



Waste Management Diagnostic Study, Development of waste data collection protocols and methodology and Undertake waste audit for residential islands in Maldives

Waste Audit for Residential Islands in Maldives (Waste Audit Data Report)

Submitted by



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Deliverable 9: Waste Audit for Residential Islands in Maldives (Waste Audit Dara Report)

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List of Abbreviations

DTU	Technical University of Denmark
EPA	Environmental Protection Agency
ICAT	Initiative for Climate Action Transparency
IPCC	Intergovernmental Panel on Climate Change
MBS	Maldives Bureau of Statistics
ME	Ministry of Environment
MECCT	Ministry of Environment, Climate Change, and Technology
MED	Ministry of Education
MEE	Ministry of Environment and Energy
MF	Ministry of Finance
MHE	Ministry of Higher Education
MMA	Maldives Monetary Authority
MRV	Monitoring, Reporting and Verification
MT	Ministry of Tourism
NBS	National Bureau of Statistics
OECD	Organisation for Economic Co-operation and Development
RH	Recycle Hawaii
RWMC	Regional Waste Management Centre
RWMZ	Regional Waste Management Zone
SIDS	Small Island Developing States
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNOPS	United Nations Office for Projects
WMC	Waste Management Centre







1. Background and Introduction

Waste management has been described as in the First Biannual Report to the UNFCC as "one of the biggest environmental threats the country faces. Geographic dispersion and limited space available on the islands makes it difficult to implement waste management strategies in the Maldives. In recent years there has been a significant increase in the magnitude of waste management problems throughout the country for several reasons, including population increase, changing of lifestyle and behaviour, single-use of plastics, public littering, and dependence on the importation, coupled with other environmental challenges. Tackling waste management problems has become a fundamental to the Government's commitment to promote sustainable development and address global climate change issues.

Maldives as a party to United Nations Framework Convention on Climate Change (UNFCCC) prioritize establishment of a Measuring, Reporting and Verification (MRV) system to meet the transparency requirement of the Paris Agreement. Maldives is obligated to periodically report relevant GHG information and emission to the UNFCCC on main sectors: Energy and Waste. However, lack of proper established mechanisms to collect data have been a challenge to estimate GHG emission from all sectors, and particularly with regard to the solid waste.

This report contributes to a project aimed to strengthen national institutions to establish a proper and reliable legal framework and data collection and data management procedures and mechanism that is robust to estimate waste emission inventory as per the IPCC standards. The project is funded by the Initiative for Climate Action Transparency (ICAT), and is implemented jointly by the Ministry of Environment, Climate Change and Technology (MECCT) and UNEP Copenhagen Climate Centre (UNEP CCC). The project is administered by United Nations Office for Project Services (UNOPS).

This report presents results of the waste audit conducted for selected islands in the Maldives. A waste audit survey was targeted to identify waste generation in island communities. Using the waste generation data of island communities, and other data from secondary sources, estimations and projections of waste generation is presented for the Maldives.

1.1 Waste Generation in the Residential Sector in the Maldives

Data on waste generation in the Maldives have not been collected on a regular basis. However, there are few sources that provide a per capita waste generation estimation in the Maldives. Average of estimations between 2015 and 2021 indicate a waste per capita generation of 1.61Kg for the national level. 1.67 for the capital Male, 0.96 for other inhabited islands, and According to the past studies, between 47% and 69% of the waste is from residential households (Table 1).

Source	National	Male	Other inhabited islands
MEE 2015		1.7	0.8
Malatesa et al, 2015		1.64	-

Table 1. Per Capita Waste Generation



Waste generation rates in Male has been high compared to the other inhabited islands. The earliest data available is for 1999 which indicate that residents in Male generated a per capita waste generation of 2.3kg per capita (Pacific Consultants, 1999). However, waste generation in Male has often been referred by the tonnage capacity of the vehicles rather than the actual waste. As there have been no weigh bridge in Male, waste generation amounts continue to be recorded as tonnage capacity of the vehicle by WAMCO. However there have been few recent estimates from waste audits which indicate that in average 1.67 kg of waste is produced in Male. This is similar to World Bank (2012) projection of 1.6kg per capita for urban areas of upper middle income countries for 2025. According to this study, urban waste generation of 2.1 kg per capita by 2025 is estimated for high income economies. The higher the economic development and rate of urbanization, there is also a tendency to consumer more goods and services, and therefore produces more waste.

Waste generation levels have also been increasing in other inhabited islands as more business activities and consumption patterns changes. For example guesthouse tourism has been increasing in a number of islands. In estimation of waste generation of tourism waste has been estimated only with respect to tourist resort Islands. There is no past data available on the tourism related waste from locally inhabited islands. With guesthouses being opened in the Islands from 2010 onwards, it is likely that waste generation in the inhabited islands are also impacted by tourism. Although there has been a number of studies on the waste generation in other inhabited islands, it is still lacking in terms of specific islands. As urban burning is most prevalent in the inhabited islands, and improvement is needed, this survey targets inhabited islands.

2. Waste Audit Survey Methodology

This survey is targeted to identify waste generation in island communities. Islands were selected across the Maldives from various atolls. There are 26 natural atolls which have been grouped as 21 atolls for administrative purposes. The selected islands are from 9 administrate atolls (out of 21 atolls) and are from different regions in the Maldives as Table 2 and Figure 1 indicates. Although 39% of the population lives in Male' (capital of the Maldives), in this study Male' is not included, because relatively more resources and data are available on Male. The selected islands have populations of a relative medium size in the context of the





Maldives. Four islands to the north of Male, one island in the same atoll as Male and 5 islands to the South of Male were included in the targeted sample of islands.

R WMZ	Atoll	Island	Area (Ha) ²	Population ²	Households ¹	Guesthouses ²
1	Haa Alif	Kelaa	213	2,230	275	7
1	Haa Alif	Ihavandhoo	61.9	3,335	384	0
2	Noonu	Velidhoo	43.5	2,682	373	4
3	Kaafu	Maafushi	36	1,824	258	58
3	AlifAlif	Thoddoo	172.6	2,058	276	54
3	Alif Dhaal	Maamigili	74.8	3,002	369	6
5	Thaa	Veymandoo	41.7	1,305	203	1
5	Laamu	Gan	595.6	4,829	524	5
7	Gnaviya ni	Fuvahmulah	491.7	12,790	1599	20
7	Seenu	Hithadhoo	526.5	16040	1900	7

Table 2 Sample Islands

The islands of the Maldives have been divided into seven Regional Waste Management Zones (RWMZ). Five of the zones are represented in the sample.

There are two islands from RMWZ 1. Firstly, Kelaa is the third most populated island in the northernmost Haa Alif Atoll. Main economic activities include, construction, trading, agriculture, reef fishing and tourism. Secondly, Ihavandhoo is the second most populated island in Haa Alif Atoll. Main economic activities include fishing, construction, and boat building. Currently Ihavandhoo has no registered tourist facility

Velidhoo from RWMZ 2 is the most populated and most densely populated island in Noonu Atoll. Tourism related work in other resort islands have been one of the main income earning characteristics of the island population.

Three are three islands from RWMZ 3. Firstly, Thoddoo from Alif Alif Atoll is one of the islands that is most well-known for agriculture in the Maldives. Although tourism activities began relatively recently in 2015, currently it has the second highest number of guesthouses in inhabited islands. Secondly, Maamigili is the largest and most populous of the islands of Alif Dhaal Atoll which is close to the South Ari Marine Protected Area. The island has an airport built and run by a private company in the Maldives. Apart from the locals, the airport serves tourists traveling to stay in nearby resort islands. Third island from RWMZ 3 is Maafushi. It was one of the 45 islands where infrastructure was mostly damaged by the Indian Ocean 2004 (World Bank et al, 2005) tsunami. Maafushi is located in Kaafu atoll, where the tourism began in the Maldives with the one island one resort concept. After the government policy was changed to allow guesthouse tourism in local islands, the first registered guesthouse in the Maldives was opened in Maafushi in 2010. It currently has the most guesthouses in inhabited islands in the Maldives.

¹ NBS (2015)

² MT (2022)







There are two islands from RWMZ 5. Veymandoo is an island from Thaa atoll, where agriculture is the main livelihood activity. It is the capital of Thaa Atoll. The other island from RWMZ 5 is Gan³ which is the largest island in the Maldives. Although it is the largest populated island in Laamu atoll, it has a low density. Unlike most other islands, Gan population include families that migrated from Male in the 1990s and a number of communities from other islands that were relocated aftermath of the Indian Ocean tsunami. Apart from fishing and agriculture, guesthouse tourism has been growing in Gan.

There are two islands from RWMZ 7. Firstly, Fuvahmulah is the only inhabited island in the Maldives that characterises as a one island atoll. The island has an airport and guesthouse tourism has been growing recently. Fuvahmulah is the third largest island and is notable for two freshwater lakes, swamps and marshland areas. Agriculture is one of the main economic activities. The other island from RWMZ 7 is Hithadhoo, which is the second largest island in the Maldives, and also the most inhabited island in the southern most region of Seenu Atoll that comprise of Addu City. It is also the second most inhabited island in the Maldives. Hithadhoo has one of the protected mangrove areas in the country.

³ Gan is also called as Gamu.



Figure 1. Locations of Sample Islands.

2.1. Sample

From each Island there are three targeted segments for data collection. Anticipated sampling segments and their approximate representative composition in each category is given below:

- a) Segment 1. Household: About 67% total sample
- b) Segment 2: Commercial: About 25% of the total sample
- c) Segment 3: Institutions: About 8% of total sample

The sample size was finalized with consideration to the size of the household (HH) population of the islands chosen by the Ministry of Environment. For waste audits a sample size of 100 to 200 households have been used as a generally accepted sample. In the Male Waste Audit done between December 2007 and January 2008, a sample size of 100 households were taken for waste audit analysis (Ewers, 2008). The audit was done over 14







days using 1 day of waste sample for each household. A waste audit done in the city of Airdrie in Canada, as a representative sample for 17,696 dwellings, a sample of 100 was taken (Schaub-Szabo, 2017). In a waste audit done in the region of Durham in Canada, a total sample size of 200 households were taken across 7 municipalities (AET consultants, 2011). Similarly, a manual for waste audit for SIDS indicate that as a general rule a sample size of 200 is recommended (Wander, 2019).

As per the experience of waste audit in Male in 2008, it took about 4 hours to audit about 10 households. In order to give attention to the waste audit process and to work within the constraints of COVID-19, it was regarded to be feasible to audit between 169 samples or 287 samples (at 15 % and 20% error respectively with 90% confidence interval).

Due to the COVID19, the Maldives government declared a status of National Health Emergency in 6th March 2020, and it was not lifted until 16th March 2022. During this period there were fluctuations of COVID19 cases. After the initial increase of COVID cases in 2020, by end of 2020, the records showed that new cases were getting lower. With measures to control, the Maldivian government opened the tourism sector. However there were restrictions for tourism in guesthouses, as well as inter island travel. Therefore the survey was organised by involving civil society and youth groups from the islands, and the survey was carried out between January and May 2021.

Although Maafushi has the most number of guesthouses in the inhabited islands, it was a period in which tourism was low, and due to the COVID19 situation in Maafushi, no local group was interested in carrying out the waste audit activity in Maafushi. Therefore Maafushi was excluded from the actual sample of survey islands. However, some data on Maafushi waste generation was received from secondary sources during the preparation of the report and is included in the waste projections.

The sample size was adjusted by increasing number of households and businesses by considering the population and the challenges that were faced during the survey period. The households comprise 67% of the sample. The total sample for households is 224 out of 5866 households in the sample islands. The sample selection is within a 95% confidence level and 7% margin of error. An acceptable margin of error used in most surveys researches typically falls between 4% and 8% at the 95% confidence level. The rest of the sample includes businesses, schools, and health facilities. Varieties of business have been included, such as shops, restaurants, guesthouses, boatyards, tailor shops, fish processors, and fish markets. For school and health sector, there is one sample from each island (Table 3).

Although the survey for the households went smoothly, there were limitations from getting data from the business, schools, and health sectors. In Maamigili we were not able to get data from guesthouses because as a special precaution for COVID19, the community did not approve to guesthouses in the survey. In order meet the number of targeted number of businesses, other types of businesses such as tailor shops were included based on the suggestions from the audit teams. The types of businesses in the sample is included in Table 4.

In some islands, as in Fuvahmulah, the survey period only partly coincided with the period the guests were in the island. We were not able to audit waste from Fuvahmulah hospital. In the islands included in this study, Hithadhoo and Fuvahmulah have the largest hospitals, but as the hospital was not included, we only have data from smaller health facilities from each of the islands. From Hithadhoo, we received data only in the total form. The auditors were not allowed to weigh, but the health facility provided the data.







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Table 3. Number of Samples

	Household	Busines			
Island	S	S	School	Health Sector	Total
Kelaa	17	6	1	1	25
Ihavandhoo	16	7	1	1	25
Maamigili	17	6	1	1	25
Veymadhoo	17	6	1	1	25
Gamu	16	7	1	1	25
Fuvahmulah	17	6	1	1	25
Velidhoo	16	7	1	1	25
Thoddoo	15	4	1	1	21
Hithadhoo	19	7	1	1	28
	150	56	9	9	224

Table 4. Types of Business in Samples

Island	Bakery	Boatyard	Fish	Fish	Guesthouses	Restaurant	Tailor	Shop
			t marke	processors			snop	
Kelaa	1	1			1	1		3
Ihavandhoo				1		2	1	2
Maamigili						2	1	3
Veymadhoo			1			2		4
Gan		1		1	1	2		2
Fuvahmulah		1			2	2		3
Velidhoo		1	1			2		3
Thoddoo					3	1		2
Hithadhoo			1			3		3

2.2. Survey

The survey was carried out by organizing teams from the respective islands. These include the following NGOs and youth groups in each of the islands as in table 5 (list of audit team members and sample places are included in the annex 1).

Table 5. Audit Teams

Island	Audit team
Kelaa	Kelaa Youth
Ihavandhoo	Ihavandhoo Masveringe Gulhun (Ihavandhoo Fishers' Union).
Velidhoo	Youth group
Maamigili	Felcon Recreation and Entertainment
Veymadhoo	Youth group
Gan	Youth group
Fuvahmulah	Youth group



Thoddoo	Youth group
Hithadhoo	Southern Community Empowerment Association of Maldives
	(SCEAM)

An online Viber group was formed for each island for discussions, and then an orientation and training session was held through Google Meet. During the audit process, specific questions and instructions were given through the Viber group. Further to this, videos and written instructions were shared on how to fill forms and collect data. A printable set of questionnaires and online links for the questionnaires were provided. Therefore the auditors could enter the details through the Google forms. Separate sets of questionnaires were prepared for:

- 1. Collecting weights of wastes.
- 2. Additional information from households.
- 3. Additional information from businesses and schools.
- 4. Additional information from health facilities.
- 5. Further information from councils.

Auditing teams were provided with handheld luggage scales for weighing, necessary PPE (Gloves and masks), and tongs for handling waste. For the collection of waste, three different colors of bags were provided, in order to make it easy to organize collection and auditing of waste.

- Blue bags were used to collect food waste
- Black bags for nappy
- Red bags for other items were later segregated and weighed.

Before data was collected audit teams were instructed to visit the sample households, businesses, schools and health facilities and asked for permission to be included and provided the information on how waste audit was going to implemented. Data was collected over a period of a week. Food waste and nappies were weighed daily to minimize the inconvenience of smell. Audit team members were also instructed to visit the households, businesses, schools, or health facilities daily to check if there were food and nappy waste. At the end of the seven-day program, the audit members weighed the other types of waste. These were kept for 7 days as some items may be too light to be weighed daily. However, if any of the participants wanted to weigh the waste before seven days, it was carried out accordingly. This was to minimize inconvenience if certain types of waste accumulate and there is a lack of space to keep. For example, empty cardboard boxes in shops. Data were collected on the following 10 categories in Table 6.

Category	Description
Food waste	Cooked and uncooked food including expired processed food and raw fruits and vegetable waste from shops in addition to food waste from households and restaurants
Nappy	Includes nappies of children and adults, and sanitary pads.
Garden waste	Fallen branches or leaves including edible leaves if not collected with the intention of consuming as food.
Paper	Paper, tissue and cardboard.
Textile	Any type of textiles and fabrics or product of it, including clothing and others such as bags.
Hazardous	Includes chemicals, medical waste, used cooking oil and electronic waste.
waste	
Glass	Glass materials

Table 6. Categories of Waste







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Plastic	Plastic bags, plastic bottles and other types of plastic
Metal	Ferrous and non-ferrous metals
Other items	Any items that are not from the categories above.

3. Results and analysis

The total amount of waste the samples from nine islands amounts to 2778.26kg per day (Table 7). The findings indicate that most of the waste was garden waste and a substantial amount was food waste, followed by paper. Garden was comprise 36.68% of the total waste (Figure 2). Garden waste is the highest in weight in Kelaa, Velidhoo, Gan, and Veymandoo. Food waste comprises the second largest, with 23.9% of the waste, and is the highest category for Ihavandhoo, Maamigili, Fuvahmulah, Thoddoo, and Hithadhoo. The third largest type is paper waste comprising 9.91% of the total waste. This is followed by other waste. It mainly included cement planks, fiberglass, electronic waste, coconut shells, husks, rope, and construction materials such as bricks, cement, and roofing items.

		Weight (Kg)													
Island	Total	Food waste	Napp y	Garden waste	Paper	Wood and woodchips	Textile	Hazardous waste	Glass	Plastic	Metal	Other			
Kelaa	240.13	28.53	5.00	170.73	13.43	0.00	1.94	2.81	1.30	3.56	12.83	0.00			
Ihavandhoo	173.64	49.46	10.04	36.10	44.96	6.39	2.60	6.46	4.66	10.84	2.14	0.00			
Maamigili	294.21	99.14	9.97	69.30	29.07	6.44	1.76	2.76	8.09	18.40	10.31	38.97			
Velidhoo	513.93	103.47	13.82	135.44	46.14	121.29	0.00	7.91	7.96	13.95	19.82	44.14			
Veymadhoo	494.15	85.97	16.09	146.36	69.71	11.53	6.53	3.14	16.59	22.23	16.40	99.60			
Gan	427.42	73.06	7.51	333.75	5.97	0.57	0.00	0.71	0.20	3.60	1.47	0.57			
Fuvahmulah	92.06	25.01	4.34	14.16	10.90	10.56	2.14	0.54	2.27	15.05	3.03	4.06			
Thoddoo	161.09	63.94	8.11	54.62	10.15	1.26	1.36	7.74	2.63	6.08	1.19	4.00			
Hithadhoo	381.64	137.00	11.40	58.58	45.00	9.20	5.49	7.19	4.96	26.58	46.31	29.92			
Total	2778.26	665.57	86.27	1019.04	275.34	167.23	21.82	39.28	48.64	120.29	113.50	221.27			
Proportion %		23.96%	3.11%	36.68%	9.91%	6.02%	0.79%	1.41%	1.75%	4.33%	4.09%	7.96%			

Table 7. Total waste generation from all samples



3.1 Waste produced by households

Total waste for households amounts to 1069.67kg per day for nine islands (Table 8). The largest composition is for garden waste and amounts to 36.8 % (Figure 3). In Fuvahmulah, it is significantly lower compared to the other islands. As Fuvahmulah is an island where home gardening is prevalent, it was assumed that that gardening waste will be high. However, we found that garden waste is used for mulching or to spread out around trees. It is also reported that in some households, garden waste is burned from time to time.

Unlike garden waste, the percentage of plastic waste low, at 4.3%. However, it can take a high volume and have a more significant environmental impact if burned or disposed to the marine environment.

On average, for the nine islands, 0.99kg of waste per day per person was generated from the households included in the sample. There is a variation between islands between 0.37 kg to 1.12kg per person per day. If waste per household is considered, it is observed that an average of 7.08kg of waste per day per household is produced. The results are similar to Aboobakur and Samarakoon (2019) on households in Kulhudhuffushi which amounts to 7.58Kg per household. Household waste ranges 2.6 kg and 13.7 kg of waste per household per day across nine islands.

Table 8.	Waste	Generation	from	households

Weight (Kg)







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Islands	Total	Food waste	Napp y	Garden waste	Paper	Wood and woodchips	Textile	Hazardous waste	Glass	Plastic	Metal	Other
Kelaa	109.33	13.87	5.00	78.47	0.00	0.00	1.94	0.21	0.59	0.06	9.19	0.00
Ihavandhoo	61.61	25.10	10.04	11.64	2.00	4.60	0.81	0.00	2.27	3.00	2.14	0.00
Velidhoo	131.59	36.23	13.82	64.36	1.29	0.71	0.00	0.00	3.76	3.21	8.22	0.00
Maamigili	159.10	37.57	8.63	44.61	4.61	6.44	0.00	0.00	4.87	9.27	6.11	36.97
Veymadhoo	232.97	40.52	13.77	70.06	7.66	10.47	5.01	0.40	10.05	9.94	7.36	57.73
Gamu	117.50	31.90	7.51	76.04	0.00	0.00	0.00	0.00	0.00	0.91	1.14	0.00
Fuvahmulah	47.23	16.34	4.34	7.12	1.86	4.47	2.14	0.37	1.71	6.18	1.99	0.71
Thoddoo	58.95	18.21	5.80	18.04	1.00	1.26	0.83	6.39	0.31	2.21	0.91	4.00
Hithadhoo	151.40	27.34	11.40	23.32	6.02	8.51	3.62	3.29	3.53	11.31	38.17	14.89
Total	1069.67	247.08	80.30	393.66	24.43	36.47	14.36	10.67	27.08	46.09	75.22	114.30
Proportion (%)		23.10%	7.51%	36.80%	2.28%	3.41%	1.34%	1.00%	2.53%	4.31%	7.03%	10.69%

Figure 3. Composition of waste from households



3.2 Waste produced by business entities

Total waste generated from the business sector for nine islands amounts to 1190.84 kg per day. Waste generation per business per day amounts to 19.52Kg. If guesthouses are excluded, then the waste generation per businesses per day amounts to 18.40kg (Table 9)

The largest proportion of waste generation is for food waste comprising 43% of the waste (Figure 4). This is due to the relatively high amount of waste generated from restaurants. Paper







constitutes the second largest proportion, with 16% of the total waste. Garden waste consists of 15%, and plastic consists of 5% of the total waste from the business sector.

In terms of different types of businesses, fish market has the highest generation of waste per day at 145.32Kg (Table 10). However a fish market was included only from Hithadhoo, which has a relatively larger population. There were four boat yards in the sample, and the average waste generation per day amount to 43kg. Cafés, restaurants and bakeries have an average amount of waste generation at 22.08kg per day, and shops produces 9.86kg of waste per day, fish processers produce 7.72kg of waste per day, and a tailor shops produces 1.81kg of waste per day.

Tourist guest houses generate 7.56kg of waste at an average. However, during the survey period tourist occupancy was at 20% in guesthouses. The national average of the tourist occupancy rate for the period between January and May was 52.72% which was higher because during the COVID19, there was less restrictions to visit tourist resort islands rather than inhabited islands. In Fuvahmulah, the survey period only partly coincided with the period the guests were in the island. That is the reason why guesthouses in Fuvahmulah have a relatively low generation of waste in guesthouses in comparison to other businesses. In Maamigili, guesthouses were not included based on the preferences of the community. There were 4 tourists on average per guest house. Average waste generation per tourist was 1.89kg per day. This is 1.9 times higher than the local average of 0.99Kg. In 2022, a report prepared for the Asian Development Bank on the Greater Male Environmental Improvement and Waste Management Project estimated that about 2kg per capita of waste was produced in guesthouses in Maafushi (MECCT, 2022). From the survey data, it is found that there were also 4 to 5 (4.7) employees in average (Table 11). Therefore per capita waste generation in guesthouses for tourists and employees together accounts to 0.85kg per day.

In this study we find that 43.26% of the waste from guesthouses were food waste and 48.94% of the waste were from garden waste. The food waste from restaurants reaches 57%. Increase in tourists could further increase food sales in the island, and food waste. In the sample Ihavandhoo is the only island without any guesthouse. The food waste from restaurants is 42% in Ihavandhoo compared to 95% from cafe in Thoddoo which has 58 guesthouses. In terms of locally registered population, Thooddoo has a lower population of 2058 people compared to Ihavandhoo's population of 3335 people.

	Weight (kg											
Island	Total	Food waste	Napp y	Garden waste	Paper	Wood and woodchips	Textile	Hazardous waste	Glas s	Plastic	Metal	Other
Kelaa	46.61	14.13	0.00	14.06	12.71	0.00	0.00	0.00	0.71	3.50	1.50	0.00
Ihavandhoo	71.66	24.36	0.00	0.71	29.90	1.79	1.79	6.46	2.39	4.27	0.00	0.00
Velidhoo	294.49	67.23	0.00	38.77	25.96	110.71	0.00	0.00	0.86	6.10	0.71	44.14
Maamigili	104.90	61.57	0.00	7.00	18.46	0.00	1.76	0.00	3.21	8.73	4.17	0.00
Veymadhoo	127.69	38.45	0.00	18.99	42.36	0.00	0.07	0.36	4.81	6.97	2.70	12.99
Gamu	227.20	144.05	0.00	52.00	15.90	2.00	0.00	0.00	0.70	9.40	1.15	2.00
Fuvahmulah	30.50	8.67	0.00	2.11	5.34	6.09	0.00	0.00	0.56	3.54	0.84	3.35
Thoddoo	67.80	45.55	1.11	9.95	5.18	0.00	0.53	0.69	2.32	2.17	0.28	0.00
Hithadhoo	219.99	109.66	0.00	35.19	38.96	0.69	1.87	3.90	1.43	15.27	8.14	4.89
Total	1190.84	513.67	1.11	178.78	194.76	121.27	6.02	11.41	17.00	59.95	19.50	67.36

Table 9. Waste generation in business sector



Table 10. Average waste generation per type of business.

		Average	
	Average waste per	customer	Waste per
Type of business	day	S	customer
Fish processors	7.72	6	1.29
Guesthouse	7.56	4	1.89
Restaurant/ café/ bakeries	22.08	142	0.16
Tailor shops	1.81	17	0.11
Shops	9.86	101	0.10
Boat yard	43.16	-	-
Fish market	145.29	-	_

Table 11. Guesthouses

	Waste	No. of	No. of
	generatio	guests	staff
Guesthouses	n per day		
Kelaa Guesthouse 1	1.00	5	6
Gan Guesthouse 1	26.14	2	6
Fuvahmulah Guesthouse 1	0.23	2	7
Fuvahmulah Guesthouse 2	2.19	7	2
Thoddoo Guesthouse 1	10.33	4	6
Thoddoo Guesthouse 2	5.72	*	3
Thoddoo Guesthouse 3	6.59	*	3

* Did not provide the information



3.3 Waste produced in schools

Total waste per day amounts to 251.88 kg for the sample schools in 9 islands (Table 12). In the schools, an overall 81% of the waste is garden waste (Figure 5). This is followed by paper consisting 15%, and plastic at 3% of waste. The situation may also be different compared to pre-COVID19 situation. Some waste could have been more or less before. A school breakfast programme was started by the government in 2019, but it has been discontinued since COVID19 crisis began in the Maldives. Otherwise, it could have resulted in a large amount of food waste and packaging waste. Only a small amount of food waste was recorded as 1% of the school waste in Thoddoo and 2% of the school waste, and glass found during the audit period in any of the sample schools.

Among nine islands, Kelaa has the second-highest level for garden waste. Regarding paper waste, the relative amount per employee and student is highest in Kelaa, with 1kg and 0.20kg per day, respectively if it is assumed all the employees and students attended the school. However this estimation will be misleading to get a per capita waste amount per student or employee, as the schools were not running in a usual way in the pre COVID period or after the COVID emergency status have been lifted in March 2022. A more appropriate indicator for the schools is to identify waste per school, and then it can be compared with waste per school overtime. The waste amount per school in the survey was 27.98kg per day. If the sample from Hithadhoo is excluded (due to low level of waste as the face to face classes was discontinued at that time), the average per school is 31.47kg per day. There is no other study that has looked in waste in schools in the





Maldives. However, a close estimate was found for institutions in Kulhudhuffushi as per Aboobakuru and Samarakoon at 38.50 per institute.

There is also a lack of studies that have published all around the world. One of the study is Rada et al (2016) on Italian schools. According to this study a per capita waste generation of 1.3kg is produced. The three schools had an average student population of 380. In the sample we used there was an average student population of 434. In the study, the highest per capita for student is in Kelaa with 0.20kg per student. Further studies are needed to confirm the extent of difference of waste generation after the COVID emergency status was lifted in 2022.

	Weight (kg)											
Island	Total	Food waste	Napp y	Garden waste	Paper	Wood and woodchips	Textile	Hazardous waste	Glas s	Plastic	Metal	Other
Kelaa	50.19	0.00	0.00	49.47	0.71	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ihavandhoo	22.73	0.00	0.00	9.67	13.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Velidhoo	32.39	0.00	0.00	19.70	10.80	0.00	0.00	0.00	0.00	1.89	0.00	0.00
Maamigili	10.10	0.00	0.00	4.37	3.36	0.00	0.00	0.00	0.00	0.37	0.00	2.00
Veymadhoo	37.03	0.84	0.00	33.71	1.71	0.00	0.00	0.00	0.00	0.43	0.33	0.00
Gamu	63.43	0.00	0.00	62.00	1.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fuvahmulah	10.83	0.00	0.00	4.93	2.60	0.00	0.00	0.00	0.00	3.30	0.00	0.00
Thoddoo	25.09	0.19	0.00	20.74	3.61	0.00	0.00	0.00	0.00	0.55	0.00	0.00
Hithadhoo	0.10	0.00	0.00	0.07	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	251.88	1.03	0.00	204.67	37.32	0.00	0.00	0.00	0.00	6.54	0.33	2.00
Percent		0.4%		81%	15%					3%	0.1%	1%

Table 12. Waste generation in schools



3.4 Waste produced in health facilities

Total average waste per day for sample health facilities is 47.13kg of waste for the nine islands (Table 13). Garden waste is recorded highest for health facilities and amounts to 67.4% (Figure 1). Besides that, paper constitutes 7.3% of the total waste. Medical waste or infectious waste is recorded as hazardous waste comprising 4.2% of the waste generated in health facilities. Due to the COVID19 situation and the policies of the respective health facilities, there were limitations on the extent of separation of waste and data collection.

In Fuvahmulah, it was planned to audit waste from the main hospital and clinic, but data was only collected from a clinic. Fuvahmulah hospital is one of the largest regional hospitals. There were difficulties in weighing the waste in Fuvahmulah hospital because all of the waste were mixed in large bags, and it was only permitted to weigh it without segregation. As it was a relatively large hospital entering the data as other waste without categorizing would result in a bias in the results for the composition of the waste. Moreover, due to the announcement of COVID19 positive cases and curfew in Fuvahmulah, it was decided not to carry out further auditing from the hospital. Similarly due to COVID19, it was not possible to audit the waste from the hospital in Hithadhoo. Alternatively a medical clinic was selected. However, the audit team was not allowed to weigh the waste. The staff of the clinic weighed and provided the data without separating the waste. As it was a small health facility, the data was entered as other waste.

Among the health facilities included in the audit, the largest is the Gan Regional Hospital. However, the average waste per employee is highest in Veymandoo, with 1.48 kg per day. Average waste per outpatient is highest in Kelaa with 1.52kg per day. This is due to a relatively high proportion of garden waste. From the 6 islands for which data is available for hazardous waste, the data indicate that 7.24% of the waste from health facilities are hazardous waste. That is about 3.41kg of hazardous waste per day.





As the type of health facilities varied, waste generation per day is identified based on the type of health facilities. In average a hospital in the atolls generate 132.29 kg of waste. A health centre generate 27.09 kg of waste, and a clinic generate 6.82kg of waste. The waste levels of the tertiary hospitals in Male, Hulhumale and Equatorial hospital in Hitahdhoo is expected to be higher, and is estimated to be about 750kg per day (Moosa, 2021).

	Weight (kg)											
Island	Total	Food waste	Napp y	Garden waste	Paper	Wood and woodchips	Textile	Hazardous waste	Glas s	Plastic	Metal	Other
Kelaa	33.47	0.00	0.00	28.73	0.00	0.00	0.00	2.60	0.00	0.00	2.14	0.00
Ihavandhoo	17.64	0.00	0.00	14.07	0.00	0.00	0.00	0.00	0.00	3.57	0.00	0.00
Velidhoo	55.47	0.00	0.00	12.61	8.09	9.86	0.00	7.91	3.34	2.76	10.89	0.00
Maamigili	20.11	0.00	1.34	13.31	2.64	0.00	0.00	2.76	0.00	0.03	0.03	0.00
Veymadhoo	93.00	6.16	2.31	23.60	17.99	1.06	1.44	2.39	1.73	4.89	6.01	25.43
Gamu	181.57	0.00	0.00	180.86	0.00	0.00	0.00	0.71	0.00	0.00	0.00	0.00
Fuvahmulah	3.50	0.00	0.00	0.00	1.10	0.00	0.00	0.17	0.00	2.03	0.20	0.00
Thoddoo	9.26	0.00	1.20	5.89	0.36	0.00	0.00	0.66	0.00	1.16	0.00	0.00
Hithadhoo	10.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.14
Total	414.02	6.16	4.86	279.07	30.18	10.91	1.44	17.20	5.07	14.43	19.27	35.57
Percent		1.5%	1.2%	67.4%	7.3%	2.6%	0.3%	4.2%	1.2%	3.5%	4.7%	8.6%

Table 13. Waste generation in health facilities.



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4 Current practices of waste management in the island

4.1 Burning

Burning of waste is carried out by both households and by Waste Management Centres (WMCs) in the islands. Across nine islands, waste is burnt by 21% of households. This is significantly higher than 5% that was previously estimated (MEE, 2017).

In Kelaa 35%, in Veymandoo 24%, in Fuvahmulah 33%, in Velidhoo 6%, in Thoddoo 57%, and in Hithadhoo, 22% of households burns waste. Waste is mostly burned in household compounds as responded by 19% of the households, while 3% of the respondents burn waste in woods, 1% of the respondents burn waste on the beach. Among the households only 0.66% of the households rely solely on burning to manage waste without removal of the waste. Among all households that practise burning, the type of waste burned by households are garden waste, paper, wood and woodchips, and plastic. Frequency of burning ranges from once a week to once in 6 months. According to one respondent, burning is practiced to minimize expenditure which may include the cost for removal of waste in terms of fees or transportation if the WMC is far. Thus this indicates that the household's economic situation is a factor that affects their choices and decisions on waste management.

From business sector, only in Gan it is found that waste is burned, and the type of waste burned are garden waste, and wood and wood chips. In Gan, these business entities are engaged in fish processing and boatyard works. Amongst the nine schools, burning is done by two schools. In





Kelaa school, paper is burned inside a barrel, whereas in Velidhoo, paper is burned on the ground.

As per the information from health facilities, in all the health facilities, burning is done for clinical and infectious waste, including those used for dressing. The methods of burning used by five health centers include burning on the ground, on an elevated metal frame, or inside a barrel. Amongst the three hospitals, two hospitals, and the two private medical clinics indicated that waste is burned using incinerators.

According to the councils of Kelaa, Gan, Maamigili, Thoddoo, and Veymandoo, waste is burned by the WMC and burned once a day. Waste is burned on the ground or an elevated metal frame at the WMC. Waste is also burned in other islands. The councils from other islands did not respond to the question whether burning is carried out or how the waste is burned at the WMC.

In Ihavandhoo, in 2016 a fire in a dump area spread out, and the rescue service officers from the Maldives National Defense Force had to attend to remove the fire. Although no one was injured, plants and trees in the area were affected (Sun, 2016). A similar situation happened in Thoddoo and the WMC was burned in 2019 (MECCT, 2022a). According to survey by Imadudeen School on 60 islands, 95% of the islands practice open burning, and it is done in locations near the beach by 56% of the islands, and inland by 44% of the islands. Moreover in in 70% of the islands plastics are also burned (Imaduddin School, 2016).

In some islands where burning is stopped, waste may be buried or dumped to the lagoon for the purpose of land reclamations. However, this can potentially have negative impact to the ground water and marine environment respectively.

The waste from Male have been transported to Thilafushi which has been used as landfilling and burning site since 1997. World Bank (2020) describes the dumpsite on Thilafushi as an island with no pollution control measures and is a public health and environmental hazard. In August 2021, Ministry of Environment disclosed that efforts were underway to stop burning waste and a project is underway to rehabilitate Thilafushi with assistance from Asian Development Bank, Japan Fund for Joint Credit Mechanism, and Islamic Development Bank (MECCT, 2021). As it was used a landfilling and burning site, the accumulated methane gas on the island had resulted in unceasing fires and noxious smoke (Hussain, 2021). A visit to Thilafushi in 2022 indicate that to an extent such fires still continue, although no waste has been deliberately burned on the island.

5 Collection of waste

In general, from all sectors in 9 islands, waste is removed by themselves (39.9%), councils (30.6%), Waste Management Company (WAMCO) (17.2%), private sector (9.6%), NGO (2.5%), and other arrangements (less than 1%).

There is no systematic waste collection service is provided for a fee in Veymandoo, Kelaa and Ihavandhoo. Waste is removed themselves by 100%, 100% and 81% of the households in Veymandoo, Kelaa and Ihavandhoo, respectively.

As for the fees currently paid for waste collection from households, it range from MVR 25 in Ihavandhoo to MVR 200 in Fuvahmulah and Gan . In Kelaa, households are willing to pay a fee ranging from MVR 50 to MVR 100, while households in Veymandoo are willing to pay a fee ranging from MVR 100 to MVR 250 (Table 14and Table 15).







In Ihavandhoo, waste transportation service was previously provided by FENAKA utility company for a nominal fee of 30 MVR, but have discontinued the service because it is not in their mandate. Therefore waste is removed in an informal manner without an organized collection system. Prior to 2017, waste collection from the households in Male was also to a large extent in an informal manner as mostly expatriate migrant workers did the waste collection for a monthly fee. In order to regulate and systematize waste collection, the task was delegated by the Government to WAMCO in Male.

As for the businesses that are currently paying for waste collection, the costs range from MVR 50 in Ihavandhoo at the lowest to MVR 3000in Hithadhoo as the highest. The highest fee is paid by a supermarket in Hithadhoo, for collection of waste thrice a week. In Ihavandhoo 28% of businesses pays private individuals or an NGO for waste collection, although there is no system officially endorsed by the Ihavandhoo council. Businesses in Kelaa are willing to pay between MVR 50 and MVR 150, while businesses in Veymandoo are willing to pay between MVR 50 and MVR 250.

As for schools and colleges, waste collection fees range from MVR 75 in Maamgili to MVR 2000 in Fuvahmulah. In Thoddoo school, waste collection service is included as a part of security service; therefore, no separate fee is levied.

As for health facilities, waste collection costs ranges from MVR 80 from a clinic in Fuvahmulah to MVR 2500 for a hospital in Veymandoo (see table 4). What is removed from the health facilities is the general waste. Besides that, separation is done for injections, dressings, and contaminated items such as syringes, needles, and viles. These types of infectious waste are managed at the health facility level, primarily by burning.

In Velidhoo, The council of Velidhoo has an agreement with WAMCO to transfer unburnable waste to Regional Waste Management Facility in Vandhoo on a monthly basis. WAMCO transports waste once every four or five months.

Island	Household	Business	School	Health
Maamiglili	50 - 100	75 - 120	500	300
Ihavandhoo	25 - 100	50 - 250		100
Gan	150 - 200	200 - 1000 -	500	800
Fuvahmulah	100 - 200	100 - 400	2000	80
Thoddoo	100	100 - 250		250
Hithadhoo	100	100 - 3000 -	300	620
Velidhoo	150	40 - 500	1000	1000

Table 14. Waste collection fees

Table 15. Willingness to pay for waste collection

Island	Household	Business	School	Health
				facility
Kela	50 - 100	50 - 150	150	500
Veymandoo	100 - 250	50 - 250	500	2500







5.1 Improvement of waste management

Many respondents indicated the importance of a waste collection system that will cater to their needs daily. While there is a lack of a systematic waste collection system in Kelaa, Veymandoo and Ihavandhoo, in some other islands, waste collection is not on a daily basis. Some households indicated that they are willing to pay for daily collection, and have the opinion that the establishment of more service providers is a solution rather than only one service provider. Some participants did say that more involvement of NGOs, the private sector could play a role in waste collection.

Improvement of waste collection is a point that is also mentioned by businesses, schools, and health centres. Some participants indicated that if segregation of waste is practiced at collection level, it will make it easier for the management of waste on the islands.

Currently, some items are not collected as waste in some islands. This includes bulky items. Therefore respondents expressed that they hope that arrangement be made to collecting all kinds of wastes. Some respondents mentioned that using the waste as a resource, income-earning opportunities could be set up, such as recycling, and the revenue can possibly be used to improve the waste system. Some participants suggested that apart from the waste collection at households or other premises, communal waste collection points or depots could be introduced.

The respondents also expressed concern on the inconvenience of waste burning and on dumping food waste to the lagoon. Therefore many respondents are of the opinion that alternative arrangements are needed. In order to utilize the garden waste and food waste, one suggestion was to encourage composting on the island. We also asked the households if they presently do compost and if they are interested in doing composting. Presently composting is done in 8% of the households across nine islands. We did not find any household engaged in composting in Veymandoo and Maamigili. It can be observed that in the largest three islands, more households are engaged in composting, such as Hithadhoo with 15%, Gan with 13%, and Fuvahmulah with 13%. Across all islands, 35% of households have expressed interest to do composting. This figure is significantly higher in Hithadhoo with 65 %, Kelaa with 47%, and Velidhoo and Fuvahmulah with 44% (Figure 7).





Figure 7. Production and interst in composting

6 Waste from Tourist Resorts

In the waste audit survey we discussed about the waste generation from the guesthouses in the sample. However, in the sample there was no resort island. While the tourism sector is significant for the Maldives, 84% of the tourist guest nights are recorded as having stayed at resort islands (MMA, 2022).

Tourism has played a major role in the Maldives economic development over the past 50 years (Kapmeier and Gonçalves, 2018). Tourism sector has also been attributed to produce waste at a higher level than the average per capita waste generation in the Maldives (Brown et al, 1997). The average estimates from past studies from tourism sector between between 1990 and 2021 indicate an average of 3.74, and if only the recent years from 2015 to 2021 is taken into consideration, then the average estimate for tourism sector is 3.24kg (table 16). This is similar to the results in Seychelles for medium and large tourist establishments where per capita waste is 3.33 kg and 4.07kg respectively, whereas for smaller apartment hotels waste generation rate was 0.55 per hotel (Jambeck et al, 2019). In our waste audit we found that 0.89 of waste was generated per tourist in the guesthouses.

Table 16. Estimates of waste	generation in tourist resorts

	Source	Per capita Tourist
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MT 1990	1.5
11,1770	1.5
Pacific Consultants, 1999	7.2
Brown et al, 1997	2.35
Peterson, 2015	7.2
MEE 2015	3.5
Nicholas 2016	4.62
Park Hyatt, 2017	2.95
World Bank, 2017	3.5
Tetratech, 2020	3
Moosa, 2021	3.24

Waste generation in Small Island Developing States (SIDS) is similar to that of OECD countries due to the high number of tourists visiting SIDS and consequently, the increased amount of waste from the tourism industry (Mohee et al, 2015). In Taiwan locations popular as tourist destinations have higher values of waste generation, such as the Green Island where waste generation is estimated to be, 3.91kg per capita (Wang et al 2021). As a popular tourist destination, waste generation level per capita of 2.9kg in Hawaii is 2.3times higher than the national average of 1.22kg in the United States (RH, 2021; Kawai and Tasaki, 2016), although tourism sector generates 10.7% of the island-wide waste in Hawaii (2013). In Seychelles it is estimated that 14% of the total solid waste is from the tourism sector (Meylan et al, 2018). In the Maldives tourism sector generates 14 to 25 percent of the waste stream (Peterson, 2013, Moosa, 2021⁴; World Bank, 2017a, World Bank, 2018b). Similarly in Seychelles it is estimated that 14% of the total solid waste in 2019 is from the tourism sector (Meylan et al, 2018).

Resorts usually segregate food waste, garden waste, plastics, metals, glass, wood, sanitary waste and other. Plastics, metal cans, glass are shredded, compacted or crushed before being transported out of the resort. Plastics are also sold or donated to plastic collectors. Crushed glass may be reused within the resort for construction.

As per the Tourism Regulation it is not allowed to burn waste in the open areas of the resorts. Therefore resorts are required to keep incinerators (MT, 2006). The incinerators are mainly used for burning paper, cardboard and green waste, sanitary waste (Jameel, 2010, Moosa, 2021). In 2021, Ministry of Tourism removed the clause that permitted food waste and biodegradable waste to be dumped into the ocean. However, implementation of it has been postponed by end of 2022 (Mohamed, 2022).

Resorts are required to maintain a log on waste transported out of the resort and report data to Ministry of Tourism on the waste transported to regional facilities such as Vandhoo or Thilafushi. However, such data is not available from the Ministry of Tourism (Moosa, 2021).

For planning on waste management in tourism sector, it is very important that data is collected. Lack of data collection from the tourism sector is an issue in other SIDS as well. For example according to STI (2021) waste generated per tourist and/or accommodation

⁴ Excluding construction and debris waste.







facilities is not currently collected and monitored in Seychelles. In order to effectively plan for waste management solutions policy makers should know what the expected waste generation will be as the tourism market grows.

In the past some of the islands have also received waste from nearby resorts as an alternative to send waste to the regional waste management facilities. One of the islands that did that was Ukulhas which had started a composting project. According to the community, the organic waste brought from the resorts helped to increase compost, and it was an income earning opportunity. Niyaz (2017) indicate that Ukulhas Waste Management Centre (WMC) receives 23 percent of its income from collecting waste from nearby resorts. Similarly Maamigili also received waste from a neighbouring resort islands two to three times a week for about 6 months, and it was stopped after Environmental Protection Agency (EPA) requested it to be stopped (Sun, 2019). According to EPA it is not permitted for waste from resorts be removed to other inhabited islands.

In the Maldives, about 10% of the resorts compost green and compostable waste, and is used as compost and soil conditioner to the landscaping operation at the islands (Jameel, 2010). Some resorts are also making compost and also reducing food waste by targeting staff. For example in Gili Lankanfushi, compost is made using an in vessel composting machine. However as the facilities are often at full capacity, and additional waste cannot be added. Therefore the resorts is targeting staff to minimize food waste, with slogans such as no bin days, and have been successful to reduce 80kg of food waste a day (TIC, 2018).

7. Projection on waste generation in the Maldives

7.1 Waste generation in all sectors

The projection is done by using the data from the survey and other literature on waste management in the Maldives. In the waste audit survey, the households, businesses, schools and health facilities were asked whether there was a difference between pre COVID19 situation and the time of the survey as it was still during a state of health emergency. Only 10% of the households indicated that there was a change. However, 67 percent of schools and 23 percent businesses indicated that there was a change in waste generation. Therefore in the projections other similar studies are referenced and averaged to increase validity of the estimations for projections for sectors other than the households.

Waste generation per capita at the national level is estimated as 2.30 kg. It is estimated that households generate 50% of the total waste. Various businesses generate 23.17% of the total waste. Tourism sector generates 17.84% of the waste. Institutions and health sector generate about 3% and 1.19% respectively. It is estimated that other sectors generate about 4.76% of the waste (Table 17).

	Waste generation	Percent of waste				
Sectors	per day (kg)	generation				
Residents in Male	379,807.78	29.68%				
Residents in Islands	260,474.02	20.35%				

Table 17. Estimate of waste generation







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Businesses	296,556.48	23.17%
Health	15,232.10	1.19%
Resorts	213,854.29	16.71%
Guesthouses	14,413.17	1.13%
Institutions	38,392.2	3.00%
Other	60,936.50	4.76%
Waste generation	1,279,666.54	100.00%
Waste generation per capita	2.30	

The estimated amount of 1279.66 tonnes per day is similar to some of the past studies on the level of waste generation for the Maldives, if it is assumed that waste generation increases at 4% annually (ME, 2015). These studies include Moosa (2021), Peterson (2013), and World Bank (2017a). However there are also other studies that estimate a lower level (Table 18).

Study	Estimations (tonnes)	Year for estimation	Projected to 2021 (with a 4% annual growth)
Moosa (2021)	1185.73	2019	1442.62
Peterson (2013)	860	2013	1176.96
World Bank (2017b)	1000	2017	1169.85
ME (2019)	755	2017	883.24
Kaza et al (2018)	224	2016	273.33
Hoornwegard and Bhada-Tata (2012)	175	2012	249.07

Table 18. Past Estimates of Annual Waste Generation

7.2 Waste generation at households

Waste generation per capita in Male is estimated to be 1.67. This is an average of the waste generation estimates between 2015 and 2021. Waste generation per capita in Islands is estimated to be 0.99 based on this survey. According to National Bureau of Statistics 40.8 percent of the population live in Male⁵, where as 47.9 percent of the population live in the outer islands⁶. The rest of the population or 11.3 percent of the resident population live in industrial islands⁷. Resident population in Male and outer islands as a whole is estimated to produce 1.26kg per capita of waste per day from the household sector (Table 19).

Table 19. Estimate of waste generation in households

	Per capita				Percentage of
	waste				waste
	generation			Waste	generation
	per day		Percentag	generation	
Population	(kg)	Population	e	per day (kg)	
Population in Male	1.67	227,429.81	40.80%	379,807.78	29.68%

⁵ Aiham (2020)

⁶ NBS (2020)

⁷ NBS (2018)



Population in other inhabited					
islands	0.99	263,105.07	47.20%	260,474.02	20.35%
All inhabited islands	1.26	490,534.88	88.00%	640,281.80	50.04%

7.3 Waste generation from commercial sector

From this survey it is found that the average waste per business to be 18.40kg per day. This is excluding the tourism, and health sector. It is estimated that there are about 23626 registered businesses⁸. About 50 percent of the businesses are not in operation. However it is expected that more businesses will be operated as the economy grows. Therefore it is estimated for 68 percent of firms that are registered, is about 16117 businesses excluding tourism, health and education. It is estimated that 23.17 percent of all waste generated in the Maldives is from business sector (Table 20). There also informal businesses that families operate in their households, such as making food products at homes for the purpose of selling. It is assumed that waste from such work will be reflected from household waste. About 37 percent of the business waste is from Male as the main hub for movement of goods across the Maldives.

Table 20. Estir	nate of waste ger	neration from	business sector

	Waste				Percentage of
	generation per			Waste	waste
	business per		Percentage of	generation per	generation
Type of Business	day (kg)	Number	Businesses	day (kg)	
Businesses (excluding					
firms in tourism, health,					
and education sector)	18.4	16,117	68.22%	296,556.48	23.17%

7.3 Waste generation from Tourism sector

There are 165 island resorts and 897 other facilities, including 727 guesthouses, 11 hotels and 158 yacht marinas operated for tourism purposes by 2022. In 2019, before the COVID19 outbreak, bed nights of the tourists in the Maldives was 10.7million of which 84.15 percent was at tourist resort islands. By 2022, as the tourist arrivals have begun to recover, the pre-covid data from 2019 is used to estimate tourist arrivals and waste generation. It is estimated that tourist bed nights per day was 61628 tourists in resorts, and 7414 bed nights per day in other facilities in 2019. It is estimated that there were 36,977 employees in resorts and 2789 employees in other facilities. Waste generation per capita at resorts was estimated as 3.47 by averaging per capita estimates from other literature between 2015 and 2021. From the survey we found that waste generation in tourist guesthouses amounts to 1.89 per tourist bed night, and 0.85 for tourist bed night and employees. As the data was collected during COVID19 period, it is possible that the waste generation become relatively lower. Therefore an average of the estimation from the survey and estimation from Maafushi in 2022 (2kg per capita) is used to minimize an under estimation. The average amounts to 1.43 kg per guest and employee per day.

As for tourism as a whole, waste generation for per bed nights and staff, amount to 3.30kg per capita. It amounts to 17.84 percent of all waste generated, with 16.70 percent from tourist resorts,

⁸ CM (2016)





and 1.13% from other tourist facilities (table 21). Therefore these estimates confirm previous studies that indicate waste from tourism sector is about 14 to 25% of the total waste generation in the Maldives (Peterson, 2013; Moosa, 2021⁹; World Bank, 2017a; World Bank, 2017b).

Based on the regulations, tourists resorts are required to maintain a tourist to staff ratio of 1:1.5. According to the World Bank (2017a) a 1:1 ratio of staff to tourists is normal in the guesthouses. However, in our study we found that tourist to staff ratio is 1:1.17 in the guesthouses, and thus it is used for the guesthouses in the estimations.

	Tourists	Staff	Tourists		Tourist and staff Per capita per day	Waste generation	Percentag e of Waste generation
Tourism category	per day ¹⁰	per day	and Staff	Percentage	(kg)	(Kg)	
Resorts	24,651	36,978	61,629	85.94%	3.47	213,854.29	16.71
Guesthouse and other facilities	4634	5445	10,079	14.06%	1.43	14362.77	1.13
Tourism accommodation facilities	29286	42423	71,709	100.00%	3.18	228217.06	17.84

Table 21. Waste generation from tourism sector

7.4 Waste from health facilities

There are about 851 health facilities in the Maldives. Each of the largest 4 hospitals is estimated to generate about 750kg of waste per day (Moosa, 2021). With data from this survey, it estimated that other hospitals generate 137.29kg of waste per day. Health centres generate 27.09kg per day, and clinics and other medical centres generate about 6.82kg of waste per day. With these data, it is estimated that 17.89kg of waste is generated per day per facility. Total health sector waste is estimated to be 1.19 percent of the total waste (Table 22)

Table 22.	Waste g	generation	from	health	sector

		Waste		Percentage of
		generation	Waste	waste generation
Type of facility	Number ¹¹	per facility	generation	
Large hospitals	4	750.00	3000.00	0.23%
Other hospitals	24	137.29	3,294.96	0.26%
Health centres	164	27.09	4,442.76	0.35%
Clinics and other facilities	659	6.82	4494.38	0.35%
All health facilities	851	17.90	1,5232.1	1.19%

⁹ Excluding construction and debris waste.

¹⁰ MMA (2022); MT (2022).

¹¹ MH (2021)





7.5 Waste from institutes

In this survey waste generation was audited at schools and it reveals that a school generate at least about 27.98kg of waste per day. This could have been higher if it was not during the COVID19 period, or could be lower in some schools as the schools do have programmes to increase awareness on waste management, and implements guidelines and rules, such as on minimize brining plastic to schools. Although no other type of institute was audited in the survey, an estimate for institutes at 38.5kg is indicated by Aboobakuru and Samarakoon (2019) is relevant to be considered. An average of these values, 33.24Kg is used to estimate institutional waste in the Maldives. For institutions it is estimated that there are 554 educational institutes and 601 other civil service and government institutes. As per estimates, the institutional sector generate 3 percent of the total waste (Table 23).

Table 23. Waste generation from institutions

		Waste generation		Percentage of waste generation
	Number of	per institute	Waste	
Institutions	institutes ¹²	per day (kg)	generation (kg)	
Educational and civil				
service institutes	1155	33.24	38392.20	3%

7.60ther waste

As this waste audit did not include Male, secondary data have been used for the estimation. However, the waste audit data have limitations as it did not include industrial islands (such as Thilafushi, Felivaru), airports, seaports, and specific industrial sectors such as construction, agriculture (e.g. agricultural products that do not reach markets due to various constraints), transportation (e.g. used engine oil). Another limitation is that littering of waste was also not included. There are also gaps in the literature on the waste generation in these sectors in the Maldives.

With reference to estimates of SIDS, for example in Mauritius, it is estimated from the waste received at landfills, about 1.8% are from poultry, farming, tuna and sludge. Another 1.8% are from construction and demolition waste. It is also estimated in Mauritius that annually 9.49 kg per capita is in leakage from the main waste stream due to littering (MCCI, 2022). If a similar amount is estimated for the Maldives it would account for at least 1% of the total waste stream. Littering to the streams and to the marine environment have been a challenge for many years. However, there are signs that the extent of marine littering is lowering. For example, Save the Beach, a civil society organization from the Maldives has been auditing the marine litter since 2012 in Vilimale island, and annual audit data indicate that between 2014 and 2018, the marine litter has got reduced by 90.34 percent (STB, 2019).

In order to account for sectors that were not audited or referenced, about 5% of the waste stream is added to the final estimated total waste generation, and amounts to 4.7% of the final estimated waste generation level.

¹² MF (2022); MOH and MHE (2019); MOE, (2020) MBS (2017), MHE (2022)







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8. Waste projection estimates

Ministry of Environment estimates that every year waste generation increases by 4 percent in the Maldives (ME, 2015). This is similar to estimates on waste generation in Mauritius by United Nations Industrial Development Organisation that also indicate a 4 percent increase in waste generation (UNIDO, 2017). As these estimates are also close to the GDP growth per capita Table 24), projection is prepared with a 4 percent annual growth for 2025, 2030 and 2050.

It is projected that waste generation per day will increase from 1279.66 tonnes in 2023 to 1751.31 tonnes by 2030 and 3837.34 tonnes by 2050. Per capita waste generation per day is projected to increase by 2.35kg in 2023, 2.73kg in 2030, and 4.18kg in 2050.

L	
Indicators	Percent
Population growth	1.8% (2020)
Urban population growth	2.9% (2020)
GDP growth	6.9% (2019)
GDP growth per capita	3.8% (2019)

Table 24. Population and Economic Growth

Source: World Bank (2021).

Population growth rate in the Maldives have decreased down from 4.6 in 2014 to 1.8 in 2020. However, it is likely that the business and industrial sectors will continue to grow, and therefore per capita waste generation is likely to increase over the years.

The assumptions used for the projections are that the annual growth will be at 1.8% based on recent data (table 24) and the annual increase of waste generation will be 4% (ME, 2015). It is projected that waste generation in the Maldives will increase by 1330.85 tonnes in 2023, 1751.13 tonnes in 2030 and 3837.34 tonnes by 2050 (table 25).

There are only two studies that have projected waste generation for future ahead of 2021. Kaza et al (2018) projects that waste generation in the Maldives will increase by 300.52 tonnes by 2030, and 393.32 tonnes by 2050. However, the population data used was 576,000 for 2050, which is lower than the current population. Similarly Hoornwegand and Bhada-Tata (2012) projected waste generation for 2025 to be 513 tonnes of waste with an assumption that population will be about 411,000 by 2025.

Hoornwegand and Bhada-Tata (2012) projects that the waste generation rate in the Maldives would become lower from 2.48kg per capita in 2012 to 2.2kg per capita in 2023. There are places such as Taiwan where per capita waste generation growth rate have been reduced with increase in awareness, and policy intervention (Chiemchaisri et al, 2007). Even if economic activities are inceasing, it is still important to have a waste reduction target. For example in Seychelles it is suggested to have a benchmark of 2kg per guest night for Sevchelles tourism industry (Jambeck et al, 2019).





Seychelles, generate about 202 tonnes of waste per day, and with a high economic and population growth, it is expected to increase waste generation by 50% by 2030 (Jambeck et al, 2019). While the Maldives is about 5.6% higher than Seychelles, the 5.6 times of the estimation of Seychelles would be about 1143 tonnes which is close to the waste generation estimation in the Maldives. However, waste generation increase in the Maldives by 2030 is expected to be about 37% increase, and a 200% increase by 2050 compared to 2021.

Projection	Annual growth rate	Baseline used for 2021	2023	2030	2050
Projected population	1.8%	557,426.00	567,459.67	642,938.52	918,596.96
Total waste generation (kg) per day	4%	1,279,666.54	1330853.2	1751312.02	3837340.31
Total waste generation (tonnes) per day	4%	1279.66	1330.85	1751.31	3837.34
Per capita waste (kg) per day		2.30	2.35	2.72	4.18

Table 25. Projection on waste generation for 2023, 2030 and 2050

8.3 Waste composition estimate

		Garde		Pape						Meta	Othe	
Average estimates	Food	n	Wood	r	Textiles	Nappy	Hazardous	Glass	Plastic	1	r	
All	31.51	30.39	2.23	7.29	2.42	5.11	1.23	2.83	5.53	2.59	8.88	
Resorts	36.95	34.91	0.61	6.37	0.88	0.00	0.15	4.54	3.56	1.51	10.53	
Male	46.71	5.73	0.29	11.41	3.87	6.33	0.80	3.10	14.57	2.93	4.26	
Other inhabited islands	26.96	34.01	3.51	7.14	2.38	4.48	2.21	2.47	4.40	2.94	9.49	ſ
This survey (nine islands)	23.96	36.68	6.02	9.91	0.79	3.11	1.41	1.75	4.33	4.09	7.95	

Table 26. Composition of waste based on past studies and this survey

Sources: Aboobakuru and Samarakoon (2019), Ewers (2008), Geotech Maldives (2022), IT Power (2007), Pacific Consultants (1999), Kapmier and Goclaves (2018), MEE (2013), Tetratech (2020), World Bank, (2017) and Authors (2022)

Data collected from this survey and data from past studies can be used to understand composition of waste in the Maldives as a whole, in Male, in other inhabited islands and in resorts. Using this it is possible to further identify burnable waste from waste stream.

Burnable waste is identified as garden waste, wood and wood chips, nappies, paper and textile waste. In the survey it is identified that 56 % of the waste is burnable. Other studies in the past have also indicated that in the islands 58% of the waste is burnable. All estimates together have estimated that 56.5% is burnable in the Maldives. Estimates for Male however







indicate that burnable waste is as a percentage low at 27%. For resorts it is estimated that 43.4% of the waste is burnable. Thus it can be deduced that in the Maldives from all waste 27 to 58 percent is burned. Therefore about 43% of the waste is burnable in the Maldives. Therefore about 0.99kg per capita of waste or 550.25 tonnes of waste is burnable. If plastics are included the burnable amount of waste increases between 42 and 60 percent. It will be about 52 in average. In this scenario 1.19kg of waste per capita or 665.42 tonnes of waste is burnable. It is also estimated that between 4 and 11 percent of the waste is other waste that was not categorized in the past estimates.

Currently there is no data available on the actual amount of waste that is burned. The survey indicates that in 66% of the inhabited islands households burn waste. Across islands, 19% of the households and 3% of the businesses burn waste. Waste is also burned in the Waste Management Centres.

The estimates indicate that organic waste including food, garden waste and wood are the highest in proportion. In Male organic waste is relatively lower at 52% because of the less percentage of garden waste, but food waste in Male is relatively high at 46.71%. In the resorts, it is estimated that 72% of waste is organic, and food waste comprises 36.95% of the waste. In other inhabited islands organic waste is about 64.4%. Estimates from the 9 islands used from this survey indicate the islands have 66% of organic waste. The estimates are higher than organic waste in SIDS, as organic waste is about 44% of the waste across SIDS (Mohee et al, 2015). However it is similar to level of organic waste of about 61% in South Asia (Kaza et al, 2018). Therefore composting is one way to reduce the extent of burning.

Although the waste generation is projected to increase, is it is possible that the rate of waste generation can be reduced. In some of the countries waste generation has been reduced although economy continues to grow (Kawai and Tasaki, 2016). Targeting sustainability in consumption and production is important for reducing and improving waste management sector. As the Maldives is dependent on importation of most of the products and as the economy is highly dependent on the tourism sector, attention is needed for these sectors. Although waste generation in the inhabited islands have been lower than Male in the past, per capita waste generation in the inhabited islands are also increasing. Attention is needed on the increasing percentage of plastic waste in all the islands. Further studies are recommended to find out the practices of burning by WMCs.







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Annex 1 – List of s	Annex 1 – List of surveyed places and audit team members							
Veymandhoo, Thaa Atoll	Velidhoo, Noonu Atoll	Maamigili, Alif Dhal	Ihavandhoo, Haa Alif Atoll	Kelaa, Haa Alif				
		Aton Surveyed places						
Dhigufeeshige Narugismaage guldhasthaage Feeroazuge Sihhee marukaz Yagoothu vIlla KolhuhoDu Dazymaage Rahameeru Kefey Enderi kefey Lilyge HuLhanguge Miskiy Dhoshuge	Aliha Kinaara Loona Concord (fihaara) Muni (boatyard) Maagala South happy Javaahiru maage Aliga Kwi (fihaara) Aahama Olhugiri Sosanvila Azum Island bistro (restaurant) Sun light Home life	Village RaaheeManzil White Sand Thari Village Sihhee marukaz Noothari Asaree Hiyaa Moon light Ganet Atholhu madhrusa Maahiyaa Aahiyaa Fazaa Fehiali Zidhunee Veligandu	Dharuma Manzil Meezaan Minitee Mas kakkathan Lagoon Dheek Finiroalhi (finihiyaa) orchid tailors Boatyard Niyandhuru Violetge Witenava Jahaamugurige Gaathumal Aaru Heenaavilaa	Nightmoon Niru Kashimaage Akiri Heylhi kuludhuhfushige binhimage sosan cafe Kelaa school Kelaa heath centre Maathila Gaadhoo Daisy Happy Zendori (shop) Eidhuge Rangiri Naaz				
Daily Fish HeenaaMaage Endherimaage Fiyaathoshige Kaneeru Villa School Athireege Aage Kenery Villa Mugurige Hazuviwu & Hamdhu Dhirun 4	Youth square (restaurant) Viyasa (fihaara) Rest block (maskahkaa ge) Light corner Saahil luboamaage Velidhoo school Health center	Reason Benhaa Dhunikolhu Tailor-1 L1 Hardware Honey Blocks Unique Variety Epozote rest. Caffeine café	Sahil Ruggandu Sihhee marukazu Alividhuvaru Fini Asseyri nala Asseyri 2 for 2 Ihavandhoo School	Beenaafush Holiday Home Kelaa (guest house) Rangigri bakery Mahal Kanmatheege Femmi mart Best Mart				
	Audit teams							
Ali Ahlam Umar Ahmad Ahmed Nazim Mohamed Lateef Ahmed Ibrahim	Hassan A Latheef Mohamed Ibrahim Ahmed Ibrahim Miuraj Mohamed Mohamed Ibrahim	Ibrahim Abdulla Kinaanathu Ibrahim Mohammed Ibrahim Ahmed Gasim Imran Abdulla	Sadhaam Samaah Lugman Ali Nasheed Nagha Nihaya	Mohamed Hassan Moosa Hawwa Thooha Mariyam Zeena Adam				







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Fuvahmulah	Thoddoo	Gan	Hithadhoo,
Gnaviyani Atoll	Alif Alif Atoll	Laamu Atoll	Seenu Atoll
	Surve	eyed Places	
Garden House	Manzaruge	Touins Villa	Novemberge
Astoria	Asrafeege	Keeli	Flat no.4
Violet Maage	Hilihilaage	Everlast	View site
Mart Traders	Ferose	Annaarumage	Nalahiyaage
Vashaniege	An'bugasdhoshuge	Cafe Azuro	Dhevelikinaara
Kalhirava	Rai bageechaage	Touins	Hanhaaruge
Kalhirava	S P villa	Sama	Saraasaruge
Finivaa	Fi-es	Hiyatheyo	Aaveli
F&A cafe	Rankokaage	Lilly beach	Keneryge
Malareethige	Uduvilaage	Masthakage	Thiyaramaage
Mathivaru	Kokaali	Luckystar	Cozy Corner
Fanthi	Vaffaru	Jauza	Athiree aage
Muraaki	Mathares	Isaadhu	Seyrubeen
javaadhumanzil	Tharividhaage	Kethi	Hiyaaleege Irumathee
Misurugadhakoalhige	Sarah Aabaadhu	Randhodhi	bai
Ethumage	A4S mart	Endhivilla	Seadum
Saamireege	Mooces Mart	Haveerihiya	Kekurimaage
Secret	Lagoon Restaurant	Safais	Kethreen
Malhabige	Health Centre	Boatyard	Naalooth
Babyhouse	Thoddoo School	Greenplus	Carnation View
Udha	Beach inn	Maskakkabin	Astralge
Sweet Bonanzaa	Sunny Beach	Gamu Regional	Baahee
F&A Mart	Lagoon Villa	Hospital	Multi Supermart
Mahaldheeb	Grand King	Ihadhoo School	Multi Store
Miyaaz	Ale Sara	Muhun cafe	Vendhitha
Fehiali		Nazaki Resident	Hithadhoo Btek Fish
		Guesthouse (Viable Mart
			Milano
			Cubano
			International Medical
			Diagonistic Center
			(IMDC)
			Abuharee Clinic
			Villa College
	Au	dit teams	
Afrah Rasheed	Mariyam Shakeelaa	Mohamed Rasheed	Aiminath Ali
Mohemed mafaaz	Adam Afsal	Mohamed Aiman	Maishaa Akram
nizam	Shahma Ali	Mohamed Riswan	Mariyam Shaba Shakir
Maadh	Abdullah Mufeed	Abdul Azeez Haroon	Nashwa Ibrahim
Mazin	Hussain shaiban	Ibrahim Anwar	Aminath Mohamed
Ahuzam			Ali Nasir







<u>Annex 2.</u>

The form was used to note if the respective sample units (such as households) have been informed and consent taken, to identify if the plastic bags have been delivered, and also to tick as waste samples were taken from the households and finally to point out if the respective samples have been audited. This form was used to cross check the form on which the waste audit results were entered.

WASTE COLLECTION SHEET Please tick ✔

	Name of the place	Informed and consent taken	Bags delivered	Food waste and nappy collection				Other waste collectio n	Audite d			
	Households			D1	D 2	D 3	D 4	D 5	D 6	D 7		
1												
2												
3												
4												
	Business											
1												
2												
3												
4												
	0.1.1											
-	School											
	** 1.1											
	Health sector											
1	~~~~											





The form for entering data (form B) as follows:

DATA COLLECTION SHEET (form B)					
Atoll/ Island					
House/ Place					
Reference No.					
Category	a. Household () b. Business () c. Health () d. School ()				

Waste Collected daily for auditing Food Waste

	Date	Weight (kg)	Comments
1			
2			
3			
4			
5			
6			
7			

Nappies

	Date	Weight (kg)	Comments
1			
2			
3			
4			
5			
6			
7			

Waste collected after 1 week

Туре	Weight (kg)	Comments
Garden Waste		
Paper		
Wood and wood ships		
Textiles		
Hazardous waste		
Glass		
Plastic		
Metal		
Other		





QUESTIONNAIRE FOR HOUSEHOLDS

The following is an English translation of the original questionnaire (in Maldivian) for households.

- 1. Auditor name:
- 2. Island
- 3. Place name
- 4. Age
- 5. Gender
- 6. Household size:
 - 8.4 Male
 - 8.5 Female
- 7. Children under 5 years
 - a. Male
 - b. Female
- 8. Type of waste burned in the house compound
 - a. Garden waste
 - b. Paper
 - c. Wood and wood chips
 - d. Textiles
 - e. Plastic
 - f. Nappy
 - g. Other
- 9. Frequency of burning in the house compound
 - a. Once a day
 - b. Once a week
 - c. Other
- 10. Place where waste is burned, if it is done by the household
 - a. House compound
 - b. Beach
 - c. Woods
 - d. Other.....
- 11. Method of burning if it is done by the household
 - a. On the ground
 - b. On a metal tray
 - c. Locally made incinerator
 - d. Incineration machine
 - e. Other.....







WUNOPS

- 12. Waste removal service
 - a. By own self
 - b. NGO
 - c. Council
 - d. Individual
 - e. Other.....
- 13. Fee for waste removal
- 14. Frequency of waste removal
 - a. Daily
 - b. Weekly
 - c. Other.....
- 15. Segregation of waste for waste removal.
 - a. No segregation
 - b. Food waste and others
 - c. Other.....
- 16. Composting at household
 - a. Yes
 - b. No
- 17. Interest for composting
 - a. Yes
 - b. No
- 18. Main challenge for waste management
- 19. Difference on waste generation compared to pre-COVID time
 - a. Yes
 - b. No

20. Suggestions on waste management in the island





QUESTIONNAIRE FOR BUSINESSES/ SCHOOLS

The following is an English translation of the original questionnaire (in Maldivian) for businesses.

- 1. Auditor
- 2. Island
- 3. Name of the business
- 4. Age
- 5. Gender
 - a. Male
 - b. Female
- 6. Average number of customers/ (number of students if it is a school)
- 7. Type of business
 - a. Shop
 - b. Restaurant/ Café
 - c. Boatyard
 - d. Guesthouse (No. of rooms.....)
 - e. Fish processer
 - f. School (No. of classrooms......)
 - g. Other.....
- 8. Existence of a guideline on waste management
 - a. Yes
 - b. No
- 9. Type of waste burned, if it is done by your establishment.
 - a. Garden waste
 - b. Paper
 - c. Wood and wood chips
 - d. Textiles
 - e. Plastic
 - f. Nappy
 - g. Other.....

10. Frequency of burning, by your establishment.

- a. Daily
- b. Weekly
- c. Other.....
- 11. Place where waste is burned, if it is done by the establishment.
 - a. Business compound
 - b. Beach
 - c. Woods
 - d. Other.....
- 12. How is waste is burned, by the establishment
 - a. On the ground







- b. On a metal tray
- c. Locally made incinerator
- d. Incinerator machine
- e. Other.....
- 13. Waste removal service
 - a. Own arrangement
 - b. NGO
 - c. Council
 - d. Individual
 - e. Other.....
- 14. Fee for waste removal
- 15. Frequency of waste removal
 - a. Daily
 - b. Weekly
 - c. Other.....

16. Segregation of waste for waste removal

- a. No segregation
- b. Food waste and other
- c. Other.....
- 17. Main challenges for waste management
- 18. Difference on waste generation compared to pre-COVID time
 - a. Yes
 - b. No.
- 19. Suggestions on waste management in the island





QUESTIONNAIRE FOR HEALTH FACILITEIS

The following is a summarized English translation of the original questionnaire (in Maldivian) for health facilities.

- 1. Auditor
- 2. Island
- 3. Name of health facility
- 4. Gender of the respondent
 - a. Male
 - b. Female
- 5. Number of employees
 - a. Male
 - b. Female
- 6. Average number of inpatients
- 7. Average number of outpatients
- 8. Bed capacity
- 9. Type of health facility
 - a. Health Centre
 - b. Clinic
 - c. Hospital
- 10. Existence of a guideline on waste management
 - a. Yes
 - b. No
- 11. Segregation of waste as per a guideline
- 12. Type of waste burned by the health facility
 - a. Garden waste
 - b. Paper
 - c. Wood and woodchips
 - d. Textiles
 - e. Plastic
 - f. Nappy
 - g. Other....
- 13. Frequency of burning waste by the health facility
 - a. Daily
 - b. Weekly
 - c. Other

14. Place where waste is burned by the health facility

- a. Compound
- b. Beach
- c. Woods
- d. Other.....







- 15. How is waste burned, by the health facility
 - a. On the ground
 - b. On a metal tray
 - c. Locally made incinerator
 - d. Incineration machine
 - e. Other....
- 16. If waste is removed from the health facility compound, where is it taken
 - a. Island Waste Management Centre
 - b. An area usually used for burning
 - c. Other.....
- 17. If medical waste is removed from the health centre to anywhere outside, where is it taken?
- 18. Waste removal service is provided by
 - a. By health facility itself
 - b. NGO
 - c. Council
 - d. Individual
 - e. Other....
- 19. Fee for waste removal service
- 20. Frequency of removal of waste from health facility compound
 - a. Daily
 - b. Weekly
 - c. Other...
- 21. Segregation of waste for removal of waste from health facility
 - a. No segregation
 - b. Food waste and other
 - c. Medical waste and other
 - d. Other.....
- 22. Segregation of medical waste
- 23. Frequency of medical waste removal from the island
 - a. Daily
 - b. Weekly
 - c. Monthly
 - d. Other
- 24. Where is medical waste removed if taken outside of the island
- 25. Main challenge for managing medical waste
- 20. Difference on waste generation compared to pre-COVID time
- 21. Suggestions on waste management in the island







QUESTIONNAIRE FOR COUNCILS

The following is a summarized English translation of the original questionnaire (in Maldivian) for councils.

- 1. Auditor
- 2. Island
- 3. Respondent's name
- 4. Gender
 - a. Male
 - b. Female
- 5. Existence of a waste management guideline for the island
 - a. Yes
 - b. No
- 6. Organisation(s) involved in waste management in the island
 - a. Council
 - b. NGO
 - c. Small business
 - d. Individual
 - e. Other
- 7. Waste removal fees
 - a. Households...
 - b. Institutions....
 - c. Shops....
 - d. Schools
 - e. Other
- 8. Segregation of waste for removal of waste in the island
 - a. Paper
 - b. Garden waste
 - c. Nappy
 - d. Wood and wood chips
 - e. Plastic
 - f. Glass
 - g. Medical
 - h. Hazardous
 - i. Food
 - j. Textiles
 - k. Metals
 - 1. Other....
- 9. Management of the island waste management centre
 - a. Individual
 - b. NGO
 - c. Small business
 - d. Council







- e. Waste Management Corporation
- f. Utility company
- g. Other....

10. Segregation of waste in island waste management centre

- a. Paper
- b. Garden
- c. Nappy
- d. Wood and wood chips
- e. Plastic
- f. Glass
- g. Medical
- h. Hazardous
- i. Food
- j. Textiles
- k. Metal
- l. Other...

11. Place where waste is burned by the island waste management centre

- a. Beach
- b. Woods
- c. Other...
- 12. If burning is done by any other party, places where burning is done
 - a. Compound of Island Waste Management Centre
 - b. Beach
 - c. Woods
 - d. Other...

13. Frequency of burning by the island waste management centre

- a. Daily
- b. Weekly
- c. Other..

14. Type of waste burned by the island waste management centre

- a. Garden waste
- b. Paper
- c. Wood and wood chips
- d. Textiles
- e. Plastic
- f. Nappy
- g. Other...

15. How is waste burned by the island waste management centre

- a. On the ground
- b. On a metal tray
- c. Locally made incinerator
- d. Incineration machine
- e. Other...
- 16. If waste is removed from the island, the frequency of removal







- a. Daily
- b. Weekly
- c. Monthly
- d. Other...

17. If waste is removed from the island, where is it taken

- a. Thilafushi
- b. Another island in the atoll.....
- c. Other...
- 18. If waste is removed by cooperating with recyclers, when was it removed, and what type of waste was removed....
- 19. If composting is done in the island, where is it done?
 - a. Island Waste Management Centre
 - b. Households
 - c. Other...
- 20. Main challenge for managing medical waste
- 21. Difference on waste generation compared to pre-COVID time
- 22. Suggestions on waste management in the island