

Research Report

The Barriers for Maldivian Local Small Island Governments to conducting waste management

by

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TABLE OF CONTENTS

1. Introduction	9
1.1. Background of Solid Waste Management in the Maldives	9
1.2. Terms used in the report	12
1.2.1. Maldives local islands.....	13
1.2.2. Infrastructure.....	13
1.2.3. Islands Waste Management Centre (IWMC)	13
1.2.4. Regional Waste Management Facility (RWMF)	14
1.2.5. Small Island Developing states (SIDS)	14
1.3. Research Question and Research objective.....	15
1.4. Justification of the study.....	16
2. Literature Review	19
2.1. Waste Management practices in the Maldives.....	19
2.2. Using 3R approach for waste management in Small Island Developing States (SIDS)	20
2.3. Best Practices in other Small Island Developing States	21
2.4. Education and Public Awareness.....	22
2.5. Environmental Awareness in the Educational System.....	22
2.6. Role of local government, citizens, and civil society organisations participation in waste management.....	23
2.7. 3R society for a sustainable society.....	25
2.8. Infrastructure measures to support the solid waste management in SIDS.....	26
2.9. Government and Private sector participation in waste management.....	27
2.10. Successful Practices followed by other SIDS on Waste Management	29
3. Research Method	30
3.1. Introduction.....	30
3.2. Research strategy.....	30
3.3. Data Collection.....	30
3.4. Interview Questions with the Stakeholders.....	31
3.5. Data Analysis.....	36
3.6. Limitations and potential problems of the study.....	38
3.7. Summary.....	39
4. Findings	40
4.1. Current waste management practice at the local island	41
4.2. Waste management case of Faafu Magoodhoo local island	45
4.3. Barriers for waste management identified by the interviewees	46
4.4. Waste management infrastructure measures.....	49
5. Discussion	52
6. Conclusion	58
References	60

Certification

I, MOHAMED Naufal (Student ID 51220611), hereby declare that the contents of this Research Report are original and true and have not been submitted at any other university or educational institution for the award of degree or diploma.

All the information derived from other published or unpublished sources has been cited and acknowledged appropriately.

MOHAMED, Naufal

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Abstract

The island nation of Maldives has various developmental challenges, and the main issue facing the island nation is waste management and plastic pollution. With the increase in economic activities and changes in consumption pattern, the issue of waste management in the local islands of Maldives are a threat to the environment and local communities. In the local islands of the Maldives, they have barriers to moving from a traditional waste management system to a more systemic process as they lack the proper infrastructure and technical expertise to address this issue. This study will examine the rural small island's practices and the issues they are facing in waste management in general and plastic waste which is recyclable. To achieve the objective, the method of this study is qualitative by reviewing literature and conducting interviews with the national government, local island councils and international organisations. From the interviews, it was identified the challenges and issues they are facing in having a proper waste management system in the local islands. When moving from a traditional waste management system to a more systemic process, there are several challenges, same as in other Small Island Developing States. It was identified that the local islands in the Maldives lack basic infrastructures such as waste management centres, machines and vehicles. In the current waste management system, the local government collects waste from households and dumps organic waste into the oceans. The recyclable items

such as plastic, metal and glass are kept in a holding area until it is shipped to the RWMF. The island councils stated that shipping recyclable waste to the RWMF is not practised in their islands, and due to this, IWMC's reach their full capacity in 6 months' time and become a barrier to managing waste at the local island level.

The national government of Maldives is currently implementing projects to build basic infrastructure by building IWMC and providing machines and vehicles to collect waste. Lacking funding and technical knowledge in SIDS is a challenge identified in other countries as well. To address waste management issues, it would require the support of local councils, civil society organisations, national governments, the private sector and citizens as well. In the case of B.Kendhoo council that was interviewed for this research stated that on their local island, they have the support of a nearby tourist resort by providing technical knowledge and funding. This resulted in establishing a better system and giving the island council and IWMC staff knowledge of more environmentally friendly waste management techniques. They aim to eliminate single-use plastic on their island and reduce the amount of waste generation on their island.

Keywords: waste management; small island developing states(SIDS); 3Rs of Plastic waste management; Maldives

List of Abbreviations

ADB:	Asian Development Bank
IWMC:	Island Waste Management Centre
RWMC:	Regional Waste Management Centre
SIDS:	The small Island Developing States
3Rs:	Reduce, Reuse and Recycle
WAMCO:	Waste Management Corporation
UN:	United Nations
MOE:	Ministry of Environment
UNDP:	United Nations Development Programme
GEF	Global Environment Facility

List of Tables and Figures

Table 1: Public Participation Models

Table 2: Tactics used in the Study

Table 3: Waste management practice followed in four categories of the islands

Table 4: Waste collection fees from household, businesses and government

Table 5: Basic Infrastructure measures available in the Local Islands of Maldives

Figure 1: Framework for data collection and analysis on the plastic waste management in the rural islands in the Maldives

1. Introduction

This chapter details the Maldives and overall waste management in the country. The background of waste management in the Maldives and key areas focused on this study will be explained in this chapter. The chapter also presents the terms used in this study and the justification of this study.

1.1. Background of Solid Waste Management in the Maldives

The Maldives comprises a chain of 1,190 islands highly vulnerable to the consequences of climate change, with over 80 per cent of the land area being below one meter above sea level (Ministry of Tourism of Maldives, 2013). In recent years, with an increase in population, changing consumption patterns, growing economic activities and barriers to transportation have contributed to the country's increasing waste generation.

The total waste generated in the country is not reported; however, the government is facing a growing challenge in controlling the increasing solid waste (Ministry of Tourism of Maldives, 2013). However, the per capita waste generation per day in the capital city, Male' city, is estimated at 1.7kg, for small local islands, it is estimated at 0.8kg, and for the tourist resorts, 3.5kg (Ministry of Environment and Energy, 2016). It is estimated to increase by 4% per annum, and this amount is similar to most developed nations. Since waste management practices and policies are poor, it is widely considered to be the most urgent environmental issue in the Maldives (Ministry of Environment and Energy, 2016). In the local islands of the Maldives, with the increase in waste generation, it is crucial to address a better waste management system and reduce overall waste generation.

In the Maldives, more than 38% of the total population lives in the capital central Male' area, also called the greater male' area, the waste generated from the greater Male'

area was started to be dumped into a lagoon and later, an artificial island was formed which became the waste dumping site for the greater Male' areas (Ministry of Environment and Energy of the Maldives, 2018). In 1992 the government decided to use the lagoon, and later this lagoon became Thilafushi island, the Greater Male' Region, which is comprising of the islands of Male', Hulhumale' and Villimale', which is the major urban centre in the Maldives and houses more than a third of the country's population. (Ministry of Environment and Energy, 2016) the rest of the population lives in the local islands, which are rural islands.

In the local Island of the Maldives, other than the capital central Male' area, waste management activities are carried out by the local council; the waste management regulation 2013 specifies the role of local councils as the government authority to manage waste on each island and local councils have the authority to fine those who do not comply with the regulation (United Nations Development Programme, 2019). However, as waste generation has increased over the years, it is challenging for the local councils to implement a system with limited resources to manage waste at the island level without proper infrastructure measures, such as waste management centres, machinery and vehicles to collect waste from households.

The islands' geography and proximity to the ocean result in an increase in the amount of waste entering marine ecosystems either as a preferred method of disposal or due to poor landfill practices that are often placed on the island's shoreline. The capital city and a few highly populated islands have recently introduced a waste collection system by the government-owned Waste Management Corporation (WAMCO). This company was initially started to implement a system and a sustainable waste management solution in the country, starting from the capital area, but the corporation officially started the operation in January 2016 by taking over the waste management function for the Greater

Male' region (Ministry of Environment and Energy, 2016). The primary process is collecting unsegregated waste from households and transfer to the Thilafushi landfill area.

However, the existing system does not focus on on-site segregation, reduction, end-of-life-use processing or recycling in the Maldives (Malatesta et al., 2015). The system focuses on collecting segregated or unsegregated waste from the household and transfer to the island waste management centres. To worsen the issue, there are currently no incentives or government policies for residents to segregate waste at the source and no procedures to follow. Although waste collection service is in place for the Greater Male Area and a few other islands, there is still widespread dumping of waste in public spaces as well as the waters surrounding the island. Waste segregation systems have been successfully implemented in a few rural islands with smaller populations; however, the system lacks a process of integrating island waste management centres into the regional waste management centres. Even with islands that have implemented proper waste segregation and collection, inorganic waste such as plastic and metals are still being piled up on those islands due to poor waste transport mechanisms to the regional waste management centres.

One essential process that lacks the current waste management process is the waste segregation process in the Maldives. Segregating waste at the household level and secondary segregation at the waste management centres. Adopting segregating waste in line with the "3R" principles into specialized waste streams at the household level will allow for more effective management of wastes down the line. Most Local islands in the Maldives follow the open burning practice in the current waste management practice. In some islands and resorts, waste management is carried out using a hybrid method where organic kitchen waste is composted, treated or segregated before final disposal on

Thilafushi island. If the “3R” principle is in place, a broad segregation stream can cluster as organic and inorganic waste. The inorganic waste will be further segregated into its constituent waste streams. After segregation, the majority of clean plastics can be sent to existing plastic collectors, and remaining materials such as glass can be used to create a substrate that can be used as construction materials or used in the production of secondary value-added products. Metals can be sold to appropriate buyers, and the organic waste can be turned into compost using simple technologies and a streamlined process. The country currently has a strong market with international ties to sell plastic and metal and export it out of the country. One such environmental organisation is Parley for the oceans, which is a global collaboration network that works to prevent plastic from entering our oceans by collecting plastics and shipping plastic to companies such as Adidas to produce products from recycled plastics.

For the long-term sustainability of the island waste management centre, a source of income is a vital component to cover the operational cost of the centre. Market size plays an essential role for the business in buying recyclable materials such as glass, aluminium, plastic, and other goods. The small quantity exported may not satisfy the demand of the international companies in terms of cost-benefit. But with proper segregation at the island level and to the regional centres via a sustainable transport network, the market for recyclable materials can be expanded.

1.2. Terms used in the report

Some of the terms used in the report are more focused on small island developing states, and especially to the Maldives islands. In here I explain the definition and context used for the scope of this report.

1.2.1. Maldives local islands

The capital city area of Maldives is referred to as the greater Male' region; this region has the highest population density (Asian Development Bank, 2018). It is the urban area of the country, and for this study, I will focus on the rest of the small islands in the Maldives. The rest of the islands are rural communities which are also referred to as the local islands. For this study, I will focus on the rural Maldives' local islands, which have fewer resources to manage waste.

1.2.2. Infrastructure

Buhr (2003) categorises infrastructure into three areas: institutional infrastructure, personal infrastructure and material infrastructure. Capital goods such as garbage disposal facilities are categorised under material infrastructure, referred to as social overhead capital, social amenities or public facilities (Buhr, 2003). Buhr (2009) defines material infrastructure as "*immobile capital goods that essentially contribute to the production of infrastructure goods and services needed to satisfy basic physical and social requirements of economic agents and unavailable to the individual economic agents (households, firms etc.)*" (Buhr, 2009, p.18). In this study, I would like to use this definition for the waste management infrastructure, which is also considered Island Waste Management Centres (IWMC) in the Maldives.

1.2.3. Islands Waste Management Centre (IWMC)

The Waste Management facility in the local islands of Maldives is called the Island Waste Management Centre (IWMC). Waste collected from the local households is kept in the

IWMC; the role of this facility is to compost organic waste and store other waste in segregated areas until it is shipped to the Regional Waste Management Facility (The World Bank, 2016). The local council manages this centre, and they have staff, vehicles and machines at the IWMC to manage waste, and these centres are constructed far from the households.

1.2.4. Regional Waste Management Facility (RWMF)

Ministry of Environment of Maldives has divided the country into seven different zones, which would have a Regional Waste Management Facility in every zones; the RWMF is defined as a facility that functions as the final disposal place for recyclables, hazardous and residual waste which are stored in the islands waste management centres in the local islands of that specific zone (Ministry of Environment of the Maldives, 2019). The key activities of a Regional Waste Management facility are to transfer recyclable, hazardous and residual waste from Islands Waste Management Centres; at the RWMF, different technology options would be developed for the final disposal of waste items such as plastic, metal and glass (Ministry of Environment of the Maldives, 2019).

1.2.5. Small Island Developing states (SIDS)

Small Island Developing States (SIDS) are a group of 38 UN member states and 20 Non-UN members vulnerable to environment and development; in the 1992 UN Conference on Environment and Development, these states were recognised (United Nations, n.d.). SIDS are regarded as some of the most vulnerable countries to climate change and natural disasters, but there are other developmental challenges such as pollution, rapid rural and urban migration, and loss of languages and culture (Kelman & West, 2009). SIDS are

grouped into three geographical regions, Caribbean SIDS, Pacific SIDS and AIMS, which consists of Atlantic, Indian Ocean, Mediterranean and South China (Mohee et al., 2015). Maldives is considered in the AIMS in the Indian ocean SIDS.

Among the other issues facing SIDS, waste has been one of the significant issues. An increase in waste generation due to the growth of economic activities and change in consumption patterns are some of the important factors. SIDS have limited options for managing waste, and the most common disposal act is landfilling; since this is the cheapest option and other waste management techniques are not available this practice is followed in most the SIDS (Mohee et al., 2015).

1.3. Research Question and Research objective

My study aims to address barriers that local governments have in small rural islands in the Maldives. The main research question of this research is:

What are the barriers which local island governments have in conducting 3Rs of plastic in small rural islands in the Maldives?

Therefore, my research objectives are in the following main areas

- 1. Practices by other Small Island Developing States (SIDS)** To understand the successful waste management practices they have implemented and the challenges they face in managing waste. Also, to understand the 3R practice which effective in SIDS
- 2. Maldives national government and local government policies on waste and 3R:** The national government and local government policies in the Maldives on waste management and to understand how much those policies are being

implemented and the challenges they face to implement.

3. **Current 3R practice by the small island local governments:** from data and literature, what are the current practices followed by other SIDS and in the case of Maldives.
4. **The barriers for the small island local governments and the Maldives to conduct waste management and 3R:** To understand the barriers that SIDS and Maldives face in the case of waste management and 3R.

The objective of this study is mainly to understand the barriers to SIDS and, in the case of Maldives. By literature study to understand the challenges other countries similar to the Maldives face in waste management. From the interview, the barriers facing Maldives' local island communities will be identified, and it will give an understanding on the current practice of waste management on the local islands. Also, the different opportunities the local governments see in waste management and how they are able to use those opportunities in the local context.

1.4. Justification of the study

Several waste management centres have been constructed on local islands, but the success rate for proper waste management at the island level is low for a number of reasons (Malatesta et al., 2015). For the individual islands to have proper waste management centres and machinery to treat waste, including plastic, metal, organic waste, and other forms of waste, is a costly process. Regional waste management centres in different regions of the Maldives could have proper waste management facilities to treat waste, and waste generated at the individual islands of the region can be transferred to the regional waste management facility. The regional waste management facilities are

currently not in operation. As a result, the centres on the local islands have reached their full capacity, and island residents dispose of waste on beaches or low-lying areas, and open burning is also practised on the island (Ministry of Environment of Maldives, 2019).

A sustainable waste management concept based on the 3Rs (reduce, reuse, and recycle) could benefit the local government, and it can reduce the waste generation at the islands through a change in waste consumption and lifestyle. Since the Maldives is in the process of implementing sustainable waste management practices with the focus on 3Rs is a significant concept to reduce the waste generated and change consumption patterns and lifestyles to create a society that reuses and recycles (Ministry of Environment of the Maldives, 2019). The findings of this study could be significant for the decision-making process of the local governments of Small Islands in the Maldives and change in practice which could be used as tools for better waste management practices. Poor waste management creates numerous health concerns from the accumulation of harmful substances, breeding grounds for mosquitoes and spreading of infections; also, the environmental impact of groundwater contamination and damage to coast and reefs are a few of the effects (Agamuthu & Herat, 2014).

The study will focus on the barriers that local governments have when conducting 3Rs of plastic in rural communities in the Maldives. The amount of waste generated in the rural communities is increasing with the change in consumption, and since the increase in the number of plastic waste and microplastic is the highest in the world, the findings of the study could be used to implement practices that will increase waste reduction and improvement in waste management in rural communities by establishing a mechanism to reuse and recycle at the local island level (Flinders University, 2020).

The findings of this study will identify the current barriers that the local governments

face, which can be addressed when working towards better waste management practices. This will benefit national governments, civil society organisations, local government institutions and stakeholders involved in the waste management in rural islands to make data and evidence-based policy decisions. The data gathered from this study is hoped to identify the gaps in the current waste management system and will evaluate the barriers that local governments face when conducting 3Rs of plastic waste management. This could be replicated in other small island communities in the implementation process as lessons learned.

2. Literature Review

This section of the report will explain the literature review examined for this study which are relevant to the research objectives and the research question. Developing a material cycle society with a focus on waste management policies that emphasize reducing, reusing, and recycling requires a collective effort of government, citizens, and civil society participation. 3R and waste management policies among countries, especially in small island developing states, differ depending on the circumstance and consumption patterns. This literature review will examine approaches that are significant for a 3R-centric waste management system and practices that were implemented in developing nations and other small island developing states.

2.1. Waste Management practices in the Maldives

Waste management for Small Island Developing States (SIDS) has several challenges, and some of the challenges facing other SIDS and Maldives are also very common. Most island nations like the Maldives have very strong cultural values and traditions, which are important to be considered when working towards a solution in waste management (Agamuthu & Herat, 2014). In the local islands of the Maldives, waste management centres in the waste management system are regarded as collection centres, where in some islands, open-air burning is practised, and in some, food waste is thrown in the ocean (Malatesta et al., 2015).

In the Maldives, the islands are geographically isolated, and it has challenges to ship waste generated at the local island to the regional waste management facility. Malatesta et al. (2015) studied the infrastructure measures and local island practices in waste management; in local islands, the island council manage the island's waste management activities. In Malatesta et al. (2015) research, a case study of Faafu Magoodhoo Island

was conducted, this is an island with 526 inhabitants, and on this island, waste is collected and separated at the centre, where it is burnt in an open dumpsite without any treatment. In the case of Faafu Magoodhoo, the island council built an area for waste collection, treatment and in 2012, they made an incinerator, but after a few years, the project faced difficulty since the island waste management centre reached its capacity and due lack of funding (Malatesta et al., 2015). Malatesta et al. (2015) stated in the case of the small island in the Maldives that an approach that would work is to integrate traditional practices and knowledge; also, the researchers noted the clash between national level and local level practice needs to be addressed in the case of Maldives.

2.2. Using 3R approach for waste management in Small Island Developing States (SIDS)

The 3R-based solid waste management approach has become part of the discussion for policymaking on solid waste management in many countries; however, creating an environment to integrate traditional waste management with the 3R approach would require strengthening proper policy, regulation, and process at the national and local level. Memon (2009) discussed the challenges with integrated solid waste management integration with the 3R approach as it is impossible for many countries to change traditional waste management practices without external funding, and many developing countries did not have a dedicated waste management plan, it was not a priority, and issues associate with an increase in a waste generation were not taken into consideration.

The international agencies realised that improvement in waste management could not be achieved with a disconnected approach; an integrated approach was required to reduce the total number of waste that is generated with the proper collection, treatment and disposal, also with awareness and policy framework it could reduce the volume of waste

since waste contains precious materials for recycling as well as energy to be used as a substitute for fossil fuel, this realisation completes the concept of 3R concept to reduce the amount of waste generated, reuse and recycle (Memon, 2009). Memon (2009) stated roles with the local and national governments were not aligned initially, and the 3R approach was promoted in each waste sector individually; however, it was realised that by integrating various sectors under the integrated solid waste management based on the 3R approach there would be various gains as resources would be better utilised, save in waste management cost and there would be substantial amounts of recovered materials and energy available to facilitate these resources in for production, cleaner and safer communities and improve the quality of life.

2.3. Best Practices in other Small Island Developing States

Solid waste management is a challenge for developing and developed nations as the resources required to implement a proper system are high. Willmott and Graci (2012) study on the Gili Trawangan, Indonesia, states that small island settings based on tourism economies can further complicate waste management scenarios. Waste generated from tourism can be near twice the rate of local waste products, and it changes disposal patterns; this creates more challenges as the small island communities have limited land availability for disposal and limited financial resources. Also, they often have difficulty finding markets for re-sale recyclables on the mainland (Willmott & Graci, 2012). As a result, on the Gili Trawangan island, solid waste is managed through open dumping on land and waste and open burning.

The drafting committee of the state of the 3Rs in Asia and the Pacific (2018) pinpointed the state of the 3Rs in Asia, and the pacific project was formulated in the 6th Regional 3R

Forum in the Maldives in 2015. The initiative to assist member countries in the Asia and Pacific region on improved decision-making towards effective implementation of 3Rs and environmentally sound waste management at the local and national level has been started (Drafting Committee of the State of the 3Rs in Asia and the Pacific, 2018).

2.4. Education and Public Awareness

Public awareness of environmental problems and solutions can be increased through education, and particular skills and knowledge gained from environmental education would help to change human behaviour towards the environment (Desa et al., 2012). Before the awareness and education programs are conducted, it is important to conduct research, understand the local context, and identify the community's perception of the current waste management issues in the local islands of Maldives. Depending on the geographical location, socioeconomic, culture, consumption pattern, and climate, the waste generated at a specific location may vary. In the context of Maldives, bottled drinking water is transported from the capital, Male' to local islands, and due to poor waste management practices, these plastics end up in the ocean or on the beaches, and the amount of microplastic pollution in the waters around the Maldives are amongst the highest in the world (Patti et al., 2020). With education and awareness among the public, consumption patterns and waste management practices can be changed since the environmental impact are almost irreversible.

2.5. Environmental Awareness in the Educational System

Desa, Kadir and Yusoff (2012) researched Malaysia to understand the importance of environmental awareness and education for solid waste management, and one of the

results presented was that when students have an understanding and information on the environment, they are keener to be part of environmental protection activities. Also get better solutions for the problems that can be implemented in the local context. The researchers assessed the awareness, attitude, and perception towards waste management of students from the University of Malaysia, and it showed more than half of the students have a negative attitude towards solid waste management, which is associated with behavioural problems, lack of enforcement, lack of monitoring, and students did not understand the roles and responsibilities.

The research based in Malaysia suggested that since knowledge and environment are important to change behaviour best method to create awareness and educate on environmental issues such as waste management is to integrate them as part of the educational system (Desa et al., 2012).

2.6. Role of local government, citizens, and civil society organisations involvement in waste management

The active participation and opinion of stakeholders when implementing a waste management system can have a positive impact to which address the concerns of all the parties. The broad definition of public participation is the *“involvement of citizens in the governmental decision-making process, and this includes public hearings and actively include in decisions that affect communities; the public also refers to private citizens, civil society, labour unions, the Government, public officials, industrial, agricultural and trade associations, scientific and professional societies, environmental, educational and health association and other minority groups”* (Squires, 2006, p.13).

Involvement of the general public when making a decision on government policies on waste management has proven successful in other SIDS, and by a social analysis, it is essential to establish a framework for public involvement; also it is important to know key stakeholders that could give input to the process (Squires, 2006). Squires (2006) researched the importance of involving and getting the public to participate in waste management issues in SIDS; this study was conducted in the Caribbean and the Mediterranean countries.

The Caribbean and Mediterranean countries, similar to the Maldives, depend on tourism activities, and sustainability relies on maintaining the marine environment free from pollution. From Squires (2006,) research identifies the lessons of experience from these island states, and since the population holds governments accountable for adequate solid waste management, it is imperative to consider everyone as a stakeholder in the country and have an excellent participatory process from the public. Some models of public participation are:

Table 1: Public Participation models (Squires, 2006)

The Exclusionary Model	This model states government or the agency is the exclusive guardian of the people, and anyone else who are self-acclaimed representative of the public interest is a meddle; in this model, only competitors and other institutional stakeholders were allowed to participate, and this is proved inappropriate for risk-oriented decision-making
The Confrontational Model	This is not a desirable model, and it is not effective in addressing matters related to local interest, but it can be effective if the activities can get the attention of a large number of inactive members of society, this is a form which can keep specific topics or concerns of the public which would make agencies to revisit a decision that has been already made. This model is very public, but it is not designed to be participatory and certainly is not conducive to informed dialogue about risk and mitigation;

	during debates on Solid waste disposal sites or other components, there have been shouting matches at meetings, and sometimes the decision-maker agrees to speak to the activist to induce them to stop their action but rarely are asked to participate in the actual decision-making process.
The Adversarial Model	This model states that all interested groups have a right to participate by submitting facts, evidence, views and argument on the subject. usually, this model is based on courtroom adjudication, parties who counsel may represent; in some cases, this is a slow and expensive process, but it can be cheaper and more effective as well, depending on the situation.
The Due Consideration Model	The Due Consideration model is similar to the adversarial model except for the agency, or the government will invite the public to comment on their decision as well as the issue before the public hearing, this model is better fit to issues related to policy and participants are less directly involved in the actual decision-making process.
The Mediation Model	In this model the representative of groups meets with the aid of a mediator or facilitator to present facts or arguments to reach an agreement; public participation may be invited at this stage as the negotiators meet until they reach an agreement.
The Advisory committee Model	This model is similar to the mediation model, but they rely heavily on scientific and technological expertise on the subject matter, and the agency forms a committee of experts to advise on the technical issues and a resolution.

2.7. 3R society for a sustainable society

3R is a concept which involves management of waste properly and it is reduce, reuse and recycle. Pariatamby and Tanaka (2014) researched the municipal solid waste management in Asia and the Pacific Islands and stated a sustainable society is one in which healthy and rich natural environments, including those on a global scale as well as in local communities, are all well preserved and provided benefits to those who live and

creating a world that can be handed down to future generations. Pariatamby and Tanaka (2014) also stated to make such a society, it is necessary (1) to protect the environment and achieve a “Low-carbon society” where the environmental impact is limited within the environmental capacity, (2) to achieve a “sound material cycle society” or “3R society” by recycling of resources that minimizes the extraction of natural resources and emissions, (3) “achieve a society in harmony with nature” that preserves healthy ecosystems.

Creating a 3R society for the future requires us to review various aspects of waste management and develop disposal methods that are designed to conserve resources more effectively and provide better protection against pollution (Pariatamby & Tanaka, 2014). Pariatamby and Tanaka (2014) stated it is important for the local governments to review their policies and adopt new measures that mitigate the environmental effects of the procedures for waste collection and management; also, costs involved in these procedures must be taken into consideration. Analysis conducted by the researchers states the best results for waste management system 1 in terms of cost, system 2 in terms of the consumption of resources, and system 3 in terms of environmental impact. Rather than focusing on the highest possible level of standards, the most relevant result is moderate levels since there is a need to balance cost and environmental impact.

2.8. Infrastructure measures to support the solid waste management in SIDS

In SIDS, infrastructure measures are one important aspect that requires immediate actions to be taken, as the waste system needs to function properly. Meylan et al. (2018) conducted a solid waste management case study on Seychelles, which also relies on tourism and fisheries income; in the case of Seychelles, the island nation has limited

infrastructure measures in place to conduct a proper solid waste management system. Was that state, even though clear government policies are in place, the infrastructure to implement a proper system also has to rely on foreign know-how (Meylan et al., 2018). In SIDS, one of the challenges for implementing infrastructure projects is due to geographical isolation and the population; in the case of Fiji as well due to low population and since the islands are isolated, they face difficulty in financing waste management projects on each island(Lal et al., 2007). Similar to the case of Maldives, in Fiji, they proposed a system in which waste is collected in one area and then to be segregated into recyclables and organic waste, then waste to transported to the nearest regional facility (Lal et al., 2007). These systems are managed and operated by the local administrative authority, the local population, and the rural waste management facilities are linked to the urban facilities, which would dispose of the recyclable items such as plastic, metal and glass. In the case of developed SIDS such as Singapore have a system of incineration which reduces the total volume of waste; even though Singapore has infrastructure measures in place, one of the main objectives is the minimization of overall waste generated (Bai & Sutanto, 2002).

2.9. Government and Private sector participation in waste management

Support and partnership of the private sector in waste management is an important key aspect of a successful system, and in developed SIDS, Singapore they have established a solid waste management system with private sector involvement (Bai & Sutanto, 2002). Bai & Sutanto (2002) stated that in the case of Singapore, the government has waste collectors from the private sector, and the government licenses them; also, private businesses operate waste treatment such as incinerator plants. This system would assist

in the waste management of a country and reduce the burden by the government since the private sector would model their system in a profit-generating system which would be more sustainable. Massoud & El-Fadel (2002) defines the partnership between the private sector and public sector as the *“transfer and control of a good or a service currently provided by the public sector, either in whole or in part, to the private sector”* (Massoud & El-Fadel, 2002 p.621). According to Massoud & El-Fadel (2002), when the private sector works towards achieving waste management solutions, they work towards innovation which would otherwise cost additional financing for the government, and they work to accomplish the service most cost-effectively. One of the keys to implementing waste management is finance and infrastructure, which the private sector can bring through domestic and foreign capital, and it in their study, it was highlighted that the private sector brings better results in waste management than government institutions working to achieve (Massoud & El-Fadel, 2002). But in order for them to enter into waste management activities, there should be incentives which would benefit for both parties, and in the case of developing countries, this is needed to be facilitated by an agency to get the private sector on board (Ahmed & Ali, 2004). Ahmed & Ali (2004) studied the developing countries' case for public partnership and stated the examples of developed countries might not work as in the developed countries as the major corporation makes the investments at a much larger scale, but in developing countries, small scale parties with public sector support would be an ideal choice. In the case of Maldives from the Private sector, Parley Maldives and Secure bag are private businesses that collect plastic bottles, reusable items and recyclable metal items and export them to foreign markets (Institute for Global Environmental Strategies, 2021).

2.10. Successful Practices followed by other SIDS on Waste Management

In the case of Small Island Developing States the challenges associated with waste management requires interisland coordination's between the island. When infrastructure measures or technological investments are made in the local communities with policy guidance requires a strong coordination and this plays an important role in the success of waste management projects (Fuldauer et al., 2019). Fuldauer et al., (2019) study stated that investing in programs that would educate and measures that prevent waste production and reusing which combines the 3R concept is less expensive. This method is proven to be more successful than investing in infrastructure or technology which does cost more. in the case of Fiji they used the method of participatory learning and action which educates people by doing something by themselves and by action, they implemented this method to solve the problem of pig-waste management (Terry & Khatri, 2009). Terry & Khatri (2009) stated that this method was proven to be more beneficial in the long term too, which could bring a positive change to the local communities in the long term. The method of education has been discussed to be more successful and beneficial, this is also one of the most important cost effective method that can be implemented to bring long term behavioural change.

3. Research Method

3.1. Introduction

This chapter studies the research methods adopted for conducting this study; this research aims to understand the barriers that local governments have in the waste management in the rural islands of the Maldives. A qualitative method using semi-structured interviews and surveys will be utilised for the data collection. In relation to the study, there are five main areas that I will be focusing on when conducting the interviews those are funding, lack of institutional capacity, education, lack of infrastructure and geographical isolation of the islands

3.2. Research strategy

This research is social research that addresses qualitative approaches and is designed in a case study-based method. The case study is defined as an empirical inquiry investigating contemporary phenomena within their real-life context (Yin, 2009). This approach will be used as data collection is used by interviews, and there is limited literature on the subject of barriers to plastic waste management and the 3Rs of waste management in the Maldives; and Yun (2009) recommended that this strategy has the researcher more control and ability to accommodate different research techniques for the study.

3.3. Data Collection

For data collection for this study, I will be conducting interviews with relevant stakeholders for my research. Questions will be open-ended semi-structured one-on-one interviews with the selected stakeholders. The object of interviews for this study is one-

on-one consultation is helpful as the researcher can gather more information and the participant can provide more historical data on the subject matter. Also, the researcher can control the line of questioning and follow up on the discussion. I have selected interview stakeholders for this study, and they consist of the government and Ministry of Environment of the Maldives waste management department staff as they are the central government regulatory department that does waste management policy work. I will also conduct interviews with the local councils from 5 different geographical regions of the Maldives. Also, international organisations such as UNDP and GEF program that support waste management activities will be interviewed. They play a crucial role in supporting central and local government in Solid waste management and plastic waste management. For the interview, the final 2 questions are common questions for the stakeholders and it explains the challenges and positive aspect of waste management from the stakeholders perspective. The rest of the questions asked to each stakeholder will vary depending on their involvement in solid waste and plastic waste management. The interview will focus on the waste management practices in the local islands, infrastructure measures available in their local islands and understanding the barriers they are facing to have a systemic waste management approach.

3.4. Interview Questions with the Stakeholders

For this study, three categories of stakeholders were interviewed that are national government, local government and international organisations. For the National government, I interviewed the Ministry of Environment. This is the national government authority mandated to manage waste issues in the country, including implementation of waste management projects and formulating legislation at the national level

Then the local government authority that manages waste issues are local island councils; they collect waste from the household, manage Island Waste Management Centres (IWMC) and discard waste. The key role in the local islands is carried out by the local councils on every island.

International donors have projects that are carried out in partnership with national governments and local councils; they implement infrastructure projects along with awareness and education on waste issues on the local island

The national government authority that governs the waste management activities at the national level in the Maldives is the Ministry of Environment, and this is the ministry that implements projects and provides funding to the local councils to manage waste management in the Maldives (Ministry of Environment Energy, 2016). The reason for choosing the Ministry of Environment for the interview is as they are the national central authority that governs waste-related activities in the Maldives. Overview of the waste issue in the local islands and the current government's policy on waste management in the local islands is implemented by them.

The questions were formulated to understand the current practice followed by the local islands in the Maldives to manage waste and the challenges that are facing. The questions also focused to understand the waste management policy at national and local level and the implementations status of those policies. Based on the challenges identified by the from the literature review questions were also asked to understand the education and awareness barriers in waste management. The final 2 questions are asked to summarize and understand their perspective on the overall challenges they are facing and from the current situation and work they are carrying out in waste management area the opportunities they see. From the literature review it was identified that SIDS have limited

resources when it comes to waste management and with limited resources some level of waste management activities is carried out. The interview questions asked are very much focused to the research objective and understanding the barriers they face.

Questions to National Government – Ministry of Environment

1. Do you think the waste management system developed by the current policy is functioning effectively?
2. Are you currently engaged in any form 3R of plastic waste management?
3. Are there any incentives for the households to participate in solid waste management and plastic waste management activities?
4. What are the main barriers that you face in waste management areas? Could you list main 3? and explain in the context of your organisation? (Why, what, which, when)
5. Do you think there is a lack of legislation and institutional capacity? Why and could you tell me some examples?
6. What strategies could be implemented to make the current system more efficient?
7. What is the government's plan to improve the traditional waste management systems in the Maldives?
8. Do you think there is an lack awareness and education among public, government institutions and civil society organisations? and Why
9. What educational and awareness programs have you conducted if any?
10. What are the challenges you face in conducting solid waste and plastic waste management programs?
11. What are the challenges do you see in waste management of the Maldives?
12. What are the opportunities do you see in waste management of the Maldives?

Local government councils in the Maldives are the central authority that implements waste management activities in individual islands, and this is one of the important key stakeholders for the study. The local islands have local-level policies and procedures to collect waste from households, transport waste to IWMCs, and segregate and dispose. The local island councils operate the IWMC, and waste-related processes are followed by them. The question set for the local councils is to understand the current waste management practices on the island, infrastructure measures, and waste policy and understand waste management issues and challenges that they face. For this study, I have interviewed six island councils to understand the barriers they are facing in their local islands.

Questions to Local Government Councils

1. What is the current waste management practice followed on the island, and are there any policies on waste management?
2. Is the waste collected from the households sorted and how frequently is waste collected from Households and How much is the collection fee from households?
3. Do you have adequate resources, machineries, facilities, staff, vehicles, and funding?
4. How is the public and households' perception towards waste, do you think public is aware and know how to discard waste properly?
5. What are the environmental effects due to improper solid waste management at your island?

6. What are the main barriers that you face in waste management areas, could you list main 3? and explain in the context of your organisation? (why, what, which, when)
7. Do you think there is a lack of legislation and institutional capacity? Why and could you tell me some examples?
8. What strategies could be implemented to make the current system more efficient?
9. What is the government's plan to improve the traditional waste management systems in the Maldives?
10. Do you think there is an lack awareness and education among public, government institutions and civil society organisations? and Why
11. What educational and awareness programs have you conducted if any?
12. What are the challenges you face in conducting solid waste and plastic waste management programs?
13. What are the challenges do you see in waste management of the Maldives?
14. What are the opportunities do you see in waste management of the Maldives?

International organisation in the Maldives implements waste management project in the Maldives local islands, and infrastructure project and educational programs are conducted with the support of local councils and civil society organisations. For this study, I have interviewed UNDP Maldives and Global Environment Facility programme in the Maldives.

Questions to International organisations

1. What are the activities that your organisations currently engaged in solid waste management and plastic waste management?

2. How successful are the past and current programs/projects on solid waste management?
3. From your observation do you think the current system of waste management in Maldives is working and if not why?
4. What are the main barriers that you face in waste management areas, could you list main 3? and explain in the context of your organisation? (why, what, which, when)
5. Do you think there is a lack of legislation and institutional capacity? Why and could you tell me some examples?
6. What strategies could be implemented to make the current system more efficient?
7. What is the government's plan to improve the traditional waste management systems in the Maldives?
8. Do you think there is an lack awareness and education among public, government institutions and civil society organisations? and Why
9. What educational and awareness programs have you conducted if any?
10. What are the challenges you face in conducting solid waste and plastic waste management programs?
11. What are the challenges do you see in waste management of the Maldives?
12. What are the opportunities do you see in waste management of the Maldives?

3.5. Data Analysis

The data analysis is divided into six hierarchical steps. After collecting the data from the interviews and survey, organising and preparing the data for analysis is the next step. It involves transcribing the interviews sorting and arranging the data into different sets depending on the source of information or the stakeholders. The next step is reading through all the data and making notes and general thoughts. The next is the detailed

analysis of the data, which is the coding process, which is the process of organising the materials into chunks before it is brought to information. In the coding process, a description process to detail renders information about specifics is used and can generate code for these descriptions. It is a useful method for designing detailed descriptions for case studies, then using the coding to generate a small number of themes or categories which will be used in the next chapter, which is findings. The next step is to use the descriptions and themes to represent the qualitative narrative. There will be visuals, figures and tables used in the discussion. The final step is data analysis which involves an interpretation or meaning of the data; it will involve personal interpretation.

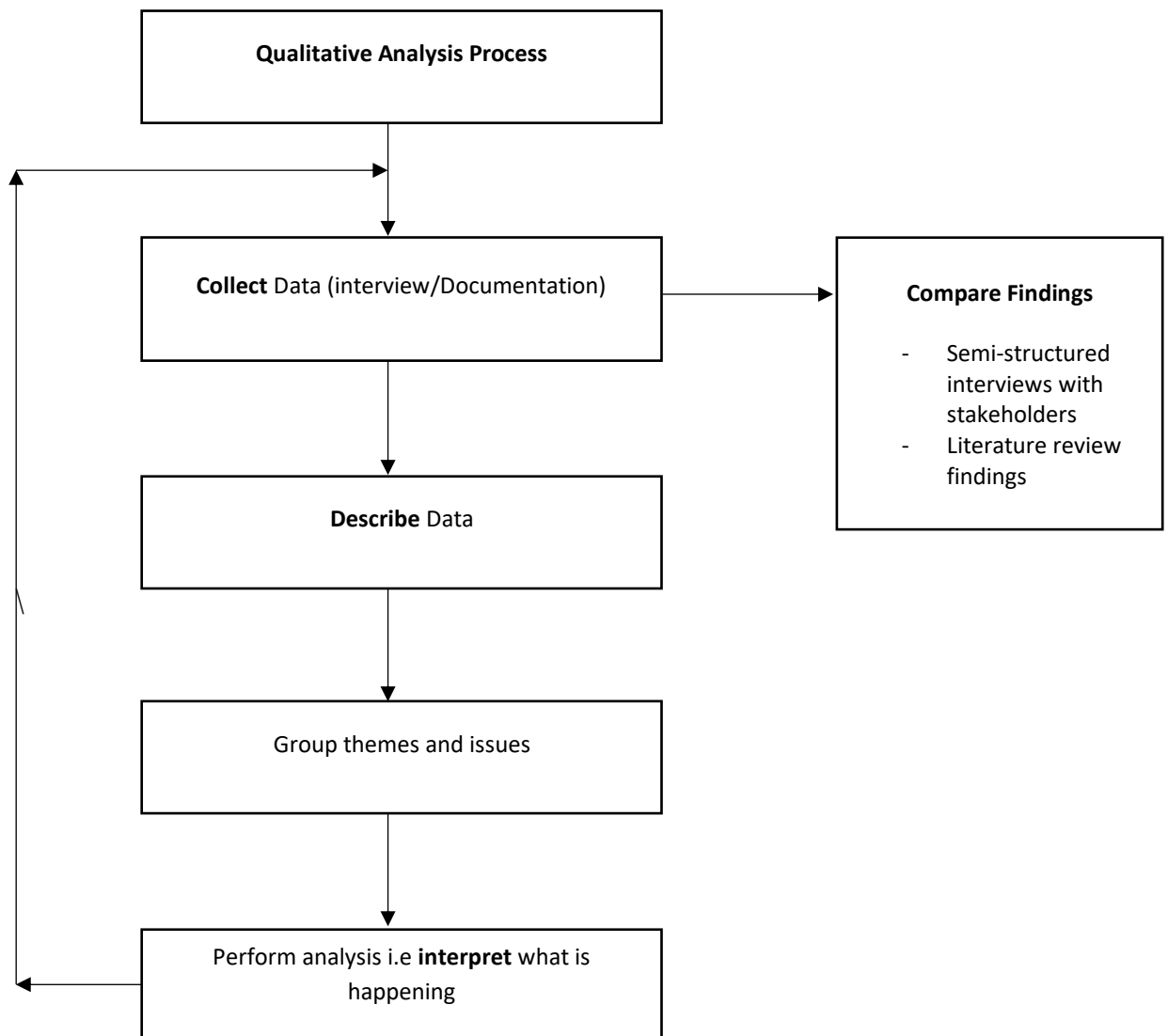


Figure 1: framework for data collection and analysis on the plastic waste management in the rural islands in the Maldives

(Biggam, 2008)

3.6. Limitations and potential problems of the study

There are certain limitations to case study research, and it is essential to establish the validity and reliability of a case study research the four tests of construct validity, internal validity, external validity and reliability tactics can be used to ensure the validity and reliability of the research strategy.

Table 2: Tactics used in the Study

Test	Tactics used in the case study research
Construct validity	Evidence from multiple sources Reviewing of the critical case study reports by key informants
Internal validity	Pattern matching Explanation building
External validity	Use of replication logic
Reliability	Use case study protocol Develop a case study database

Another shortcoming is the limited availability of the literature in the case of the Maldives; however, similar litterateur reviews from small island developing states would

be analysed. Also, since interviews are used to gather data, the information is filtered through the interviewees' views, and everyone may not give detailed information.

3.7. Summary

This study examines barriers that local governments have in conducting waste management activities in the small local islands of Maldives, and to understand the issues local island councils are facing, I will collect primary data. I will use a qualitative method based on interviews and a literature review study. After examining the literature review, I have identified five critical barriers for developing states: funding, lack of institutional capacity, education, lack of infrastructure, and geographical isolation of the islands. The stakeholder for the study includes the central government and local government international organisations. I will be conducting interviews with the stakeholders also the practitioners in waste-related activities in the Maldives. For the interview, five common questions will be asked to each stakeholder to get a common perspective on the barriers, and the interview questions are open-ended so they would give input on the issues they are facing. The national government, local government, and international organisations interviewed for this research are the key parties working on the waste-related issues in local islands, and they are important to be interviewed for the scope of this research.

4. Findings

This chapter will explain the findings of the research. This chapter will cover the findings from the semi-structured interviews conducted with the stakeholders. There are four sections in this chapter which are divided into the main barriers that were identified from the research. In the interview with the national government, local government and international organisations, I have identified barriers that the local islands have in managing waste management.

For the study I have interviewed stakeholders from national government, local government and international organisations. The interviews with the stakeholders are between 30 to 45 minutes long and the interview questions were semi-structured open ended. The interview mainly focused to be in the scope of research objectives, and it was mainly to understand the waste management practices followed and the challenges faced. The barriers for waste management in the local islands were identified from the interviews with the stakeholders. For this study I have interviewed the following stakeholders in the Maldives.

National Government

1. Ministry of Environment

The key party that manages the national level waste management activities in the Maldives are Ministry of Environment and the reason for interviewing them for my study was to understand their policy and challenges in waste management. Ministry of Environment in Maldives provide infrastructure, budget and educational and awareness to the local small islands of the Maldives. This was one of the key stakeholders for the study that could give an overall view of the waste management issues from a national level on small local islands of Maldives.

Local Government

1. R.Hulhudhuffaaruu Island Council
2. R.Ahngolhutteemu Island Council
3. Gdh.Gahdhoo Island Council
4. B.Kendhoo Island Council
5. F.Magoodhoo Island Council
6. L.Kunahandhoo Island Council

The local governments in the Maldives are small rural island councils and they are the local island level government institution that manages waste management activities in every specific island. They are the ones who could give an understanding on the waste related issues and barriers in their local island, which the scope of the study is very much based.

International Organisations

1. UNDP Maldives
2. GEF SDG Programme

International organisations such as UNDP and GEF Programme support the local councils in waste management activities, and it was identified that these international organisations have funded and implemented waste management projects in the local small islands of the Maldives.

4.1. Current waste management practice at the local island

The current system and practice of waste management in the local islands were questioned in the interviews and it was important finding for this study to examine and understand the current situation. Waste management at the local island level is followed

in a semi-formal system. From the interview with the island council, except F.Magoodhoo Island, in other islands, the council collect waste from the households and transport it to the IWMC. From the interview with the island councils, they stated waste is segregated in the household into three categories, food waste, green waste mainly consists of leaves, grass and small branches, and then the third category is other items which consist of plastic, metal and glass. In the Municipal solid waste collection from the household includes glass, disposal nappies, plastics, aluminium, food waste, untreated medical waste, toxic materials such as batteries and paints, and green waste (Kapmeier & Gonçalves, 2018). The waste collected from the household is carried in vehicles owned by the island council or rented for the work of waste management. In the islands, waste collection is started between 9 AM to 10 AM, and the work is usually finished at 2 PM to 3 PM. During this period, the staff take a break between 12 PM to 1 PM, so according to the island councils, on average it takes 5 hours every day to collect waste from household and then transport it to the IWMC.

From the interview with the island councils, it was identified that the islands have a designated area for waste management; this site is called Island Waste Management Centre (IWMC). On every island, that is collected from the households and is then transferred to the Island waste management centre for secondary segregation. Daily food waste is discarded into the sea; during the interviews, the councils stated that it is shipped to a distance out to the seas and dumped, before that they carry secondary segregation at the IWMC to check if food waste contains any recyclable items such as plastic bottles or cans, which are mixed with food waste in few cases. It is estimated that except for greater Male' areas (capital city), roughly 90% of food waste generated is dumped into the ocean (Kapmeier & Gonçalves, 2018). From the interview with Mr Amru Adam Moosa from the Ministry of Environment, roughly 70 to 75 % of the waste generated at the local islands

is organic. The basic waste management infrastructure in the local islands has the capacity to store plastic, metal, glass and other items for a period of 6 months. Mr Amru stated that the national government has a policy to stop dumping organic waste into the sea; however, since the basic infrastructure in the islands is not yet completed, they have not been able to stop the practice of dumping organic waste into the ocean. Even the island councils stated that they believe dumping waste into the sea is not a good practice, but with the limited resources, from their perspective, it is a better solution than burning in a landfill area. They stated that before waste is dumped to the nearest areas and burned, it causes pollution due to smoke, so the current system they follow to collect waste from households and dump it into the ocean is better. R.Hulhudhufaar council president and B.Kendhoo council president stated that there had been few cases of organic waste washed up on beaches of nearby islands and even on their own island due to changes in currents. Also, when the sea is rough or during the rainy season, they are not able to dump organic waste into the ocean; in these cases, they have to keep the waste in the IWMC until the next day.

One main common issue raised by all the island councils is that recyclable waste (e.g., plastic, metal, glass, etc.) generated at the islands are not being shipped out of the island to regional waste management centres on a regular basis. From the interview with Mr Amry Adam Moosa, he stated the national government policy for the local island is to have basic infrastructure measures, which include an Island Waste Management centre, equipment and machines to manage waste. The government plans to transfer plastic, metal and glass from the local islands to the nearest regional waste management facility every six months. But according to him, the system has not been developed fully and transfer to regional waste management centre is not regularly carried out. This is the main issue identified by all the island councils interviewed for this study. Even though

waste is collected and segregated at the local islands, since recyclable items such as plastic, metal and glass are not being shipped to the RWMF, the island-level centres would not be able to function. R.Hulhudhuffaar island council president stated that during the start of waste collection, it was difficult to sustain and move from the traditional waste management system as the public had no confidence in waste being collected daily from the household. He believes now the perception has changed, and they want to enhance the current system and start to generate revenue from waste. But they are not aware, and they do not have adequate knowledge to generate an income from waste and sustain the waste management centre.

Below Table 4 shows waste collection fees from households, business and government authorities of the six islands that I interviewed for this research. The collection fee is between 100 and 150 Maldivian Rufiyaa. All the islands except F.Magoodhoo collect waste from the household, businesses and government offices on the island. As per the local government, the collection fee and financial support provided by the local government are not enough for them to manage waste at the local island level, but as per the councils, the current system is better than what has been previously practised in their local islands. Before the waste is dumped into landfills in different parts of the islands and the local community does not practice segregation in the households, and the landfills are burned once or twice a week.

Table 4: Waste collection fees from household, businesses and government in local islands

	Island Name	Waste collection fee Household (MVR)	Waste collection fee business (MVR)	Waste collection fee government (MVR)

a)	R.Hulhudhuffaaru	100	200	600
b)	R.Ahngolhutteemu	130	500	500
c)	Gdh.Gahdhoo	130	200	500
d)	B.Kendhoo	125	200	1000
e)	F.Magoodhoo	-	-	-
f)	L.Kunahandhoo	150	200	500

For this study, one of the islands interviewed is Faafu Magoodhoo, a local island in Faafu atoll. Based on the literature on the waste management practices in the F.Magoodhoo and the interview, the following case would explain the practice in the context of a small local island in the Maldives.

4.2. Waste management case of Faafu Magoodhoo local island

The case study of F.Magoodhoo will examine the waste management practices in the islands and based on the interview with the local island council the main issues that are facing to have a proper waste management system at the local islands. F.Magoodhoo is one of the inhabited islands of Faafu atoll with a population of 794, and the island has 200 households; Magoodhoo has an island waste management centre which is not being used yet (Zahir et al., 2021). During the interview with the Vice president of the island councils, he highlighted that they started to use the centre before, and it was stopped later. The main economic activity of the island is based on fishing, and in 2009 Magoodhoo council built a dedicated area for waste collection and treatment; and in 2018, the construction of the island waste management centre project was commenced, in 2019, the project contract was terminated while 95% of the work was completed, they now have

a proper centre, collection bay and compost slab. Even though they have some of the infrastructures in place, the council have not started waste management on the island.

From the interview with the island council, it was stated that waste collection from households is not followed on the island as they do not have vehicles to collect waste from the household; out of the six islands that I interviewed for this study, Magoodhoo is the only island that does not collect waste from the household, in this island households are required to bring their waste to the island waste management facility. In Magoodhoo, waste at the household level is segregated into two, which are compostable and non-compostable waste (Zahir et al., 2021). In the interview, it was also stated that at the centre, there are four staffs who carry out the work of waste management, and they follow open burning on the island (Malatesta et al., 2015).

The island has a proper waste management centre with an incinerator which was built in 2012. In 2012 the island council stated that they started to operate waste management on the island, but after a couple of years, the project had difficulty sustaining as it reached its capacity and lack of management; it was later stopped. The island residents stopped delivery of waste to the centre, and mainly due to a lack of financial support for the treatment of segregated waste such as plastic, metal and glass, the locals started to dump waste at a dump site (Malatesta et al., 2015). However, the council's president stated that in his opinion, the F. Magoodhoo public is aware of waste issues as public littering is not practised on the island.

4.3. Barriers to waste management identified by the interviewees

In the Maldives local islands, the waste management is a crucial environmental issue in terms of regulation and technical sides; the national waste management policy of Maldives is structured based on main five tasks:

1. *Having waste management governance established and activated*
2. *Creating duties and responsibilities for waste producers*
3. *Waste management infrastructure to be established*
4. *Waste management system at the regional level to be activated*
5. *Changing the consumer behaviour and waste management practices*

(Malatesta et al., 2015)

In the local islands, there are a number of island waste management centres (IWMCs) that deals with the solid waste issue at the island level; they manage waste at the islands by collecting waste from the household and dumping it in a landfill and burning organic waste or dumping into the ocean. The island waste management centre in the Maldives is described as an area with a concrete pad with waste storage bays, guttering, a rainwater tank and a fence with lockable gates, the waste generated at the island is brought to this centre before final disposal (Malatesta et al., 2015)

Out of the six island councils interviewed, 5 of the island councils dumped food waste into the ocean, and one island council burned at the waste management centre. In all 6 of the island's plastic and metal, waste is segregated and kept in the waste management centre. The island councils stated that from the recyclable items segregated at the IWMC majority of the items are plastic bottles; they have no record of the amount of plastic, metal or glass waste is generated at the island since no waste audit is carried out at the local islands. Ms Fathimath Saeedha from GEF small grants stated also stated that local islands need to conduct a basic analysis of the lifecycle of different waste generated at their local islands and conduct an audit. This would help them to make better decisions and understand the current situation better. She also stated that Islands councils must work on waste reduction ways, such as plastic bottles that are increasing on the local

islands. On the local island of Maldives, they use rainwater and bottled water for drinking, and it is estimated that every year 73,600 plastic bottles are brought from the capital city Male' to the small local islands (Acciarri et al., 2021). Ms Fathimath Saeedha highlighted that under the GEF programme in the Maldives, they are currently working with local NGOs to provide alternatives for plastic bottles in the local islands and educate the local councils on ways to eliminate single-use plastic in their local islands. This program includes providing reusable bottles and shopping bags and creating incentive packages for the local community to participate in this initiative.

The findings from the interviews with the local island councils, Ministry of Environment, UNDP Maldives and GEF (Global Environment Facility) small grants program stated the lack of infrastructure at the local island level to manage waste. Island waste management centres in the Maldives are built with the support of international donors such as ADB, UNDP and GEF. The project cost covers the construction of the IWMCs, providing waste management equipment and vehicles to collect waste from the household. GEF programme national coordinator Ms Fathimath Saeedha stated that previous waste management projects carried out with the support of the GEF Programme were successful until the project funds ended, and once the funds were over, the island councils could not sustain the project. One reason highlighted by her was that those projects are not formulated under a business model.

When small island developing states work to achieve sustainable development outcomes in waste management, strategic planning is a grand challenge on which the success of these outcomes depends (Fuldauer et al., 2019). The work carried out by the island councils is not with a long-term vision but to implementors-term solutions to the issues.

Table 3: Waste management practice followed in four categories of the islands (Malatesta et al., 2015)

	<i>Local Systems</i>			
	Inhabited Islands	Urban Settlements	Uninhabited Islands	Resorts
<i>Solid Waste Management Systems and Practices</i>				
Dumpsite and open air burning	Majority	No	Yes	No
Onsite incinerator	Few cases	Planned	No	Yes
Waste treatment	Few cases	Few cases	No	Yes
Waste reuse or recycle	Majority	Few cases	No	Yes
Shipping to Central or Regional Sites	Very few cases	Yes	Yes	Yes
Organic fraction dumped in the sea	Majority	Yes	Yes	Yes

Table 3 states divide the local waste management practice followed into four categories of the islands in the Maldives, and it shows the local inhabited islands of the Maldives has poor waste management practice as the majority of the islands follow open burning at the dumpsites and organic waste is dumped in the sea in the majority of the island. In terms of shipping plastic, metal and glass to regional waste sites, this is followed in very few islands, and the mechanism is not in place. This issue was highlighted by all the councils that I interviewed for my study. Once the capacity to store plastic, metal and glass at the waste management centre, the island council does not have a way to treat these.

4.4. Waste management infrastructure measures

Infrastructure measures are referred to the facilities that are required for waste collection, treatment and land required for the ultimate disposal of waste, and this includes equipment such as waste incinerators, plastic crushers, glass crushers and other machines that are used at the waste management centre (Mohee et al., 2015). In the local islands of the Maldives, few islands have the basic infrastructure to manage waste at the island

level. A 2004 report on the barriers to waste management in the Maldives also highlighted that local islands in the Maldives do not have basic infrastructure, and previous projects carried out with support from international donor ADB is not sustainable as the centre does not have a proper revenue generation model (Ministry of Home Affairs and Environment, 2004). This issue was raised by the Island councils that I interviewed; even though they have some resources, the centres are not managed in a way that could generate adequate revenue as the fee collected from households and funding provided by the national government are not enough.

Out of the six islands I interviewed, two islands have basic infrastructure measures available at the island level, and this includes Island Waste Management Centre, Household waste collection vehicle and waste management equipment. But in the case of these two islands, it was stated that, like the rest of the islands, they collect waste from the households and dump it in the sea, and other recyclable wastes are stored in the IWMC.

Of the six island councils that I interviewed, five rely on the budget provided by the national government to cover the expenses of the waste management centre; no income is generated at the centre since there are limited options for the island councils to sell plastic and glass or metal. B.Kendhoo council stated that they get financial and technical support from nearby resort Soneva Fushi to discard plastic waste and glass waste generated on their local island. They sell these items to the resort for a, and it is then used for the expenses of the IWMC in B.Kendhoo island. They also stated the budget provided by the national government is only sufficient to cover the salary of staff, electricity of IWMC and fuel cost of the vehicle. If there is the maintenance of a vehicle or any of the equipment, the budget from the national government is not enough.

Table 5: Basic Infrastructure measures available in the Local Islands of Maldives

	Island Name	Island Waste Management Centre	Vehicles to collect waste from the household	Waste management equipment
a)	R.Hulhudhuffaaru	Yes	Yes	No
b)	R.Ahngolhutteemu	Yes	No	No
c)	Gdh.Gahdhoo	Yes	No	No
d)	B.Kendhoo	Yes	Yes	Yes
e)	F.Magoodhoo	Yes	No	Yes
f)	L.Kunahandhoo	Yes	Yes	Yes

The study revealed that the waste management at the island level is not aligned with the national guidelines set due to the limitation of funding, institutional capacity and infrastructure. From the six island councils interviewed, they have a different set of waste management systems at the island level. UNDP Maldives Programme Associate Mr Umarr Mavy stated that UNDP had provided basic infrastructure of waste management centres, vehicles and equipment to local islands; since those projects are carried out without a holistic approach, the waste management system at the local islands does not function properly. He highlighted that RWMF is not functioning, and due to this, waste generated at the islands is not being shipped to the RWMF. Since the IWMCs have six months' capacity to hold recyclable waste, the local systems would not function without discarding those waste first. This issue was highlighted by all the island councils that I interviewed for the study.

5. Discussion

The waste generation at the local island is increasing, but the management of waste is weak as the local councils, and national government have several challenges in addressing this issue. From the interviews with the Practitioners, it was identified that all island waste management activities are carried out by the local council in some form. Since the system is not addressed in a holistic way, there are several gaps that need to be bridged

The interview with the national government, local island councils and the international governments were focused on to understand the current practice followed and barriers and challenges. From the interview with the Table 5 in findings has listed the infrastructure available at the local island level, from the interview with the councils it was identified one of the main issue common for the island councils are that recyclable items not being shipped to the regional waste management facility. R.Angolhitheemu council president says the *“Metal, plastic and cans are in the island without being transported to the regional waste management facility and it’s been 2 years without it been shipped out of island”*, however in the case of B.Kendhoo the island council president stated *“with support from local nearby resorts we get support to discard plastic, metal and glass and also make different type of products out of plastic and glass”*. This proves that with technical support and know how local island councils can bring localised positive change to the waste issue at their islands. Also from the interview with R.Hulhudhuffaaruu council it was said *“we do not have machineries to manage waste at the island, but if we have we can discard plastic, cans and glass”*. From the interview it was stated that they are aware of the innovative methods followed by B atoll islands such as B.Kendhoo and they are working towards getting support from local nearby resorts as well. R.Hulhudhuffaaruu council stated they are discarding plastic waste by sending it to

Parley, a local business that takes plastic waste and it does not generate any money. However, they are able to safely ship plastic waste out of the island. The island councils in some islands have implemented successful methods which does not require additional fundings and support from the national government and it have proven to be successful to manage waste at their islands.

Local island councils very much rely on the national government budget for waste management activities; basic expenses of the IWMC, such as staff salary, electricity and vehicle fuel cost, are covered by the funding given by the national government and fees collected from the households. The main reason for this is due to limited options to generate revenue by the island council, and local communities would not be able to afford a high fee for waste collection. It is important for the local councils to build partnerships with business and civil society organisations to understand ways to generate more revenue and sustain the waste management system on the local islands. The example of the B.Kendhoo island council that has established partnerships with nearby resorts Soneva to eliminate single-use plastic and establish a better waste system could be replicated in other local islands as well. Since Soneva has tested methods and technical knowledge on waste management in the context of local islands in the Maldives, this could assist in bringing a positive impact (Soneva, 2021). In islands such as L.Kunahdnahoo that have resources such as IWMC, machines and vehicles to collect, it was identified that they lack the technical knowledge to run the waste management system on their island. L.Kunahandhoo Island council president also stated that their staff does not have adequate knowledge to manage waste even though they have resources. So it is important to build partnerships and get technical expertise from business and NPOs as the national government have difficulty giving support to all the inhabited islands at the same time.

From the literature review the success of other SIDS in waste management have proven to implement more education programs which are action based. They have proven to be more beneficial to the local communities in the case of Fiji and it brought a long-term change to the society. The example of Soneva is also using more educational method which teaches the local councils to make product and the concept of circular economy, which aims to convert waste into usable products. When people are educated on how waste is generated and how to discard properly it have been proven to be more successful in other countries as well.

The main issue identified in the local islands to manage waste is lack of infrastructure; from the six island councils interviewed, five councils face difficulty in managing waste as they do not have adequate facilities. On all the islands, they have some form of a waste management centre but either no machines to bale plastic and metal or crush glass items. Due to this, in all the islands, the waste that is collected is segregated and kept in a holding bay area until it is shipped to the RWMF. On the island of L.Kunahandhoo, during the interview, it was stated that UNDP Maldives had provided a waste management facility, machines and a vehicle to collect waste. In L.Kunahandhoo Island, they collect waste and transport it to the island waste management centre and dump organic waste into the ocean. The recyclable items are kept in the holding areas after segregating. Ministry of Environment official Mr Amru Adam Moosa stated that islands such as L.Kunahandhoo that has some infrastructures available, but they lack commitment and local island councils rely on the central government to implement the works that need to be carried out by the local government.

The IWMC in the local islands has six months capacity to hold waste, and since plastic waste is the majority of the recyclable waste generated at the local, it is important to reduce waste generation and implement ways such as single-use plastic in the local

islands. Plastic pollution in the Maldives is a major issue that is threatening the ecosystem and a large amount of it ends up in the ocean due to poor disposal methods (Nazeer & Hameed, 2021). Nazeer & Hameed (2021) study on marine litter in the Maldives also stated having better infrastructure in the local islands of the Maldives to manage waste is an important factor in addressing the marine pollution issue in the Maldives. It is vital to have proper waste management infrastructure in the local islands and connect the island level system to the regional or national level waste management facilities. This would assist in discarding recyclable items such as plastic, glass and metal better.

Mr Amru highlighted that in the Maldives, it is difficult to achieve national and island-level vision due to a lack of skilled staff in the waste management area. At both the national and local island levels, they face difficulty in hiring skilled staff to operate waste management centres. To address this issue Ministry of Environment is starting basic certificate-level courses on waste management, and according to the ministry, this would build the capacity of the local government councils as well. This issue was raised by three island councils that I interviewed, stating they face difficulty in hiring trained staff for the waste management centre work, and it was highlighted that labour turnover is high at the IWMCs. In the case of B.Kendhoo, they receive technical and financial support from Soneva resort. One is to build capacity and educate council staff and IWMC staff on waste management. They provide training to the staff on how to make compost, recycle materials and recycle plastic waste and glass to make objects or building materials. Island council stated that this is a pilot project to create awareness and educate that waste can be converted into other objects if recycled. However, they have established additional revenue measures by selling metal to the resort, and this is an extra income that can be used for the expense of their IWMC. B.Kendhoo island council working with the private sector is an example stated by Ministry of Environment Mr Amru Adam Moosa as well;

according to him, this is not the case in most local islands. He said it is difficult to get support from the private sector if there are no incentives or business models which would generate profit.

In literature, public awareness and education were stated as a barrier to SIDS; however, from the interview with island councils, their perception of awareness and education among the public is different. Island councils believe the public in their islands is aware of waste issues, and on every island, there are a small number of people who do not follow rules of proper waste disposal. The island councils have the authority to fine and take action against those who do not follow the rules. Island councils stated households segregate waste, but littering is common on every island; according to R.Hulhudhuffaar island council president, it is because people are irresponsible and they expect the government to clean the trash thrown on the street. In B.Kendhoo, the island council conducted awareness and educational programs for school children and their parents by giving practical lessons on how to segregate waste. This teaches them the importance of waste management and how the work is carried out at the Island waste management centre. This technique was proven successful on their island.

Islands in the Maldives are geographically isolated, and due to this, it is required for every island to have the infrastructure measures to manage waste. Ministry of Environment official Mr Amru Adam Moosa stated it is costly to construct an Island Waste Management centre and provide types of machinery and vehicles to collect waste on every island, but it is a requirement since there is a need to manage waste on every island. Those facilities also have overhead costs such as staff salary, fuel cost, electricity and maintenance costs. From the literature, it was identified that due to the geographical isolation of islands in SIDS, building infrastructure and funding for waste management is a challenge; even though the population is small on some islands, it is important to

have a proper system of waste management. Also, shipping recyclable waste from every island would be challenging.

Ministry of Environment official Mr Amru Adam Moosa said the government of Maldives is currently implementing projects to have better waste management facilities in the local islands of Maldives. He stated one key objective would be to operationalize the current RWMF and connect the IWMC. The Minister of Environment addressed also stated the government of Maldives is currently working on two main projects to address waste issues in the Maldives, and those are supported by international donors such as ADB (International Monetary Fund, 2021).

6. Conclusion

Waste management on the local island is challenging as some of the basic infrastructure measures are not in place. In the traditional waste management system in the local islands of Maldives, the community dumps waste into the nearest landfill, and this waste is not segregated. In recent years, with support from international agencies and the national government, there have been several waste management centres being built in the local islands of Maldives. But still, it is not a fully functioning system, and the current system does not allow waste to be dumped into landfill areas but rather segregates waste at the household level and transfers it to the IWMC, which is a designated area to manage waste.

The national government and Local government in the Maldives face a lack of finance to conduct waste management projects as it is required to have a separate Island waste management centre on every inhabited island, regardless of population size. Interview with GEF programme national coordinator Ms Fathimath Saeedha, she stated that the projects carried out are not sustainable, and once the funds provided by international organisations are over, the project faces difficulty continuing. The project fund covers the construction of the IWMC and provides infrastructure; for maintenance of the centres, the local governments have to rely on the funds given by the national government. This has been the case in Faafu Magoodhoo as well. The current waste management system focuses on waste collection from the household, and final disposal is not environmentally friendly. Island Councils collect waste and dump organic waste into the ocean. Councils stated that local governments practise this as they do not have an alternative to dispose of waste.

One common barrier for the island council is to store recyclable waste since the IWMC have a limited capacity to store waste, and shipping to RWMC is not followed by plastic, metal and glass waste is a challenge for local governments to manage. Suppose Island councils receive private-sector support similar to the example in B.Kendhoo, which received technical and financial support from nearby tourist resorts. In that case, local governments can upgrade the current system and strengthen the institutional capacity. It would help the small local islands train staff and have a more environmentally friendly system. Mr Amru Adam Moosa from the Ministry of Environment also agreed that the current IWMCs are not fully connected to the RWMF as the regional facilities are not fully operational. This is an additional burden for the local governments as they have no way to store to discard recyclable items on the local island.

For this study, the findings from the interviews conducted with the local government, national government and international organisations highlighted the common issues that the island nation is facing, and these issues are vital to be addressed when working towards a better waste management system. The local communities require the technical knowledge and support in terms of finance to establish local-level solutions, and it could be sustainable if the IWMC is operated in a revenue-generating model. For the local island-level waste management centres to be sustainable, the regional and national level systems must be operational

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