List of Companies that Exported Metal Scrap, 2017–2019

Exporter	Year	Types of Exported Recyclables
Company 1	2018	HMS
Company 2	2018	HMS
Company 3	2017	HMS
Company 4	2017 2018	aluminum, copper brass, copper
Company 5	2019	battery, HMS
Company 6	2017 2018	HMS
Company 7	2017 2018	copper, HMS aluminum, HMS
Company 8	2017 2018 2019	HMS HMS aluminum, HMS
Company 10	2017 2018	aluminum, HMS HMS
Company 11	2019	HMS

Continued on next page

Table 3 continued

Exporter	Year	Types of Exported Recyclables
Company 12	2017 2018 2019	aluminum, battery, HMS aluminum, battery, HMS aluminum, HMS
Company 13	2018	HMS
Company 14	2019	HMS
Company 15	2019	HMS
Company 16	2018	HMS
Company 18	2018 2019	aluminum, copper copper
Company 19	2018 2019	aluminum, HMS aluminum, copper, HMS
Company 20	2019	aluminum, HMS
Company 21	2019	aluminum, battery, copper, HMS
Company 22	2017 2018 2019	aluminum, battery, copper, HMS aluminum, battery, copper, HMS battery, HMS

HMS= heavy melting steel.

Source: Authors, based on interviews and Customs Export data.

Table 4: List of Companies that Exported Paper and Plastic Wastes, 2017–2019

Exporter	Year	Types of Exported Recyclables
Company 5	2019	HDPE
Company 7	2018	paper
Company 8	2017	fishing net
Company 9	2017	PET
Company 17	2018 2019	PET, HDPE PET, HDPE
Company 22	2017 2018 2019	PET paper paper
Company 23	2017 2018	LDPE LDPE, PET

HDPE = high-density polyethylene, LDPE= low-density polyethylene,
PET = polyethylene terephthalate.

Source: Authors based on interviews and Customs export data.

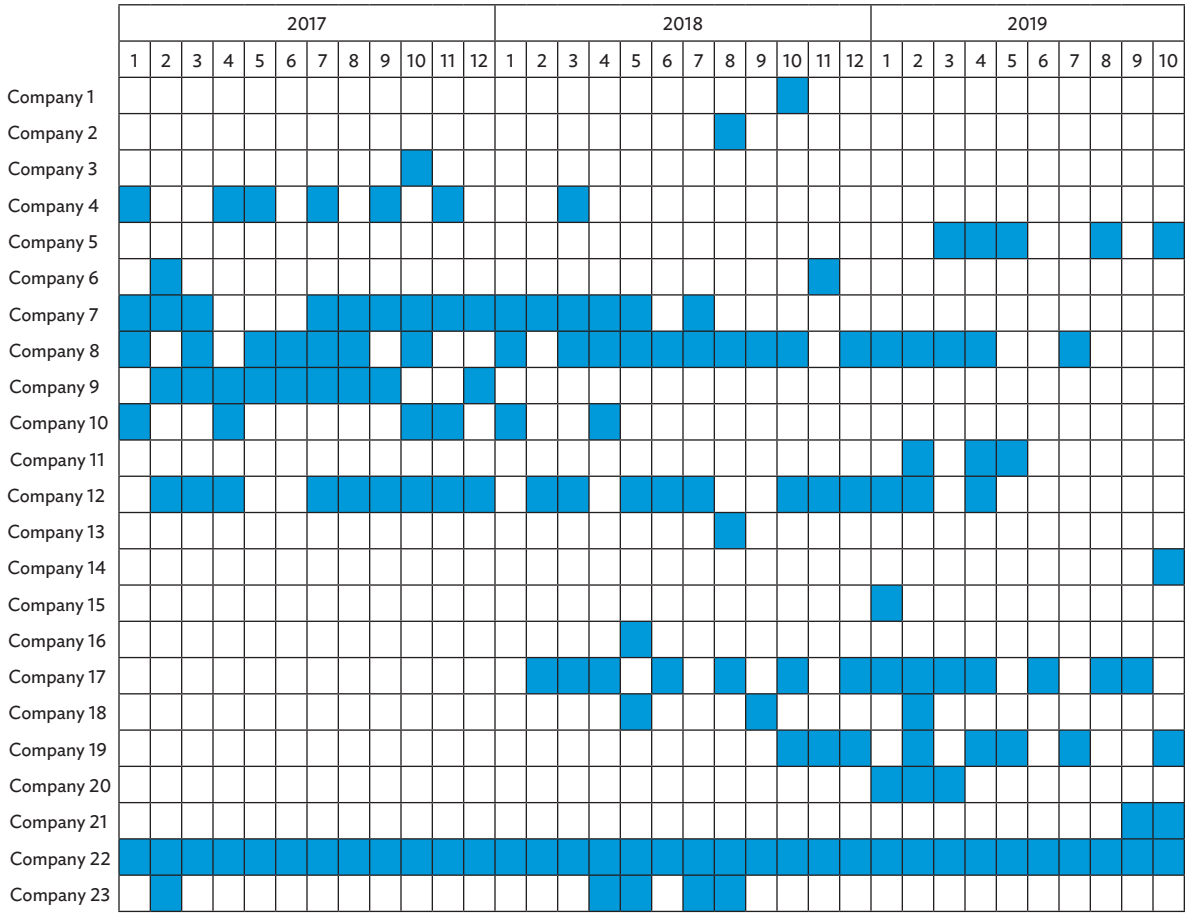
46. Figure 1 illustrates the frequency of exports; the months when exports of recyclable materials are reported are shown in blue.

47. Three companies exported scrap metals while one company exported plastics regularly over the reported period. Only one of them (Company 22) exported recyclable materials consistently every month. Seven companies reported occasional exports (i.e., once or twice) within the reported period. One of the reasons was that they were not able to collect sufficient monthly volumes of recyclables to make regular shipping feasible. The other reason, as some players explained, was associated with logistics; the export shipments were not scheduled every month because they had to face storage constraints.

48. During the interviews, it emerged that there are some scrap metal exporters who operate on a contractual basis. For these companies, exporting of scrap metals is not their primary business. Even the regular exporters cannot rely on income from recyclables and have other business activities in their portfolio.

49. One of the interviewed businesses that is currently exporting PET and HDPE plans to start intercepting polypropylene and intends to consider new export destinations in Europe. It is also planning to set up a local sorting facility in Greater Malé in collaboration with the government and WAMCO, and in coordination with an ADB project. The overall strategy is to establish a local plastic recycling chain that includes shredding, washing, and pelletizing of plastic materials for more efficient use at the local end markets. Once this facility is commissioned, larger volumes of recyclables for processing can be accommodated

Figure 1: Reported Export Frequency of Recyclable Materials



Source: Authors based on Customs export data.

C. Export of Ferrous and Nonferrous Metals, and Batteries

1. Supply Chain and Quality Requirements

50. The collected scrap metals are sorted at junkyards in Maldives and then exported for recycling abroad. Ferrous and nonferrous metals are the most widely collected recyclable materials. The scrap metal collection activities were observed primarily in Malé, Thilafushi, and Hulhumalé.

51. The ferrous metals collected include mild steel, cast iron, and stainless steel. The nonferrous metals include brass, copper, and aluminum. Steel scraps are often sourced from discarded engines, structural steel products, and components like motors of electrical equipment.

52. The supply chain is similar for all scrap metal businesses. During the site visits it was observed that the sorting operations were predominantly carried out by a small number of foreign workers, mainly from Bangladesh. One or two staff work at the junkyard, receiving and sorting the materials while the street collectors source, sell, and bring the materials to the junkyard. The street collectors are either employed directly by the business or self-employed. Sometimes locals also bring recyclable materials to the junkyard that would otherwise be dumped at WAMCO facility. The sorted materials are accumulated at the junkyards in sufficient quantities before they are ready to be exported.

53. According to the companies engaged in scrap metal collection, they do not impose quality requirements on the street collectors, and foreign buyers do not define export specifications. After the material is received at the junkyard, steel and cast iron are kept together while batteries, aluminum, copper, and brass are stored separately.

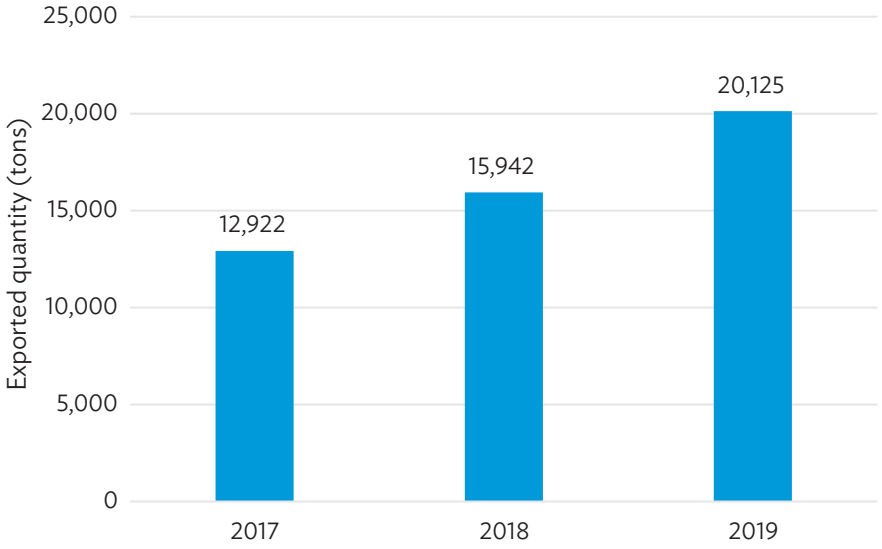
54. When cables, electronics or mechanical equipment or components are brought to the junkyard, they are first broken down to extract the valuable recyclable content that could be exported. Once an adequate volume of materials is collected or when the junkyard space is exhausted, and when a ship is available for loading, the collected scrap is loaded separately in a loose form. Exporters of scrap metals have stated that at the time of loading, the goods are inspected by Customs to identify the presence of hazardous materials. It is also indicated on the Customs Service website that vessels and export cargoes are subject to examination.

55. For the regular exports, predominantly to India, the maximum shipping volume is limited by the vessel capacity. According to the exporters, approximately 100–120 tons on average are contained in every shipment. Interviews with the exporters have shown that many of them are directly connected to scrap metal dealers in India. Therefore, once the material reaches India, the Indian dealer is responsible for management of further operations.

2. Export Volumes

56. Our analysis of export data for the reported period shows that amounts of metals exported for recycling have been steadily increasing at a rate of approximately 23% per year in line with a demand for scrap metals (Figure 2).

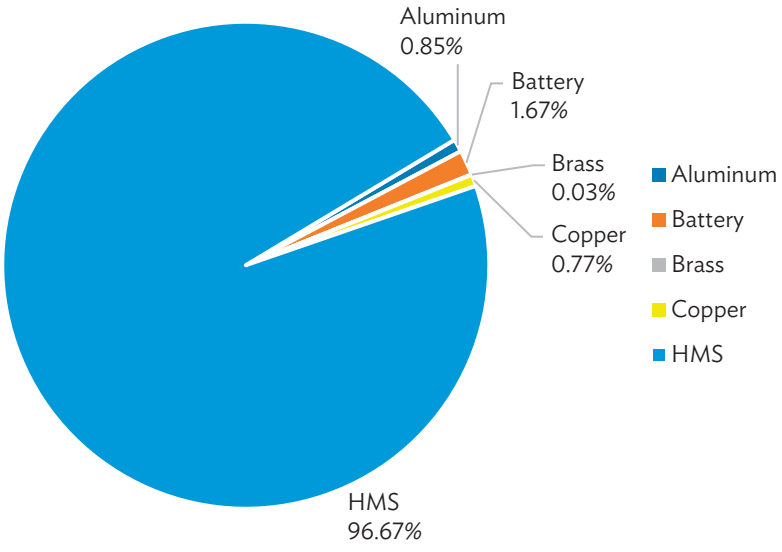
Figure 2: Total Quantity of Scrap Metals Exported, 2017–2019



Source: Authors based on Customs export data.

57. As can be seen in Figure 3, HMS accounted for approximately 97% of the exported scrap metal tonnage. For comparison, the tonnage of copper, aluminum, and brass is significantly lower, at less than 1% of each. Lead acid batteries contribute to approximately 2% of all metal exports.

Figure 3: Proportions (by weight) of Ferrous and Nonferrous Metals Exported, 2017–2019



HMS = heavy melting steel.

Source: Authors.

58. The trade-in nonferrous metals has demonstrated a consistent fall during the reported period, while HMS exhibited a steady increase (Table 5). Export of brass was reported only in 2018.

Table 5: Quantity of Scrap Metals, by Type, Exported Annually
(metric tons)

Metals	2017	2018	2019
aluminum	206	116	93
battery	310	425	85
brass		5	
copper	217	104	58
HMS	12,189	15,292	19,889

HMS = heavy melting steel.

Source: Authors based on Customs Exports data.

59. The exports of aluminum scrap reduced by approximately 50% and the exports of copper decreased even more, by approximately 75%. For comparison, the exports of batteries that initially increased by 37% from 2017 to 2018, dropped by 80% in 2019.

60. The increase of HMS exports can be attributed to a range of factors, including a global demand for metals for new construction projects and a steady and firm price on this export commodity.

3. Export Destinations

61. Four export destinations for metal scrap within the reported period included India, Malaysia, the Republic of Korea, and Sri Lanka (Table 6). While exports to all four destinations were reported in 2017, exports to Sri Lanka and the Republic of Korea appeared to have stopped in 2018.

Table 6: Quantities of Scrap Metals and Their Export Destinations
(metric tons)

	2017				2018		2019	
	India	Republic of Korea	Malaysia	Sri Lanka	India	Malaysia	India	Malaysia
Aluminum	206				116		93	
Brass					5			
Copper	217				104		58	
HMS	12,112		50	27	13,992	1,300	19,489	400
Battery	85	225			425		85	

HMS =heavy melting steel.

Source: Author based on Customs export data.

62. According to local exporters, the ship departs from Malé to Tuticorin, one of India's major trading ports. The timber boats that supply general goods and perishables from India return with metal recyclables from Maldives. This is the mode of shipping adopted by the regular exporters. Those exporting once or twice on a contract basis export the materials in shipping containers through a logistics company. Within the reported period, the nonferrous metals (i.e., aluminum, brass, and copper) were exported only to India. The volumes of these nonferrous metals are provided in Table 6.

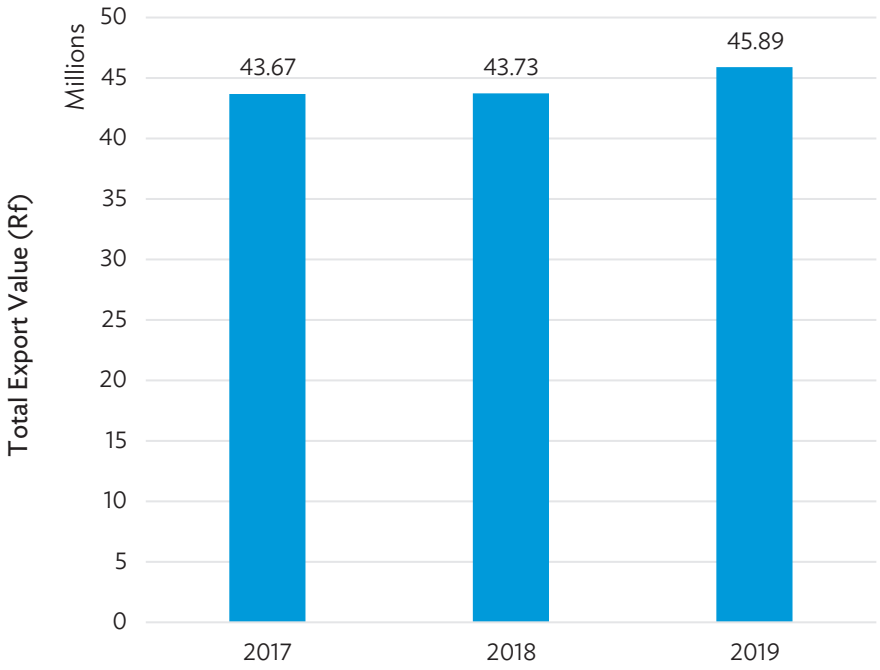
63. The only type of metal recyclables exported to the Republic of Korea in 2017 were batteries. Batteries were exported by only one player who was also exporting batteries to India. The battery export to the Republic of Korea was stopped from 2018 onward and India remained the single importer of batteries from Maldives.

64. HMS was exported to India, Sri Lanka, and Malaysia over the reported period. However, the export volumes to Sri Lanka and Malaysia are less significant compared to the exports to India, which receives more than 90% of HMS. This is not surprising because India is the second largest steel producer in the world and, given its proximity to Maldives, shipping costs are thus lower. Exports of HMS to Sri Lanka stopped from 2018 onward, which could be attributed to the legislative changes in Sri Lanka that discouraged imports of steel for recycling.

4. Export Value and Price Analysis of Metal Recyclables

65. The total export value of metal recyclables remained stable, at approximately Rf45 million per annum (equivalent to about $2.92 million), within the reported period as shown in Figure 4.

Figure 4: Total Annual Export Value of Scrap Metals
(Rf million)



Source: Author based on Customs export data.

66. The breakdown of the yearly export value for each commodity is presented in Table 7.

Table 7: Annual Total Export Value of Different Types of Scrap Metals
(Rf million)

Metal	2017	2018	2019
Aluminum	2.68	1.78	0.70
Battery	3.93	3.91	0.67
Brass		0.23	
Copper	13.51	7.32	4.21
HMS iron	23.55	30.49	40.31

HMS = heavy melting steel.

Source: Author based on Customs export data.

67. The procurement prices were obtained from the local exporters (Table 8). It appears that each exporter has fixed prices and the price ranges are comparable across different exporters. An average procurement cost was computed for comparison.

Table 8: Scrap Metal Procurement Cost of Exporters
(Rf/kg)

	Company 8	Company 12	Company 22
Aluminum	6	10	10
Battery	5	6	6
Brass	27	35	30
Copper	60	55	65
HMS	1	1	1

HMS = heavy melting steel, kg = kilogram.

Source: Author's evaluation based on information provided by local exporters.

68. A unit selling price for each material was estimated based on the quantities exported and free-on-board prices. Since the prices fluctuate, a yearly average is calculated. The estimated selling prices are given in Table 9.

Table 9: Annual Average Selling Price of Exported Scrap Metal
(Rf/kg)

	2017	2018	2019
Aluminum	13.35	15.89	13.96
Battery	12.38	8.87	7.11
Brass		46.19	
Copper	55.79	67.55	71.28
HMS iron	1.99	1.84	2.11

HMS = heavy melting steel, kg = kilogram.

Source: Author based on Customs export data.

69. The comparison of procurement and recent selling price (Table 10) suggests that the material is traded at much higher prices than the material costs. HMS is traded at more than double the material cost.

Table 10: Comparison of Yearly Average Selling Prices, Cost Prices, and Profit Margins, 2019
(Rf/kg)

	Cost Price	Selling Price	Profit Margin
Aluminum	8.7	13.96	5.26 (60%↑)
Battery	5.66	7.11	1.45 (26%↑)
Copper	60	71.28	11.28 (19%↑)
HMS iron	1	2.11	1.11 (111%↑)

HMS = heavy melting steel, kg = kilogram.

Source: Author based on Customs export data and average prices of procurement.

70. The 2019 selling prices were also compared against the prices of the commodity in India and Sri Lanka. Since only HMS was exported to Sri Lanka, the price comparison of HMS is done with the price of HMS in Sri Lanka. It is evident that exporting iron and steel to India is more attractive than exporting to Sri Lanka. However, the export price is considerably lower than the price for the commodities in India. For batteries and HMS, the Maldivian prices are more than 50% cheaper while for aluminum and copper the price is 25% and 20% cheaper, respectively (Table 11). This can suggest that Indian scrap dealers who are connected to the Maldivian exporters have an influence over the price, but from a business perspective the cheaper prices of the Maldivian material are a primary reason that would drive the scrap export business of Maldives.

Table 11: Comparison of Prices of Scrap Metals in the Region
(Rf/kg)

	Maldives Export Price	South India Price	Sri Lanka Price
Aluminum	13.96	18.86	
Battery	7.11	16.65	
Copper	71.28	87.91	
HMS Iron	2.11	4.42	1.28

HMS = heavy melting steel, kg = kilogram.

Source: Prices are adopted from Shantha (2019) and RecycleinME (2021).

D. Export of Plastic Materials

1. Supply Chain and Quality Requirements

71. Using the latest survey data of the waste composition of Maldives (10% plastics in household waste, 5% in resort waste), the overall plastic waste generated in the country would be between 20,000 and 30,000 tons per year.[12] Like metals, plastics are not recycled in Maldives because of insufficient volumes collected to achieve sustainable operation, and neither public nor private players were pursuing a coherent approach. Though potentially viable small-scale processing solutions (500 kilograms [kg] per hour) that would fit the local market scale are available, this business segment that may be an option for PET bottle-to-bottle recycling remained unexplored to date. Apart from this, Maldives lacks a reprocessing industry such as plastic prime producers which operate at even larger scales (up to several hundred thousand tons per annum). In addition, the use of recycled materials is highly exposed to the prime market and therefore would need to be incentivized or supported by an EPR scheme.

72. As a consequence, in Maldives recyclables are only collected and sorted before being exported for recycling. The sourcing and sorting activities of plastics were observed to be conducted in Malé and Thilafushi. The sourcing method for plastic waste varies depending on the exporter.

73. Very few businesses are involved in exporting plastics. In December 2016, WAMCO started collecting and baling plastic bottles (WAMCO 2016). The collection and export operations were intensified during the first half of 2017 but reduced during the second half of the year (WAMCO 2017). WAMCO signed a memorandum of understanding to collaborate with Company 22 to export plastics. The PET bottles collected in WAMCO's transfer station were handed over to Company 22 for exporting. Analysis of export data for 2017 shows approximately 80 tons of uncategorized plastics were exported (same tonnage as per the memorandum of understanding). Although the data in Customs Services is uncategorized, the type of plastic is most likely to be PET. After 2017, Company 22 interrupted the plastic business and 2017 was the last time it reported exported plastics. This may be because plastic was not the main recyclable material the company was focusing on (their focus was on metals), they had difficulty in marketing plastics at a sufficiently high price, and the importing country enforced a ban on plastics imports.

74. Parley seems to be the only exporter of plastic waste that has been able to sustain its operations and the only exporter of PET currently in the market. The bulk of the material they collect is PET, but they collect HDPE as well. Parley has several sources from which they obtain the material. In addition to the plastic waste provided by WAMCO (WAMCO is observed to keep separate PET bottles that are handed over clean during waste collection from households), Parley has agreements with cafés, restaurants, resorts, guest houses, offices, island councils, schools, and sea vessels to collect PET bottles. Parley staff collect the bottles from cafés, restaurants, and other collection points in Malé in a collection vehicle. Big generators or islands that turn in plastics are provided with jumbo bags. The collected bottles from islands are sent in boats traversing between Malé and the islands. The collected material is transferred to the compacting and baling centers. Parley has a baling center in Thilafushi and in Malé. The baling center in Malé was recently moved to the industrial zone closer to WAMCO's transfer station. Since 2017, Parley has only placed a few jumbo bags in the WAMCO waste transfer station in Malé. According to WAMCO (2018), their current endeavors on recyclables are limited to segregating PET bottles and handing them over to Parley. Currently, PET bottle collection is estimated at 17 to 30 kg per day.

75. Parley sorts the PET into colored, clear, and blue-tinted PET. The PET is then baled for exporting. There were no specific sorting or processing activities for HDPE. HDPE free of contaminants was simply

[12] Kocks Consulting. 2017. *Feasibility Study for an Integrated Solid Waste Management System for Zone III*.

collected and exported in bales to Taipei,China. The main—if not the only—recycler purchasing plastic waste from Parley seems to be the Adidas manufacturing facility in Taipei,China.[13]

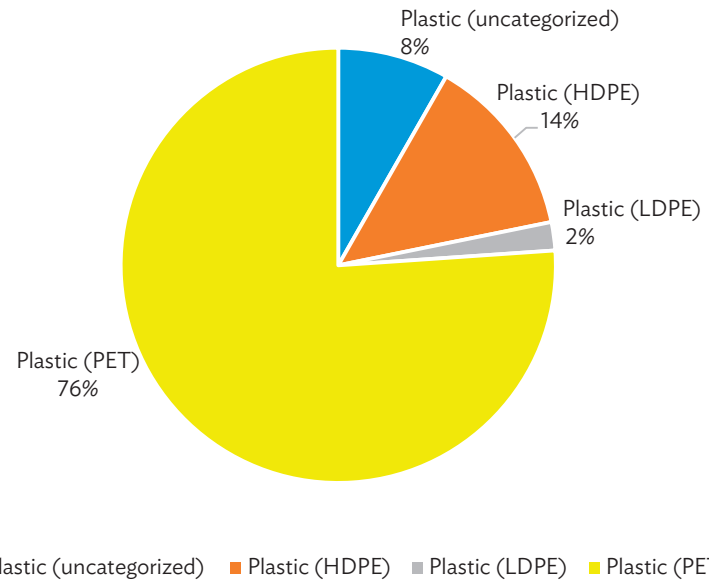
76. According to the exporters, there are no specific quality requirements for the collected plastic except that it is not mixed with other waste, contaminated with chemicals like paint or oil. For shipping, the plastic should be free of rot and smell.

2. Export Volumes

77. The bulk of the plastic waste exported is PET and accounts for more than three quarters of the plastic waste exported (Figure 5). Comparatively, the export of LDPE was small (2%).

78. As observed from Figure 6, the export of plastic waste drastically reduced by 40% in 2018 and has remained at about the same level since then. Given the factors that influence plastic exports such as collection efforts, sales price fluctuations, demand variations, etc., it is difficult to judge why the exports dropped. It is probable that the series of import bans from neighboring economies that started in 2018 has affected the business viability of several exporters.

Figure 5: Proportions (by weight) of Plastic Types Exported, 2017–2019

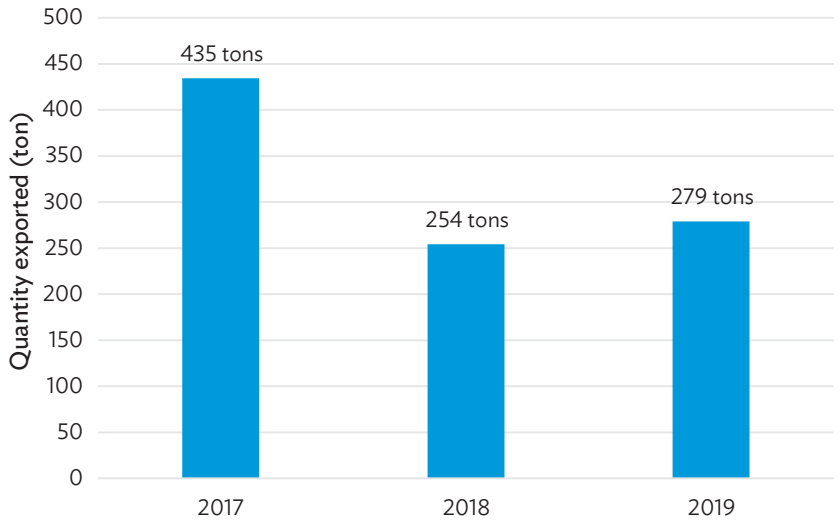


HDPE = high-density polyethylene, LDPE = low-density polyethylene, PET = polyethylene terephthalate.

Source: Author based on Customs export data.

[13] International Institute for Sustainable Development. 2020. *Shipping Partnership Advances Waste Management in Pacific Islands*.

Figure 6: Total Annual Export Quantity of Plastic, 2017–2019



Source: Author based on Customs export data.

79. The exports of PET had been decreasing during the reported period. The amounts of PET exported were 341 tons in 2017, 227 tons in 2018, and 168 tons in 2019 (Table 12). Hence, the export of PET had decreased by 30% on average. Additionally, in 2017 and 2018 there has been a company other than Parley that was exporting PET (Table 4).

Table 12: Quantity of Each Type of Plastic Material Exported Annually
(tons)

	2017	2018	2019
Fishing Net	0.10		
Plastic (uncategorized)	80		
Plastic (HDPE)		20	111
Plastic (LDPE)	13	7.4	
Plastic (PET)	341	227	168

HDPE = high-density polyethylene, LDPE = low-density polyethylene, PET = polyethylene terephthalate.

Source: Author based on Customs export data.

80. Company 22 is believed to have exported plastic waste in 2017 but stopped due to the changes in its supply chain. Company 23 exported PET in 2018 but also stopped. Both companies were exporting to Sri Lanka.

81. LDPE was exported in 2017 and 2018 but no exports were recorded in 2019. In 2017, 13 tons of LDPE were exported while only 7.35 tons were exported in 2018. These were exports to Sri Lanka as well.

82. Compared to LDPE and PET, HDPE exports increased more than fivefold from 2018 to 2019. Only 20 tons were exported in 2018 while 111 tons were exported in 2019. Parley exported 20 tons of HDPE in 2018 and doubled its export volume in 2019 (Table 13).

83. A new entrant to the market (Company 5) in 2019 exported 70 tons of HDPE. This new entrant is also involved in exporting metals as well and its primary focus seems to be on HMS iron and used batteries.

Table 13: Type and Quantity of Plastic Materials Each Company Exported Annually
(tons)

	2017					2018				2019		
	Fishing Net	Paper	Mixed Plastic	Plastic (LDPE)	Plastic (PET)	Paper	Plastic (HDPE)	Plastic (LDPE)	Plastic (PET)	Paper	Plastic (HDPE)	Plastic (PET)
Company 5											70	
Company 7						70						
Company 8	0.10											
Company 9					341.45							
Company 17							20		210		41	168
Company 22		200	80			150				100		
Company 23				13				7.35	16.83			

HDPE = high-density polyethylene, LDPE = low-density polyethylene, PET = polyethylene terephthalate.

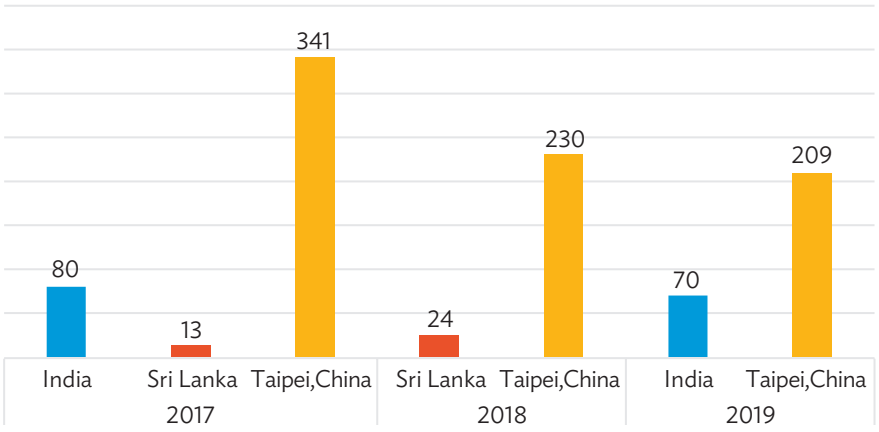
Source: Author based on Customs export data.

3. Export Destinations

84. Plastics had been exported to Taipei,China; India; and Sri Lanka in the reported period (Figure 7 and Figure 8). Taipei,China had been the market to which plastics were continuously exported during this period and accounts for approximately 80% of the total plastic exports by weight. The second most exports, accounting for about 16%, were to India. However, the exports to India were observed to be intermittent with figures recorded in 2017 and 2019 and no recorded figures in 2018.

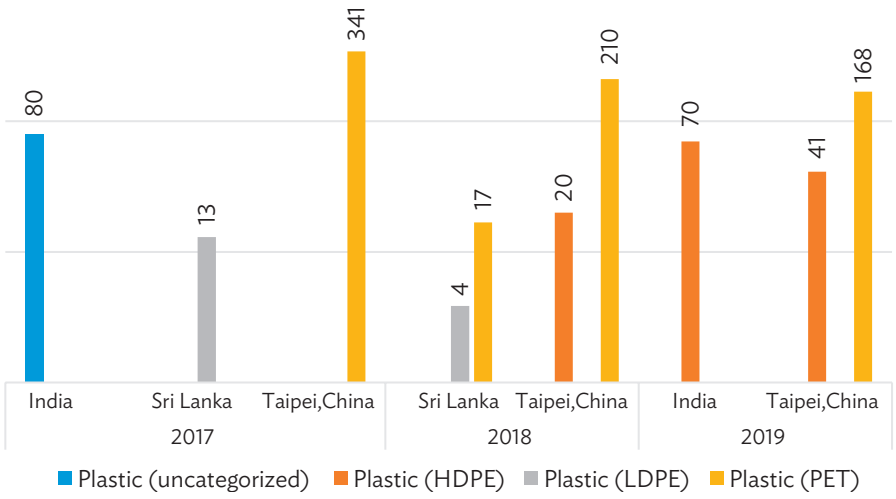
85. Plastics had been exported to Sri Lanka in 2017 and 2018 but had stopped since then. Relative to the exports of plastics to other economies, the exports to Sri Lanka were significantly less at 3%. Whether the fluctuation in the plastic waste export to India and Sri Lanka can be explained by the restrictions imposed by the national authorities on the import of plastic waste or whether they are due to entrance and absence of players in the business or to general market volatility remains uncertain.

Figure 7: Total Quantity of Plastic Waste Sent to Export Destinations
(tons)



Source: Author based on Customs export data.

Figure 8: Quantities of Each Type of Plastic Waste Sent to Export Destinations
(tons)



HDPE = high-density polyethylene, LDPE = low-density polyethylene, PET = polyethylene terephthalate.

Source: Author based on Customs export data.

4. Export Value and Price Analysis of Plastic Materials

86. The breakdown of yearly export values of the different types of plastics is presented in Table 14. The annual export values are significantly lower compared to those of scrap metals because the export tonnage of plastic is much lower.

87. Evaluation of the export values, defined by free-on-board prices, shows that the export values of HDPE are in line with the exported volumes (Table 14). However, the consecutive reduction in PET and LDPE exports over the years was not reflected in the export values. Despite a reduction of approximately 30% in PET exports from 2017 to 2018, the export value jumped from approximately Rf740,000 to nearly Rf1.3 million. Similarly, the export value of LDPE doubled despite a 40% reduction in the export quantity due to a significant change in the demand driven prices of these commodities.

Table 14: Annual Export Value of Plastic Materials
(Rf)

	2017	2018	2019
Fishing Net	1,539		
Plastic (uncategorized)	98,445		
Plastic (HDPE)		92,340	248,315
Plastic (LDPE)	1,539	3,964	
Plastic (PET)	741,375	1,292,497	989,820

HDPE = high-density polyethylene, LDPE = low-density polyethylene, PET = polyethylene terephthalate.

Source: Author based on Customs export data.

88. A price analysis was conducted to evaluate the value of different commodities in different regions. Since the plastic materials are collected as a waste collection service and not traded in the market, the cost for recyclable plastics is zero. However, there are costs associated with the collection, sorting, and baling activities that must be considered. The selling prices of different types of recyclable plastics were deduced from the Customs Services export data as the prices were not disclosed by the players in the market.

89. A summary of the selling prices for different types of plastic is shown in Table 15. The selling price of HDPE in 2018 was constant at an average of Rf4.62 per kg. This is because Parley was the only exporter in 2018. However, in 2019 the average selling price fell to Rf3.66 per kg. A closer evaluation of the data set reveals that this drop is due to the selling price of the new entrant into the HDPE export market.

90. The minimum selling price for HDPE in 2019 was determined to be Rf0.46 per kg and this is the export price of the new exporter. The new exporter exported 70 tons of HDPE to India in 2019. The remaining 41 tons of HDPE were exported to Taipei,China by Parley in 2019 and were exported in two occurrences at the unit selling prices of Rf4.62 and Rf5.89.

91. In contrast to HDPE, the exports of PET had shown a steady decline over the reported period. However, unit selling prices had been increasing each year and relative to 2017 the selling price had more than doubled in 2019. The average unit selling prices of PET per kg had been Rf2.17 in 2017, Rf3.40 in 2018, and Rf5.89 in 2019. Compared to HDPE, PET seems to be commanding a better price.

Table 15: Analysis of the Export Price of Plastic Waste
(Rf/kg)

	2017			2018			2019		
	Min	Max	Average	Min	Max	Average	Min	Max	Average
Fishing Net	15.39	15.39	15.39	–	–	–	–	–	–
Plastic[a]	1.23	1.23	1.23	–	–	–	–	–	–
HDPE	–	–	–	4.62	4.62	4.62	0.46	5.89	3.66
LDPE	0.12	0.12	0.12	0.54	0.54	0.54	–	–	–
PET	1.90	2.23	2.17	2.15	5.90	3.40	5.89	5.90	5.89

– = not available, HDPE = high-density polyethylene, LDPE = low-density polyethylene, PET = polyethylene terephthalate.

[a] The type of plastic is not specified in the export data.

Source: Author based on Customs export data.

92. There seems to be a regional difference in the price offered for plastic recyclables from Maldives. The price Taipei,China offers (Table 16) is greater than the Indian prices. Also, the yearly average prices offered by Taipei,China have increased each year. Usually, recycling commodity prices are driven by the market demand for prime materials. For example, PET prime bottle grade prices plunged from first quarter 2018 to last quarter 2019 by almost $300 per ton which would, according to general observations of the market in Europe and Germany, result in a decline in PET bales for recycling by $100 to $150 per ton.[14] Since the Taipei,China destination includes a particularity, i.e., the involvement of a multinational enterprise focused on sportswear (with demand expected to grow in the future given the increasing popularity of sustainable fashion), this collaboration between the exporter and that enterprise may also have a price impact which is not reflected in the market price variations.

93. The prices at which plastic materials were exported to India were compared with the local prices in India. The yearly average current market price in South India for baled PET bottles is Rf3.81 per kg and Rf4.40 per kg for HDPE (RecycleinMe 2021). In 2019, HDPE was exported to India at an extremely cheaper price relative to the local prices in India.

[14] *PRNewswire*. 2020. S&P Global Platts to Assess Prices for Food-Grade Recycled PET Packaging Pellets. 16 November. https://www.prnewswire.com/news-releases/sp-global-platts-to-assess-prices-for-food-grade-recycled-pet-packaging-pellets-301173672.html; and C. Murray. 2019. Outlook '20: Europe PET to be Tested by Sustainability Amid Economic Turmoil and Oversupply. *Independent Commodity Intelligence Services*. 24 December. https://www.icis.com/explore/resources/news/2019/12/24/10455401/outlook-20-europe-pet-to-be-tested-by-sustainability-amid-economic-turmoil-and-oversupply, and considerations on PET prime and r-PET bales prices in Germany.

Table 16: Comparison of the Unit Price of Plastic Waste Exported to Different Markets
(Rf/kg)

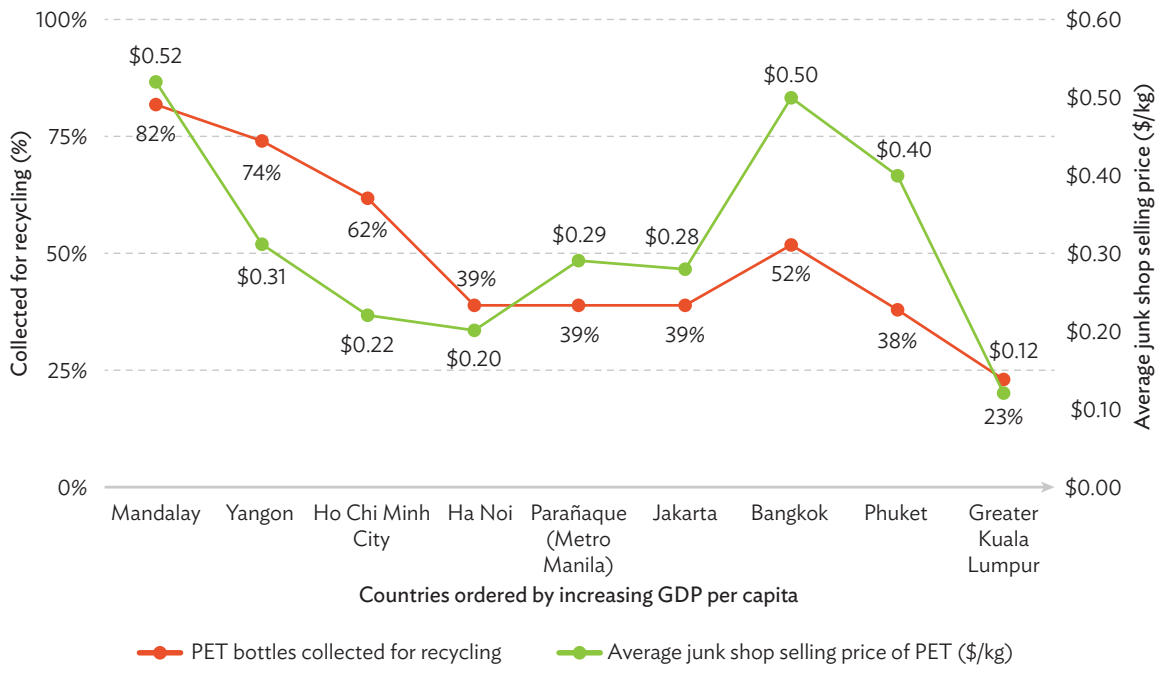
	2017			2018		2019	
	India	Sri Lanka	Taipei,China	Sri Lanka	Taipei,China	India	Taipei,China
Fishing Net		15.39					
Plastic (uncategorized)	1.23						
Plastic (HDPE)					4.62	0.46	5.25
Plastic (LDPE)		0.12		0.54			
Plastic (PET)			2.17		3.40		5.89

HDPE = high-density polyethylene, LDPE = low-density polyethylene, PET = polyethylene terephthalate.

Source: Author based on RecyclingMeIn 2021 market data.

94. The prices of scrap PET bottles in Southeast Asia are also presented in Figure 9. The values are based on primary data collected through 2017–2018 from junk shops across the six Association of Southeast Asian Nations members studied and show the prices at which junk shops sell to aggregators. An average price equals approximately $0.32 per kg (approximately Rf4.8/kg) which is in the order of magnitude of the prices obtained for selling PET to Taipei,China.

Figure 9: Selling Price of PET Bottles in Six Key Southeast Asian Countries



GDP = gross domestic product, PET = polyethylene terephthalate.

Source: as per GA Circular, 2019.

V. VIABILITY OF BUSINESS MODELS OF SCRAP METAL EXPORTERS AND PLASTIC WASTE EXPORTERS

95. The financial feasibility of exporting recyclables was evaluated to better understand the economics and the minimum scale required for sustainable operations. The evaluation was done separately for exporting plastics and metals. For the scrap metals, the two exporters that were observed to export regularly during the reported period had been selected for evaluation. Similarly, Company 9 and Company 17, are selected for the analysis of plastic waste exporters. Since both companies appear to be the same exporter, data of both Company 9 and Company 17 were combined for the evaluation and treated as a single exporter.

96. The revenue and quantities are based on export data available. The shipping prices are based on prices quoted by freight forwarding companies prior to the COVID-19 pandemic because prices during the pandemic were soaring. However, due to lack of data, reasonable estimates based on observations made on the operations of the exporters and market values of salaries and land rent prices had been utilized.

A. Business Viability of Scrap Metal Exporting

97. Company 12 and Company 22 were selected to evaluate the viability of exporting metal scraps to India. Company 22 was identified as the only exporter of scrap metals that exported every month over the reported period. In contrast, though Company 12 had been continuously exporting over the 3-year period, the activities were intermittent throughout a year showing 1 or 2 months without any exports between periods of exports. Analyzing trends in exports, the data was cross-checked with the primary information on these two exporters that was gathered through interviews, site visits, and observations made on their operations. Since the entrepreneurs did not share any data on the viability of their business, the operational expenses were estimated based on market rates for rent, payroll, and transportation costs. The shipping rates were obtained from a logistics company.

98. The expenses used in the viability analysis are given in Table 17.

Table 17: Estimates of Operational Expenses per Month Used in the Viability Assessment

	Company 22	Company 12
No. of junkyards	2	1
Rent (Rf)	50,000	30,000
Payroll (Rf)	100,000	25,000
Transport (Rf)	2,500 per day of loading	2,500 per day of loading
Misc. Expenses (utilities) (Rf)	5,000	1,200

Misc = miscellaneous.

Source: Author based on interviews and available data on rent.

99. Table 18 shows that Company 22 has been exporting approximately 8,000–9,500 tons of scrap metals annually while Company 12 (Table 19) was able to export approximately 1,500 tons per annum in 2017 and 2018. One possible reason could be the strategic location of Company 22's junkyard, which is in the south of Malé in an area where outlets of sellers of second hand and reusable items are concentrated. Consequently, Company 22 can easily collect higher volumes, which gives them the opportunity to export every month.

Table 18: Annual Financial Figures of Company 12

	2017	2018	2019
Exported months	Feb, Mar, Apr, Jul, Aug, Sep, Oct, Nov, Dec	Feb, Mar, May, Jun, Jul, Oct, Nov, Dec	Jan, Feb, Apr,
Exported Qty (tons)	1227	1675	385
Revenue (Rf)	4,158,173	4,773,914	1,007,456
Cost of Materials (Rf)	2,170,000	2,209,000	430,000
Shipping Cost (Rf)	464,589	614,962	124,492
Operational Expenses (Rf)	674,400	674,400	224,800
Net Profit (Rf)	849,184	1,275,551	228,163
Breakeven Qty (ton)	543	579	191

Source: Author, based on Customs export data and own calculations.

Table 19: Annual Financial Figures of Company 22

	2017	2018	2019
Exported months	All months	All months	All months
Exported Qty (tons)	7,960	8,525	9,475
Revenue (Rf)	23,328,638	22,311,200	22,160,252
Cost of Materials (Rf)	17,100,000	13,360,000	9,600,000
Shipping Cost (Rf)	3,000,461	3,195,233	3,459,637
Operational Expenses (Rf)	1,860,000	1,860,000	1,550,000
Net Profit (Rf)	1,368,177	3,895,967	7,450,614
Breakeven Qty (ton)	4,586	2,754	1,631

Source: Author, based on Customs export data and own calculations.

100. The estimated monthly costs for Company 12 are shown in Table 20 while those for Company 22 are in Table 21. The monthly expenses cover the cost of materials, operating expenses, and shipping expenses. Since metal scraps are purchased from end users and street collectors, the main expense is the cost of materials. For Company 12, the cost of materials is approximately 45% of the total expenses while for Company 22, the cost of materials covers 65%–75% of the total expenses. Cost of materials is considered a variable cost.

Table 20: Annual Revenue and Expenses of Company 12

	2017	2018	2019
Minimum revenue (Rf)	269,220	246,320	230,700
Maximum revenue (Rf)	1,018,096	1,154,250	406,098
Average revenue (Rf)	462,019	596,739	335,819
Minimum expenses (Rf)	56,200	56,200	56,200
Maximum expenses (Rf)	817,266	750,045	278,840
Average expenses (Rf)	275,749	291,530	194,823

Source: Author's calculations based on Customs export data and own assumptions.

Table 21: Annual Revenue and Expenses of Company 22

	2017	2018	2019
Minimum revenue (Rf)	758,204	1,074,580	1,385,100
Maximum revenue (Rf)	3,500,679	3,016,839	3,461,625
Average revenue (Rf)	1,944,053	1,859,267	2,216,025
Minimum expenses (Rf)	737,919	848,845	982,272
Maximum expenses (Rf)	3,168,198	3,136,257	2,216,536
Average expenses (Rf)	1,830,038	1,534,603	1,470,964

Source: Author's calculations based on Customs export data and own assumptions.

101. The operating expenses cover the rent of the junkyards and salaries. Company 22 has a junkyard in Thilafushi and Malé and employs administrative staff. Only one or two staff were observed to work at the Malé junkyard. It is also believed that the staff and properties are utilized for Company 22's other business activities. Nevertheless, the salaries of 10 workers and two administrative staff were considered in the analysis as expenses of the exporting business as a conservative assumption. The monthly operating cost of Company 22 is Rf155,000 or approximately 10% of its total expenses. This type of operating cost is accounted as a fixed cost.

102. For Company 12, interviews with its workers revealed that despite being employed they work as street collectors and do not earn a fixed salary from the company. Instead, they sell the collected scrap to their employer. Hence, for Company 12 a salary is assumed to be taken only by the owner and a supervisor stationed in the junkyard to document the transacted scrap. For Company 12 the operating cost amounts to Rf56,200 per month and takes up approximately 20% of its total expenses.

103. The post-pandemic cost of shipping a 12-foot container of metal scraps to Tuticorin takes about Rf19,500. This is a conservative value and it would be much less for sending the scraps in the return trips of the wooden boats bringing perishables from India to Maldives. For Company 12, shipping takes approximately 12% of total expenses (Table 22). Since the amount of exports of Company 22 has increased over the years, the shipping cost ranges between 15% to 25% of total expenses (Table 23). Shipping cost is accounted as a variable cost.

Table 22: Breakdown of Expenses of Company 12
(%)

	2017	2018	2019
Cost of Materials	46	43	44
Operating expenses	22	17	24
Shipping expenses	13	12	13

Table 23: Breakdown of Expenses of Company 22
(%)

	2017	2018	2019
Cost of Materials	75	70	65
Operating expenses	10	11	11
Shipping expenses	15	18	24

Source: Author, based on own calculations.

104. For Company 12, the monthly revenue ranges from Rf230,700 to Rf1,018,097. For Company 22, the monthly revenue ranges from Rf758,204 to Rf3,500,679.

105. As can be seen from Table 20 and Table 21, the annual average net profit is positive for each year analyzed and had shown growth year-on-year. Therefore, by analyzing the two companies, it is evident that exporting metal scraps to India is financially feasible even when there are no exports for one quarter of a year.

B. Business Viability of Plastic Material Exporting

106. To estimate the incurred costs of plastic waste exporters (PET or HDPE), a range of assumptions were made. These assumptions were validated via interviews conducted and/or data shared by the stakeholders in the plastic export business.

107. Besides fixed costs such as payroll, rent, maintenance, depreciation, and administration, the exporters bear variable costs like utilities, containerizing the bales, transporting containers from the baling centers to the harbor, and shipment cost. The latter are, to a very high extent, dependent on market demand for containers and ocean carriers. A major portion of the variable costs, however, is due to containerizing the bales.

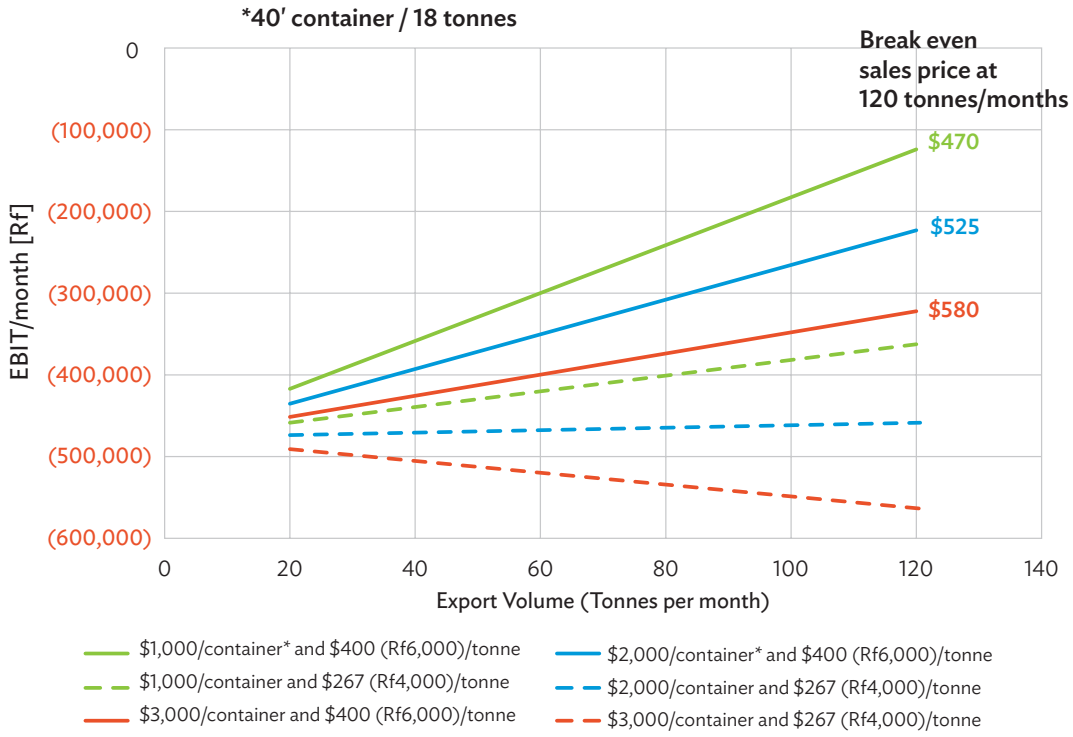
108. Loading the containers is restricted to shipping companies; hence, they can charge unreasonably high prices. These vary—subject to the loading location—between $1,770 and $2,850 per container and are in the range of the current shipment costs for a 40-foot container to Taipei,China. Since these costs contribute significantly to the overall costs, **they could be considered as an obstacle for export.**

109. Because the plastic materials are collected from waste generators, the cost of materials is taken to be zero. Whether this may be assumed in the future will depend on an agreement between WAMCO and any other entity in that business remit.

110. Earnings before interest and taxes (EBIT) analysis was carried to evaluate the impact of shipment costs, sales price of the material, and the volume of recovered material on the viability of the business

(Figure 10). Whereas the sales prices are subject to the recycling commodity market unless special agreements between supplier and purchaser are in place, the shipment costs can be understood as reflecting the shipping distance (i.e., India or a farther market, e.g., Taipei,China). For the sales prices, a low price to reflect a low demand period (Rf4,000 or $267 per ton) and a higher price to consider a market shortage period (Rf6,000 or $400 per ton) were assumed. The latter is in the range of the highest sales price ever obtained (Rf5,900 per ton). Volumes ranged from 20 to 120 tons per month. The average export volume during the 3-year period that was considered for this study was around 20 tons.

Figure 10: Sensitivity Analysis for the Export of Baled Plastic Waste Materials from Maldives



EBIT = earnings before interest and taxes.

Source: Based on the author's EBIT calculation.

111. Irrespective of shipping costs, EBIT is highly sensitive to the overall volume of materials collected, baled, and exported, which is due to the considerable portion of fixed costs.

112. Exporting recyclable plastics from Malé may be profitable only if a significantly greater monthly amount of HDPE or PET (or both, at 120 tons and more) can be tapped than what is currently source segregated, and can be sold at very high prices which are beyond the prices that reflect the current market conditions. For the assumed fixed and variable costs (including shipment costs that ranged between $1,000 and $3,000 per container), breakeven sales prices for plastics are between $470 and $580 per ton at 120 tons per month of recovered material. The current maximum amount of exported material is 20–40 tons per month.

113. For comparison, the market prices for clear PET bottles in Germany in May 2021 went up to $600 and even $720 at its peak due to a very high demand while the market was short of used PET

bottles. On the one hand, the shortage of used PET bottles is a COVID-19-lockdown phenomenon (i.e., less leisure activities) so that sellers can ask for higher prices. On the other hand, buyers cannot switch to prime materials because prime producers shut down their facilities due to the pandemic and instead opted for planned maintenance activities. How long this sales price rise in the German market will continue is unclear but it demonstrates that these effects need to be considered when assessing the viability of the recovery and sales of recyclables. Mandatory substitution rates that would force producers to replace prime materials with recyclables can also help stabilize the sales prices because it would stimulate the market demand. Any dealer or waste management company separating recyclables is exposed to the market demand that, besides the economies of scale, has a similar effect on the viability of the business as the shipment and overall handling cost.

114. Fluctuations as assumed for the EBIT analysis do occur as it can be retrieved from the experiences accumulated by Maldivian exporters (Table 15) whereas the limited market, the unfavorable geographic conditions (i.e., scattered island nation), and the high handling costs for collecting, sorting, and containerizing set a challenging environment for any entity that wishes to enter this niche market.

115. Given these preliminary results, it is not surprising that some of the players experienced problems when they had to face the real costs of exporting recyclables. Whether a player may find favorable conditions for exporting plastics to markets other than Asia is not only subject to the market conditions (offer or demand) but especially to the quality requirements of the recyclers in those countries. Targeting a monthly export volume of 120 tons or more, however, will require a different and more expensive technology and personnel set-up to sort, store, and handle the recyclables, which is not yet considered in the EBIT analysis.

116. Another conclusion from the EBIT analysis is that exporting mixed (or unclassified) plastics will not be a viable business due to the lower achievable sales prices, let alone that importing countries banned their import.

117. Parley, the only player that remained in the plastics export business, may be able to sustain its operations because of the support they are receiving from multinational enterprises which buy PET at a high price to convert them into sustainable sports garments. This is an expanding industry that may be promising for scaling up plastic recycling.

118. An extended producer responsibility scheme (EPR) can also pave the way forward to cover the expenses that are associated with the sourcing and handling of plastic waste. Such an EPR may either consist of a deposit refund system (DRS) to be implemented (e.g., for plastic bottles) or a financial contribution of the producers, importers, and retailers of plastic material to the waste management system. EPR schemes, however, require sound preparation and a strict enforcement since they have to be regulated and monitored. Also, EPR implementation and its smooth functioning require time and the collaboration of all stakeholders.

VI. PRODUCTION AND RECOVERY OF POLYETHYLENE TEREPHTHALATE IN MALDIVES

119. Safe drinking water is scarce in Maldives, especially in the Greater Malé region. As a solution to the water problem, the Malé Water and Sewerage Company (MWSC) was founded to produce and distribute desalinated water. Though the water is produced to meet the potable water standard approved by the World Health Organization, the distributed water is not widely accepted by the public as a source of drinking water. The taste of water is claimed by many as a reason for rejection. Subsequently, the demand for bottled desalinated water was created. PET bottles are prevalently used in Maldives for beverages and drinking water.

120. The four main players in the market that produce and distribute PET bottles in the Greater Malé region are:

(i) Malé Aerated Water Company (MAWC),
(ii) International Beverages Company (IBC),
(iii) Island Beverages Maldives (IBM), and
(iv) State Electric Company (STELCO)

121. MAWC is a privately owned company that started in 1983 and is the only company bottling beverages like Coca Cola and other international brands. They produce the drinking water brand Bonaqua.

122. Founded in 2003, IBC is a sister company of Happy Market Trading Company and produces the drinking water brand Life.

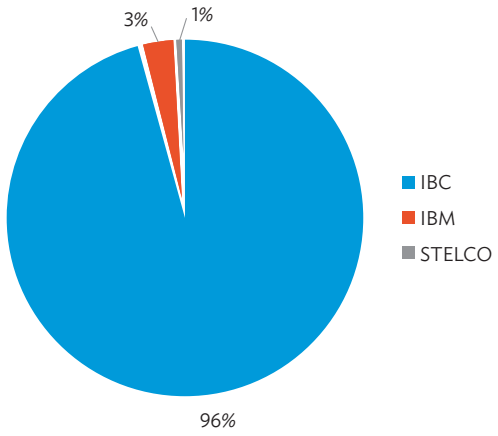
123. IBM followed in 2004 and is a joint venture between MWSC and Champa Brothers Pvt. Ltd. The desalinated water of MWSC is subjected to further processing to produce Taza bottled water which IBM distributes and markets.

124. STELCO entered the landscape in 2017. Since production of drinking water is not its main business activity, the main objective of STELCO in production is to recover the high waste heat generated in their power generators. Hence, it is likely that production depends on heat recovery and is limited to the power generation capacity of STELCO.

125. PET bottles are manufactured using PET preform. Information gathered revealed that MAWC and IBM import PET resin and inject mold the preforms, which are then blown to manufacture the PET bottles. In 2019, the amount of PET resin imported into the country was 3,507 tons (2,787 tons from India and 720 tons from Oman). The cost, insurance, and freight value of the PET resin imported sums up to Rf61.82 million. The importers had bought PET resin from India at an average unit price of Rf17.28 per kg in 2019.

126. The production data for the first half of 2019 was provided by three of the producers. Over a 6-month period, the three manufacturers had produced 27,949,200 PET water bottles. Assuming similar rates of production, it can be estimated that the number of PET water bottles produced locally in 2019 by IBC, IBM, and STELCO would be about 56 million bottles. Despite the lack of data on production of PET-bottled beverages, by means of a weight analysis and knowing the amount of PET resin imported in 2019, a rough estimate for the total number of PET plastic entering the market in 2019 could be estimated at about 128 million bottles.

Figure 11: Relative Market Share of PET Water Bottle Producers, 2019



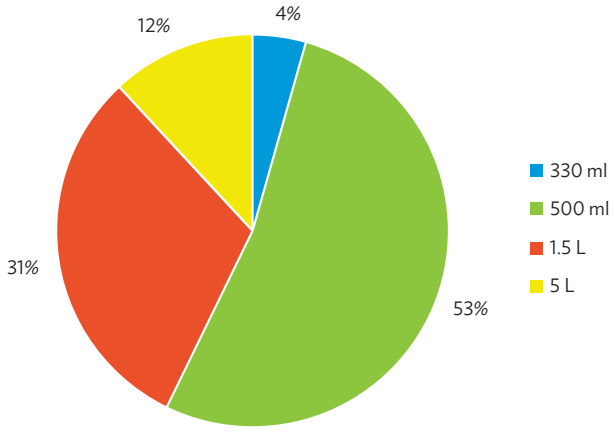
IBC = International Beverages Company, IBM = Island Beverages Maldives, PET = polyethylene terephthalate, STELCO = State Electric Company.

Source: Author's calculations of production share of each bottling company based on production data.

127. IBC appears to dominate the market (Figure 11). The available data shows that IBC accounts for 96% of the total bottles produced. Factoring the production of MAWC would reduce the market share of IBC but would probably remain well above 50%, as claimed by the company.

128. The most produced water bottles are 500 milliliter (ml) bottles (Figure 12). With more than 14,680,000 bottles produced in the first half of 2019, 500 ml bottles comprise 53% of the total number of bottles produced. The second-most produced bottles are 1.5 liter (L) bottles at more than 8,710,000 bottles (Figure 13).

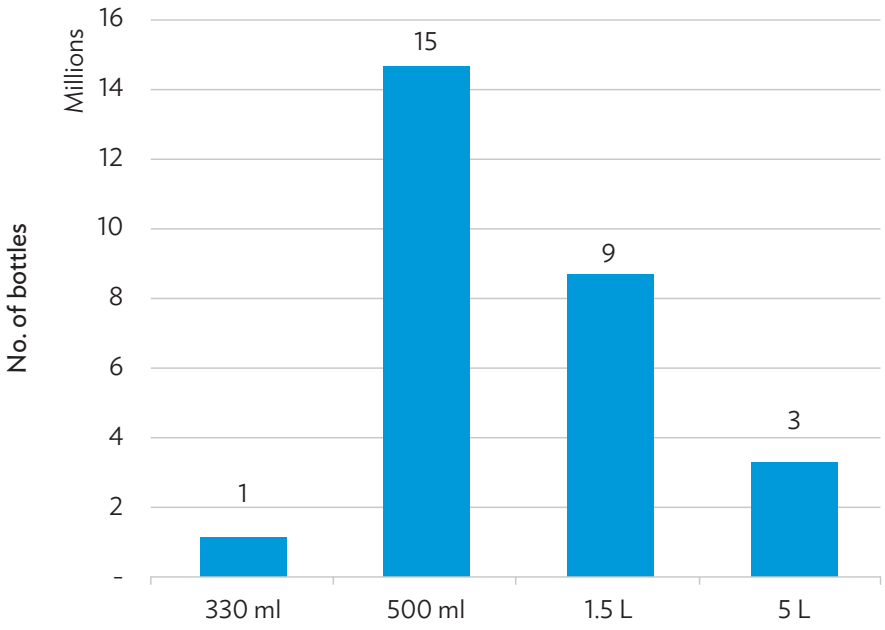
Figure 12: Proportions, by the Number of Water Bottles, of Different Sizes of PET Water Bottles Produced from January–June 2019



L = liter, ml = milliliter, PET = polyethylene terephthalate.

Source: Author's own calculations based on production data.

Figure 13: Quantity of PET Water Bottles Produced from January–June 2019



L = liter, ml = milliliter, PET = polyethylene terephthalate.

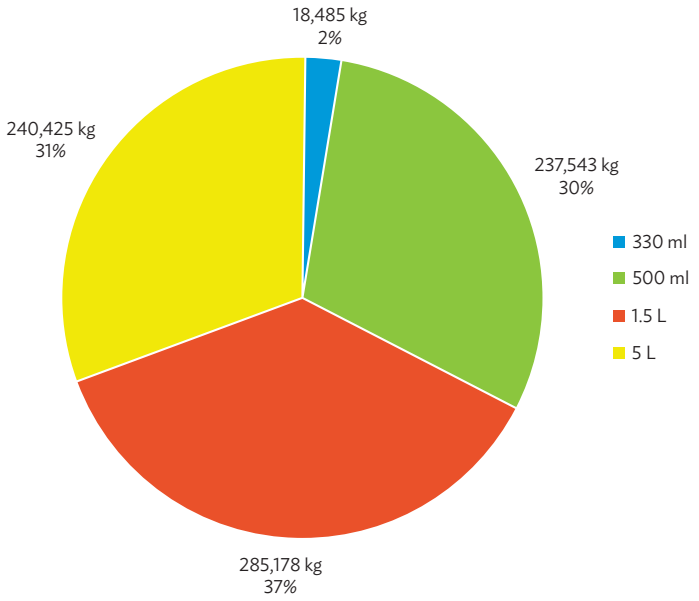
Source: Author based on production data.

129. Combined, the 1.5 L and 500 ml bottles account for approximately 80% of the plastic bottles in the market, perhaps due to its utility.

130. As 500 ml bottles make up more than half of the plastic bottles in the market, from a volumetric perspective these would be the highest contributors to plastic pollution and cause a greater challenge in waste management. However, if we consider the weight of the bottles and perceive the issue from a material consumption perspective the results are contrasting.

131. The weight of the preforms used for both the 330 ml and 500 ml bottles is 16 grams (g). The weight of preforms for the 1.5-L bottle is 32 g and 72.9 g for the 5-L bottle. Hence, the larger bottles consume two to five times more plastic than the smaller plastic bottles. Figure 14 shows the amount of materials used for the production of each type of bottle over a 6-month period. Interestingly, nearly 70%, by weight, of the imported resin had been used in the production of 1.5 L and 5 L bottles.

Figure 14: Proportions, by Weight, of Different Sizes of PET Water Bottles Produced from January–June 2019



L = liter, kg = kilogram, ml = milliliter, PET = polyethylene terephthalate.

Source: Author's calculations based on production data.

Table 24: PET Consumption, by Weight in kg, in Production from January–June 2019

	IBC	IBM	STELCO	Total
Jan	121,683	3,569	998	126,250
June	106,046	3,549	599	110,194
Feb	114,012	3,810	737	118,559
Mar	144,639	4,276	831	149,747
Apr	143,130	4,964	1,221	149,315
May	122,288	4,320	958	127,566
Total	751,797	24,488	5,345	781,630

IBC = International Beverages Company, IBM = Island Beverages Maldives, STELCO = State Electric Company.

Source: Producer's production data.

132. The production rate of each manufacturer is similar each month (Table 24). During these 6 months, a total of 781,630 kg of plastic bottles were produced by the three manufacturers.

133. The monthly average production by weight for IBC is 125 tons, 4 tons for IBM, and 1 ton for STELCO. It is practical to expect a similar rate of production in the second half of 2019. Therefore, it could be estimated that 1,563 tons of PET resin were transformed into PET water bottles in 2019 by the three producers.

134. Comparing this value with the 3,507 tons of PET resin imported in 2019 reveals that this accounts for 45% of the total PET resin imported. Hence, the remaining 55% can be assumed to have gone into the production of beverages and Bonaqua water bottles. Since these are single-use plastics and assuming all imported materials are consumed in production during the year, an equal amount of plastic waste could be assumed to be generated in 2019. In that year, the export of recovered PET bottles, however, were 168 tons or 5% of the total production only which suggests that a significant portion of the PET currently ends up on Thilafushi.

VII. LOCAL MATERIAL RECOVERY AND RECYCLING INITIATIVES, CHALLENGES, AND EXPORT OUTLOOK OF METALS AND PLASTIC MATERIALS FOR RECYCLING

135. One of the conclusions of the study for improvement of local material recovery and recycling is that there is a need to establish a modern waste collection and transportation system across the country that includes source segregation of recyclable materials. This will ensure sustainable quantity and quality inputs to the recycling and reprocessing industry. Other options for the separate collection of recyclable materials can be explored, e.g., introducing recycling bring bank systems, DRS, and front-of-store collection points at large supermarkets.

136. Local initiatives are mainly in the form of collecting and exporting potentially recyclable materials. The main players that were succeeding in their operations are the steel export businesses. Parley is the only company that currently collects and exports plastic waste.

137. MWSC had several initiatives aimed at material recovery beginning in 2011, when they implemented an incentive program for the return of Taza bottles to MWSC premises to be shredded and exported. However, MWSC faced challenges to continue this initiative. In June 2018, MWSC started a new initiative by introducing its Smart Bin reverse vending machine. Reverse vending machines are also popular in Western Europe where the deposit system was established in the late 1990s. The deposit for plastic bottles is much higher (e.g., in Germany it is equivalent to Rf4.5 per bottle), so the motivation to hand back the bottle is monetary.

138. The Smart Bin had a collecting capacity of approximately 538 bottles per day, and it accepted 330-ml, 500-ml, and 1.5-L bottles. By using this machine, consumers were eligible for discounts on their water utility bills. For each bottle returned the consumer received Rf0.15 and every Rf30 earned through the machine were discounted on the consumers' bills. The Smart Bin was initially popular but soon ended by MWSC due to the machines' constant technical failures and the lack of space to place them.

139. MWSC faced other challenges that jeopardized their initiatives, including the lack of storage facilities for shredded materials and difficulties with collecting sufficient volumes of bottles. However, MWSC is keen on continuing its efforts at PET recovery. The company also plans to diversify into glass bottle manufacturing and to increase awareness and encourage using tap water to eliminate packaging waste.

140. It is envisaged that the current key players involved in the export markets would be continuing their operations. However, there are challenges that the current players and new market entrants face. These challenges are associated with high shipping and handling costs, high operational costs due to land rent, payroll, fluctuations in exchange rates, and the waiting time for the ships frequenting Malé

and India, let alone the market price fluctuations of any commodity. The limited market size is also a constraint, especially for new entrants.

141. Since the costs incurred for recovering PET bottles are significant, the EPR scheme that the national government aims to introduce can boost the recovery and eventually stimulate a local recycling initiative. Alternatively, PET bottles and HPDE (or polypropylene) containers as single materials may be shipped to other countries that can count on a well-structured formal recycling industry rather than to neighboring countries that struggle to set-up their own recycling system which, among others, caused them to ban the import of plastics.

142. Europe's experience with EPR for PET and/or HDPE recycling suggest contribution rates in the range of $100 to $400 per ton (using 2017 data) to cover the expenses of the involved enterprises.[15] Whether such rates would suffice to cover the expenses in a country like Maldives is to be assessed as many variables have to be considered.

143. The economic analysis of plastics export confirmed its viability is subject to the tonnage of recyclables tapped, shipping costs, and sales prices achieved. Hence, a contribution to recover the costs via an EPR scheme would reduce the risks of an entrepreneur irrespective of which option will be pursued.

144. Besides the cost implications, the regulatory environment must assign clear roles and responsibilities to all stakeholders involved in any recycling business. Because of usually diverging interests between the public (waste management companies, authorities, regulatory bodies) and private players (producers, retailers, facility operators, recyclers) the commitment to contribute to and finance the EPR system must be enforceable.

145. Despite the positive effects that EPR schemes yielded in many countries, it is believed that an EPR in the Maldives' context should only focus on single material streams that can be source-segregated with the least effort.

146. It will be interesting to see whether the player that envisages a local recycling industry for PET, HDPE, and potentially polypropylene will succeed and how the EPR scheme will suit the need to recover the high costs that are inherent in dealing with plastic waste materials. Reportedly, this player aims to enter a higher price segment via hot-washing, flaking, and even pelletizing plastics for either local or overseas use.

147. A comprehensive EPR for packaging waste as implemented in Europe might not be suitable in the Maldives' context because of the market size, which does not allow for establishing a recycling industry at comparable scales, and because of the export constraints for mixed plastics and paper. It was estimated that recovering the PET and HDPE objects completely would yield 3,000 to 5,000 tons annually while the Greater Malé region is expected to generate approximately 20,000 to 25,000 tons of packaging waste per year in 2025 (assuming a paper/plastics content of 10% each) (footnote 12).

148. Consequently, all packaging material that cannot be reduced or recovered or any sorting residue will end up as municipal solid waste and will need to be disposed of safely, maximizing the environmental benefit for a country like Maldives.

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[15] E. Watkins et al. 2017. *EPR in the EU Plastics Strategy and the Circular Economy: A focus on plastic packaging.* Brussels: Institute for European Environmental Policy. https://ieep.eu/uploads/articles/attachments/95369718-a733-473b-aa6b-153c1341f581/EPR%20and%20plastics%20report%20IEEP%209%20Nov%202017%20final.pdf.

VIII. CONCLUSIONS AND RECOMMENDATIONS

149. The current key players involved in the metal and plastics export markets are expected to continue their operations. However, the study has identified the key challenges that the existing players and new market entrants face. These challenges are associated with high shipping, handling, and operational costs due to land rent, payroll, fluctuations in exchange rates, and the market price fluctuations of respective commodities.

150. The study revealed a regional difference in the price offered for the recyclables from Maldives. For example, the price Taipei,China offers for plastic recyclables exported from Maldives has been higher than the Indian prices, which, however, is due to the involvement of a large NGO and multinational company.

151. For the regular exports of recyclable materials, predominantly to India, the maximum shipping volume is limited by the vessel capacity, which are often small and not comparable to large cargo ships.

152. The records show fluctuations in the volumes of plastics exported to India and Sri Lanka in the period from 2017 to 2019. Whether these fluctuations in plastic waste exports can be explained by the restrictions imposed by national authorities on the import of plastic waste or whether they are due to entrance and absence of players in the business or to general market volatility remains uncertain.

153. The study has estimated that only less than 2% of total plastic and 5% of PET material were recovered and exported in 2019 and a significant portion of the plastics currently ends up in the Thilafushi dumpsite. Exporting recyclable plastics from Malé may be profitable only if a significantly greater monthly amount of HDPE or PET (or both, at 120 tons or more) can be captured than currently are recovered, and can be sold at very high prices which are beyond the prices that reflect current market conditions.

154. Any dealer or waste management company separating recyclables is exposed to the market demand. For comparison, the market prices for clear PET bottles in Germany in May 2021 went up significantly due to very high demand while the market has been short of used PET bottles because of the COVID-19 lockdown. The shortage of used PET bottles (attributed to a sharp reduction in leisure activities during the lockdown) encouraged sellers to ask for higher prices. The buyers could not switch to prime materials as prime producers shut down their facilities due to the pandemic.

155. The economic analysis of plastics export confirmed that its viability is subject to the tonnage of recyclables tapped, shipping costs, and sales prices achieved. Therefore, a contribution to recover the costs via an EPR scheme would reduce the risks of an entrepreneur.

156. The EPR scheme that the national government aims to introduce can boost the recovery and eventually stimulate a local recycling initiative. Alternatively, single materials may be shipped to other countries that can count on a well-structured formal recycling industry rather than to neighboring countries that struggle to set up their own recycling system which, among others, caused them to introduce import bans.

A. Opportunities to Improve Material Recovery and Recycling

157. To improve material recovery in Maldives, three key factors would need to be considered given the challenges and constraints identified above: (i) lower logistics costs, including collection and transport; (ii) maintain a stable high selling price for plastics to make business viable; and (iii) partner with the private sector and nearby countries with reprocessing infrastructure.

158. Based on conclusions and outcome of the study, the following five key steps should be considered:

(i) **Establish a modern waste collection and transportation system across the country** that includes segregation of recyclable materials coupled with continuous behavior change campaigns. This should aim to reduce recyclables leaking into the environment, improve their quality by reducing contamination, and decrease costs through economies of scale for collection. Successful initiatives to promote recycling and collect PET bottles through community engagements in islands, schools, and resorts should also be replicated across the country.[16] Other options for the separate collection of recyclable materials can be explored, e.g., introducing recycling bring bank systems and front-of-store collection points at large supermarkets. DRS, where consumers are paid back upon returning materials, can also help in improving quantity and quality of recyclables.[17]

(ii) **Introduce an extended producers' responsibility scheme** to help cover the high cost of recycling in the country and subsidize or stabilize the fluctuating selling prices of materials such as plastic. The Maldives legislative and regulatory framework does not have an effective EPR scheme yet, although EPR is mentioned as part of the National SWM Policy. In countries where EPR schemes are well-designed and recycling rates are high (e.g., Austria, Germany, and Sweden), the collection and processing and treatment costs of recyclables are financed through contributions paid by producers. EPR schemes could encourage design for material recycling, help improve the efficiency of the recycling process, reduce littering, and promote better cooperation among manufacturers, local governments, the public, and the recycling and reprocessing industry. The regulatory environment must assign clear roles and responsibilities to all stakeholders involved in any recycling business.

(iii) **Establish public–private partnerships with exporters and recyclers and** improve business viability through viability gap contributions or target subsidies. For example, the government may provide land for storage and baling and/or electricity price at subsidized rates (currently recyclers pay commercial rates) in return for meeting performance requirements (i.e., minimum percentage of waste recycled per year). This will result in improved environmental benefits at little cost and effort for the government.

(iv) **Explore preferential freight prices to key recycling destinations with shipping companies**, and international cooperation agreements with countries that have major reprocessing facilities (but subject to quality requirements), given the high transportation costs and the limited in-country demand of a small islands state like Maldives. An interesting initiative in small Pacific islands could be tested in Maldives (footnote 13).

(v) **Incentivize domestic market demand and innovative waste reprocessing facilities for recyclables** by partnering with international industries or players (e.g., establishing PET recovery and pelletization for PET bottling plants or advanced 3D printing in Maldives), although this may be limited only to a niche market or applications.

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16 Parley Maldives. https://www.maldives.parley.tv/programs.

17 Watkins, E., et al. 2019. Policy Approaches to Incentivize Sustainable Plastic Design. *OECD Environment Working Papers*. No. 149. Paris: OECD Publishing.

159. Several challenges to substantially expand recycling in a small island context like Maldives will probably remain in the short to medium term because of the limited economies of scale, high transportation costs, and very low starting point. The global transition into circular economy and innovative recycling and material applications has the potential to transform the recycling outlook and minimize waste of valuable materials worldwide. However, this will take substantial efforts from many actors and years to come, if not decades. In the short to medium term, while recycling maximization should be pursued together with waste minimization initiatives,[18] **it will be important to continue concentrating efforts to establish a basic SWM infrastructure for Maldives that can treat and dispose sustainably all the waste generated that cannot be recycled because of technical, behavioral, and commercial or market limitations. This is a crucial milestone to preserve Maldives' pristine environment, ocean health, and make its blue economy thrive.**

[18] The Government of Maldives has recently taken as concrete step forward with the banning of single use plastics effective since 1 June 2021, and to be further extended in 2022. Source: Government of Maldives, 2020. *President declares list of Single-use Plastics prohibited to import from June 1, 2021. Malé.*

REFERENCES

Environmental Protection Administration. 2018. *Amendments for Industrial Wastes Categorized As Industrial Raw Materials Preannounced*. https://www.epa.gov.tw/ENG/F7AB26007B8FE8DF/77a67587-4785-401b-9d16-f2f1c45fa702

Environmental Protection and Preservation Act. Act No. 4/93. 1993.

Export–Import Act of Maldives. Act No. 31/79. 2020. https://presidency.gov.mv/Press/Article/23508.

GA Circular. 2019. *Full Circle: Accelerating the Circular Economy for Post-Consumer PET Bottles in Southeast Asia.*

Government of India, Central Pollution Control Board. 2019. *Annual Report for the year 2018-19 on Implementation of Plastic Waste Management Rules.* Delhi. Government of Maldives. 2020. *List of treaties to which the Maldives is party to.* https://www.gov.mv/en/files/treaties-list-december-2020.pdf.

Government of India, Ministry of Commerce and Industry. 2021. *Trade Statistics*. https://tradestat.commerce.gov.in/meidb/brcq.asp?ie=i.

Government of India, Ministry of Environment, Forest and Climate Change. 2018. *Plastic Waste Management (Amendment) Rules, 2018.*

———. 2019. *Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016 (Amendment 4).*

Government of India, Ministry of Steel. 2019. *Steel Scrap Recycling Policy.*

Government of Maldives, Ministry of Environment and Energy. 2013. *Waste Management Regulation*.

———. 2015. *National Solid Waste Management Policy.*

Government of Sri Lanka, Sri Lanka Customs. 2015. *Tariff Schedule.* https://www.customs.gov.lk/customs-tariff/import-tariff/.

Government of Sri Lanka, Central Environmental Authority. 2017a. *The Gazette of the Democratic Socialist Republic of Sri Lanka Extraordinary No. 2034/33.* http://www.cea.lk/web/images/pdf/Polythene_gazets/2034-35_E.pdf.

———. 2017b. *The Gazette of the Democratic Socialist Republic of Sri Lanka Extraordinary No. 2034/34.* http://www.cea.lk/web/images/pdf/Polythene_gazets/2034-34_E.pdf.

———. 2017c. *The Gazette of the Democratic Socialist Republic of Sri Lanka Extraordinary No. 2034/35.* http://www.cea.lk/web/images/pdf/Polythene_gazets/2034-35_E.pdf.

———. 2017d. *The Gazette of the Democratic Socialist Republic of Sri Lanka Extraordinary No. 2034/37.* (http://www.cea.lk/web/images/pdf/Polythene_gazets/2034-37_E.pdf.

———. 2017e. *The Gazette of the Democratic Socialist Republic of Sri Lanka Extraordinary No. 2034/38.* http://www.cea.lk/web/images/pdf/Polythene_gazets/2034-38_E.pdf.

Government of Sri Lanka, Department of Government Printing. 2021. *The Gazette of the Democratic Socialist Republic of Sri Lanka Extraordinary No. 2211/50.* http://documents.gov.lk/files/egz/2021/1/2211-50_E.pdf.

Gunarathne, A., T. Tennakoon, and J. Weragoda. 2019. Challenges and Opportunities for the Recycling Industry in Developing Countries: The Case of Sri Lanka. *Journal of Material Cycles and Waste Management.* 21. pp. 181–190. doi:https://doi.org/10.1007/s10163-018-0782-x.

Kumar, S., Smith , S. R., Fowler, G., Velis , C., Kumar , S. J., Arya , Rena, R.K., and Cheeseman, C. 2017. Challenges and Opportunities Associated with Waste Management in India. *Royal Society Open Science.* 4(3). doi:https://doi.org/10.1098/rsos.160764.

Material Recyling Association of India. . The Industry. http://mrai.org.in/theindustry/ferrousmetals.html.

Ministry of Urban Development. 2016. *Municipal Solid Waste Management Manual.*

Mohan, V. 2019. Centre Widens Import Ban of Plastic Waste. *The Times of India*. 16 October. http://timesofindia.indiatimes.com/articleshow/71606197.cms?utm_source=contentofinterest&utm_medium=text&utm_campaign=cppst.

Parley for the Oceans. n.d. Adidas X Parley. https://www.parley.tv/updates/adidasxparley.

PlastIndia Foundation. 2019. *Indian Plastics Industry Report.*

Presidential Resolution Declaring the Single-use Plastic Categories Prohibited to Import into Maldives. 2020.

RecycleinME. 2021a. *Current Market Prices–Indian Scrap prices*. https://www.recycleinme.com/scrapresources/india_scrap_prices.

RecycleinME. 2021b. *Current PET Bottles Baled Prices–South Indian Plastic Prices*. https://www.recycleinme.com/scrapresources/india_scrap_prices.

Royle, J., Jack, B., Parris, H., Elliott, T., Castillo, A., Kalawana, S., Nashfa, H., and Woodall, L. C. 2022. Plastic Drawdown: A Rapid Assessment Tool for Developing National Responses to Plastic Pollution When Data Availability is Limited, as Demonstrated in the Maldives. *Global Environmental Change.* Vol. 72.

Samarasinghe , K., Kumar, S. P., and Visvanathan, C. 2021. Evaluation of Circular Economy Potential of Plastic Waste in Sri Lanka. *Environmental Quality Management*. doi:https://doi.org/10.1002/tqem.21732.

Shantha, A. 2019. The Issues and Challengers of Ferrous/Scrap Industry in Sri Lanka: Policy Analysis. *American Journal of Humanities and Social Sciences Research.* 3(6). pp. 185–197.

United Nations Environment Programme. 1989. *Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal, List B.* http://www.basel.int/Portals/4/Basel%20Convention/docs/text/BaselConventionText-e.pdf#page=81.

Waste Management Corporation Limited. 2017. *2016 Annual Report.* Houston.

———. 2018. *2017 Annual Report.* Houston.

———. 2019. *2018 Annual Report.* Houston.

World Steel Association. 2020. *World Steel in Figures.* Brussels.

Metals and Plastic Recycling in Maldives

The reduce, reuse, and recycle approach forms the backbone of both Maldives' solid waste management (SWM) policy and sustainable SWM strategy. However, recycling rates remain low despite the high volume of recoverable waste generated in the country. Knowledge of the market size and understanding of constraints to improving recycling in Maldives is limited. This paper aims to fill this knowledge gap and provides recommendations to policy makers and SWM industry stakeholders on opportunities to further strengthen this sector, where viable. A stronger recycling industry could help improve overall SWM system efficiency and provide business and employment opportunities contributing to green growth.

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