Bhutan Waste Accounts Report

Version as of March 2021

1 Background

Bhutan's 12th Five-Year Plan (2019-2023) includes national level waste management as a key performance area. The Plan defines a number of national level indicators including the absolute amount of solid waste (in tonnes) that is recycled. To monitor progress towards this goal of greater recycling, reliable statistics need to be developed for both total solid waste produced, as well as amounts of waste materials that are recycled. Typically recycling is managed according to different types of materials, such as metal, plastic, paper and cardboard, and glass.

In the 2019 National Waste Management Strategy, one of the implementation obstacles identified was an 'informational barrier.' To start addressing this lack of information, a national waste survey was conducted in 2019. The focus was on waste production by different aggregated sectors. An analysis of the different types of wastes was also conducted. The waste survey data was able to be re-organized into a type of physical supply table. The survey did not include detailed information about waste collection or waste treatment. This data served as the starting point for this waste accounts project.

2 Introduction to waste accounts

2.1 Multi-purpose data systems serving user needs

Developing stakeholder relevant information is one of the responsibilities of national statistical offices. One group of stakeholders include policy makers, but policies typically change over time so trying to identify not only current needs, but also anticipate future needs are helpful when developing statistical systems. Developing environmental-economic accounts, which take a more holistic approach of integrating statistics into accounts, can be useful. Environmental statistics are often developed to follow a specific activity. These statistics can help to evaluate the effect of environmental policies and regulations. But as policy and regulations change over time, often the statistics do not capture the newly needed information. Developing accounts that are able to track activities in a more comprehensive manner can provide the flexibility and details needed both now and in the future. With this perspective in mind, NSB has used existing waste data to develop physical waste accounts as far this was possible.

By considering one country's waste policy development, and the subsequent changes in the waste statistics and accounts which were needed, it may be possible to anticipate the developments that could also happen in Bhutan.

Waste policy in Norway developed from focusing first on amounts of waste landfilled in different geographic areas (municipalities), then there were policies focusing on different types of waste being produced, and currently there are policies focusing not only on the types of waste but also on who was producing the waste and what happens to the waste – the different treatments (recycling/landfill/incineration, etc.).

When the focus was on amounts of waste put into landfills, the approach to developing relevant statistics was to estimate the typical weight of the waste dumped into the landfill by certain types of trucks, and then count the numbers of the different types of vehicles that came to the landfill. An estimate of the

total amount of waste placed in landfills was made by multiplying the number of vehicles times the typical weight of each of the loads in the different types of vehicles and summing these totals to provide information for each of the landfills. Totals for the country were made by summing over all the landfills. This approach provides information about how much mixed waste is deposited into landfills.

Then the policy makers wanted to start regulating different types of waste and the landfill focused statistics could not provide any useful information. The statistics needed to change to include different types of waste. A series of studies focusing on different types of waste fractions were conducted to provide the information the Ministry of Environment requested. A whole range of different types of waste were investigated, including wet organic waste, paper and cardboard, packaging, plastic, construction, and glass, to name a few. The problem that arose after nearly 10 years of these different types of studies was that it was not possible to determine the total amount of waste produced since a number of the categories overlapped which resulted in double counting. For example, packaging waste includes some but not all of the categories paper and cardboard, and the same for plastics. And construction waste includes some glass waste. Getting rid of the double counting was important, but then the policy focus changed again. The policy makers wanted to target regulations not only on the types of waste but on who is producing each kind of waste and then what happens to the waste, i.e. what is the final treatment.

Although some of the waste can be identified as coming from certain industries, such as wet organic waste from the fish processing industry, slaughterhouses, and meat packaging plants, this type of waste is also from restaurants, hotels, and households. There was a need to have a full accounting system where it was possible to identify which economic entities produced the different types of waste, and to be able to track, as best as possible, what happened to the waste – in other words, the different waste treatments. In addition, it was important to identify the economic aspects of waste generation, collection, and final waste treatment.

Waste accounts as described in the System of Environmental-Economic Accounts – Central Framework 2012 (UN et al., 2014, Chapter 3, section 3.6.5, pages 88-92), using the national accounts concepts of supply and use tables are useful tools to identify and track the physical flows of waste through the economy. In the SEEA-CF manual, the example shown is only final treatment. However, in this case, we want to develop waste accounts showing who produced the waste by types of waste (supply of waste) and then how the waste is treated (if treated directly by the producers), and how much is collected and taken to another location (similar to 'intermediate consumption') for final treatment (similar to 'final use').

The three main phases of waste management i.e., production, collection, and treatment, are important to keep track of in the waste accounts since policy can be developed in different ways and having a full set of waste accounts can assist in providing the foundation for evidence-based policies, good management practices, and advocacy for improvements.

2.2 Developing Waste Accounts in Bhutan

Waste production and treatment is becoming more important in Bhutan due to some waste related environmental and health issues. In 2019, there was a detailed, country-wide waste survey. The data from this survey forms the data foundation for the development of these preliminary waste accounts. Needed data was lacking from the waste collection industry (ISIC 38.1). Unfortunately, due to the COVID pandemic, it was not possible to conduct any additional surveys to collect new data, although obtaining

data from the waste collection entities was attempted. Estimates were made based on existing data to allow the development of preliminary physical flow waste accounts presented in a supply and use format. When additional data become available, either more detailed by industry groups (ISIC) or by treatment categories, these accounts can easily be revised since the major components of the waste SUT system have been established and the NSB has experience developing the system.

Bhutan's waste survey and results as main data source for waste accounts project

The 2019 national waste inventory survey (NSB Bhutan, 2019) was the first nation-wide waste survey conducted in Bhutan. There were two main aspects in the survey. One was the generation of waste (in physical units and by waste types), and the other was perceptions related to waste and waste collection services. For this project, the physical data are the ones we are able to re-use.

The survey results produced waste generation statistics developed by 12 waste types, and by 7 economic sectors. Households were also split by urban and rural categories for some of the statistics. There are also some percentage data regarding waste disposal or treatment (called 'management' in the 2019 report) for some of the sectors. These data are used to help develop estimates of the waste treatment portion of the waste accounts.

The NWIS-2019 did not cover the entire waste generating sectors. Since the survey duration coincided with academic year ending, some schools although open, had no students, with the vacation having already started. This resulted in slight downward bias in the quantity of waste collected from those schools. The survey had not estimated and analysed the non-domestic waste that were seen or dumped in open areas, river banks, roads/ drains, etc. as it was not planned, given its extensive area and limited resources and time. And also survey report did not make any adjustment for seasonal variation of waste generation.

3 Waste accounts development

3.1 Introduction to the Supply and Use System for Waste

The national accounts use a specialized system for showing the production and consumption of products in the economy which are developed into linked tables called, Supply and Use Tables (SUTs). The national accounts SUTs are developed using industries and products in the columns and rows, respectively. For the waste SUTs, the industries would be the same as in the national accounts SUTs, but the products would be replaced by the different waste types and/or treatments.

The categories used for industries in the national accounts are defined by the International Standard Industrial Classification of all economic activities (ISIC). For the waste categories, there is currently no internationally agreed upon list of waste. However, in many countries there is an official list of waste types, often established by the environmental authorities in consultation with the national statistical office. Therefore, national waste lists are used by default when developing waste statistics and accounts in countries.

To develop a fully populated SUT system for waste, the supply table shows the types of waste in the rows and the industry groupings are shown in the columns. The supply table entries are the amounts of different types of waste produced by the various industries. The next step would be to develop tables for

each industry showing the types of waste in the rows, and the treatment in the columns. Many industries and households 'treat' their own waste by burning, composting, or dumping it in the environment. They also have some, or all, of their waste collected.

The next step is to figure out what happens to the waste that is collected. Some of it can be collected as separated fractions that can easily be recycled, such as paper, metal and glass, if these types of waste are separated at the source and collected in a manner that keeps them separated. The waste collection services (ISIC 38.1) often take their mixed waste to be incinerated or landfilled (ISIC 38.2). Developing a picture of how much waste is collected and then the treatment of the waste, a fuller picture of the waste management system can be obtained.

The separate waste treatment tables – from the individual industries plus the waste collection companies – are then aggregated to develop a 'use' table. In this case, the final treatment of the waste is thought of as it's 'final consumption' in a national accounts way of thinking.

This detailed supply and use system is the ideal, unfortunately obtaining this type of detailed data is seldom fully possible. Much of the time, waste is simply mixed together and following the different waste types from generation to final treatment is extremely difficult. Given these difficulties in tracking what happens to the waste, estimations are made based on the best available data.

3.2 Economic data related to the waste accounts

In addition to the physical flows of waste production – collection – treatment, there are expenditures connected to this activity. Costs for waste collection and treatment are considered environmental protection expenditures and identifying how much industries, households and government units are spending on waste can be of interest. If these costs can be separated out, an indicator of cost per unit of waste can be developed.

The waste collection and treatment industry (ISIC 38) often contributes significantly to employment and value added in a country, in addition to assisting in controlling pollution and preventing some public health issues. Separating out the waste management industry's contributions to the economy as part of the efforts to green the economy can also be of interest. Environmental protection expenditures have been viewed as costs, but these expenditures are also needed for a better environment and the economic activities resulting from these expenditures also contribute to employment and the GDP.

3.3 Procedure for developing the waste accounts

A stepwise process was used to try to figure out how to re-use existing data from the national waste survey and identify gaps that could try to be filled. The national waste inventory survey (NBS-Bhutan, 2019) data were used as the starting point.

3.3.1 Industry categories in waste survey vs. standard ISIC categories

Ideally, the industry groups in the physical flow waste SUTs are the same as those used in the national accounts' SUTs. The groups are defined by the international industry classification, ISIC. If the physical flow waste accounts use ISIC categories, then combining economic data and physical waste data becomes easy.

In this case, the economic activity groupings used in the waste survey were not based on ISIC. After an examination of the survey methodology, it was also determined that the number of units included in the

original sample for the national survey was too small to allow the aggregated, non-standard groupings to be split according to ISIC to produce reliable estimates for the more detailed, dis-aggregated, standard ISIC groupings. The waste survey included only limited numbers of units from each ISIC, and those units were not selected in a representative manner by ISIC, but were selected according to more aggregated, non-standard categories.

The result of these limitations due to the sampling size and structure used to conduct the original waste survey, is that we are not able to restructure the data in a way that helps us developed detailed waste accounts that are compatible with the economic data (employment, turnover, value added, etc.) typically available from industry statistics and the national accounts from the NSO.

Therefore, the economic activity groupings used in the accounts remains the same as in the waste survey: Households, commercial, industries, health centres, institutes, government offices, vegetable markets.

3.3.2 Waste categories

Since there is no international agreed list of waste, national lists are used. In this case, the waste types used in the national waste survey published results were those used to develop the accounts.

The waste types were:

1. Food waste
2. Plastics (hard and soft)
3. Paper and cardboard
4. Glass
5. Sanitary (pads) waste
6. Metals
7. Textiles
8. Wood
9. Rubber
10. Electronic waste
11. Other
12. Green plant materials
13. Medical waste

3.3.3 Waste generation, collection, and treatment steps

Ideally, the waste accounts provide information about waste generation and treatment in a way that you can follow all the different flows separately. A complicating component is the collection step. Figuring out which economic units produce certain amounts of different types of waste, is usually determined by waste generation analyses, where one analyzes how much of each type of waste is produced by a representative sample of units. But what happens after it is produced is not so easy to identify, especially if it is all mixed together and picked up by a waste collection service. If a company treats its own waste (burning, burying, recycling/selling, etc.) they can report this information. If the waste is separated at the source and the different types of waste are collected separately, then what happens to each type of waste can often be traced. However, if there is only mixed waste that is collected, then there is no good way to track the different types of waste. Another problem can be that when the waste is collected, it leaves the control of the company producing the waste.

What the waste collection services units does with the waste, can only be obtained from the waste collection companies. In many cases, the waste collected is simply collected and then landfilled or incinerated. There may be some attempt to split out items of value, such as metals, which can be sold to scrap dealers. This collection stage can be considered similar to ‘intermediate consumption’ in an SUT system since the waste collection companies are transporting the waste to a final treatment location where the waste is often placed back into the environment (landfilled, dumped) or burned with resulting air emissions and ash (which is then usually landfilled).

The waste survey did not include detailed information about the collection portion of the waste cycle. In this project, an attempt was made to collect additional information but due to the COVID pandemic and the unavailability of the comprehensive list of the waste collection companies'/scrap dealers, the collection of new data was not possible.

The only information available from the waste collection companies was from the waste survey. The waste survey obtained figures for total waste amounts collected by registered waste companies i.e. also by just three types of wastes; food waste, recyclable and non-recyclable wastes.

However, when coming to medical waste, amongst health centers generating pathological and infectious waste, more than half the health centers- 51 percent reported either they burn or bury the pathological and infectious waste generated from their health centres. Around 25 percent stated that they autoclave or do chemical treatment for pathological and infectious waste. Rest of the health centers reported that they dump in separate pits or treat with bleaching powder prior to dumping. For the E-waste, it usually sold to the recycling companies, but few reported that it is dumped in the landfill with general waste.

3.3.4 Estimating waste treatment or disposal ("use") based on existing data – main ideas used

Determining what happens to each type of waste can be challenging. Estimation methods need to be developed. For households, there can be marked differences for waste treatment for rural or urban locations. Often food waste from households in rural areas is used for feeding animals, whereas in urban areas food is thrown out and is collected with other types of waste. The same type of urban/rural waste treatment differences may be because of the coverage of waste collection services in urban areas is much higher than the rural areas.

4 Detailed explanation of the calculation model used for estimating the final treatment of waste by industry groups and households

The results of the waste survey were used to develop the waste supply table, showing the types of waste in the rows and the different aggregated sectors in the columns. Going from the supply table to the use table required information about the types of treatment of the waste.

Although it was possible to obtain the amount of waste produced according to waste types, waste treatment amounts are only able to be estimated by treatment types and not by both treatment and waste fraction. Most of the waste fractions become intermingled to the point where they cannot be traced from production to collection and further to type of treatment.

Different estimation methods were used for the various industry groupings and households to calculate the final treatment of the produced waste. In this section, the calculation methodologies for making the estimates are described in detail.

In urban areas, (National Waste Inventory Survey (NWIS-2019), almost 90 percent of the households and other waste generating sectors use waste collection services to dispose of their waste. For the waste collected by waste collecting services, since there is no information on how each different type of wastes are being treated, the study assumed that two-thirds of the recyclable waste collected are assumed to be recycled within Bhutan, while one-third is assumed to be exported. (Bhutan Trade Statistics report-2019). The waste reported as sold to the scrap dealers by different sectors were also assumed to be exported.

The food wastes and non-recyclable wastes collected by waste handlers were assumed to be taken to the landfills. There are also some sectors or households in urban areas resorting to waste composting, reuse and recycling within their sectors as presented in the SUT.

In rural areas where there are no waste collecting facilities, the wastes are usually dumped in a pit or burned in the surrounding and they use food wastes as either animal food or dumped in vegetable gardens directly. Some households and other sectors also sell their recyclable wastes to scrap dealers. There are also some sectors or households resorting to waste composting, reuse and recycling within their sectors. The wastes dumped in the pit by the rural flocks were assumed to be dumped in the environment as there is no treatment or further management after dumping in the pit, the food wastes used as animal foods and dumped in kitchen garden are not considered as waste. The recyclable waste sold to scrap dealers is treated as export of waste since most of the scrap goes beyond borders either for recycling or upscaling.

The 2019 Bhutan Trade Statistics report (2019, BTS, MoF) shows that Bhutan has exported little more than twenty thousand kilogram of wastes in day which is coming slightly higher than what our report shows. This could be mainly because of non-coverage of most of the scrap dealers in our survey as they operate informally.

4.1 Supply Table – Waste types by sectors (aggregated industries and households)

Supply table is based on the waste survey data. It is the total waste generated by types of waste and sectors. The process involved for collecting the data in the survey are as follows:

- The selected sampling units were first administered the perception questionnaires;
- Subsequently, the units were provided with the plastic bags to store the waste generated;
- The households were asked to store the waste daily waste generated for a period of one week (seven days) while establishments/units were asked to store two days' waste (since the amount of waste they generate is too large);
- The collection days were agreed with the respondents and their waste is collected based on the agreed schedule;
- The above processes were repeated for each sample area;
- This was followed by weighing waste and recording the weight in the data sheets developed for waste quantification;
- The collected wastes are taken to the waste drop off center and segregated to determine the waste composition by types following the standard procedures as in the guidelines; and
- Finally, the waste is weighed by type and recorded it in the data sheet;

4.2 Use (Treatment/disposal) Table

The Use table is estimated mainly from the disposal practices adopted by different sectors for different types of wastes. The information on disposal practices were obtained from the waste survey. As most of the sectors adopts different methods for different types of wastes. The assumptions are used as follows for different treatment.

4.2.1 Landfill

Includes food wastes and non-recyclable wastes collected by waste companies and total waste taken to drop off centre directly by different sectors. It is calculated based on the total food waste and non-recyclable waste collected by waste companies and the proportion of sectors reporting to take their waste to drop-off centre multiplied by total waste generated by respective sectors.

4.2.2 Environment

Includes all the waste reported to be thrown in pit and open space without any treatment. It is calculated based on the proportion of sectors reporting to dump their waste either in pit or open space multiplied by the total waste generated by respective sectors.

4.2.3 Recycling/reuse

Includes portion of total waste generated and are reported to be recycled or reused by different sectors. It also includes little more than three-fourth of the total recyclable waste collected by waste companies.

4.2.4 Composting

It is estimated based on the proportion of sectors reported to compost their waste multiplied by total waste generated by respective sectors

4.2.5 Export

This category includes all the recyclable waste reported to be sold to scrap dealers by different sectors and the one-fifth of the total recyclable waste collected by waste companies.

4.2.6 Burn

It is estimated based on the proportion of sectors reporting burn their waste multiplied by total waste generated by respective sectors.

4.2.7 Other Treatments

It includes medical waste where different treatment methods such as autoclave, incineration, etc are used and also the sectors using other forms of waste disposal practices than the one mentioned above.

5 Final physical supply and use tables for waste

The national accounts Supply and Use approach is used to organize the data. In the Supply Table, the amounts of different types of waste are presented for each economic activity. Since it was not possible to develop detailed industry categories according to the standard ISIC classification the more aggregated categories used in the waste survey are presented.

Because there was no detailed data from the waste survey that allowed for tracking the treatment of the different waste types for each economic sector, the final use table showing the final waste treatment/disposal by economic sector was developed using estimation methods.

A Supply and Use Table system has certain characteristics which allow for double checking the values entered. For the SUT system developed, the totals of the columns in the Supply Table are equal to the totals of the columns in the Use Table. For example, the total waste for Households by waste type in the supply table (81 500.5 kg/day) is the same as the total waste for Households by type of treatment (81 500.5 kg/day). Also the grand total of the Supply table is equal to the grand total of the Use table (172 141.2 kg/day).

Supply of waste (Tonnes/year)

Category	Households	Commercial	Industries	Health Centres	Institutes	Gov. offices	Vegetable Markets	TOTALS	Percent Total
Food Waste	14745.9	8720.4	480.1	239	750.3	427.2	1591.3	**26954.3**	**42.9**
Plastics	5931.7	4347.9	281.2	195.6	419.5	238.8	168.9	**11583.5**	**18.4**
Paper and Cardboard	3070	3144.2	818.9	180	477.4	271.8	281.4	**8243.7**	**13.1**
Glass	1270.2	2824.9	97.1	19.8	41.4	23.5	3.6	**4280.6**	**6.8**
Sanitary Waste	1731.3	761.5	1.3	29.9	41.8	24.4	58.1	**2648.2**	**4.2**
Metals	666.3	1916	88.7	6.1	42.2	24.6	0	**2744**	**4.4**
Textiles	785.3	687.8	19.5	19.6	64.6	37.7	0.6	**1615.2**	**2.6**
Wood	130.9	884.3	58.2	1.9	37.4	21.6	16.7	**1151.1**	**1.8**
Rubber	719.9	294.8	170.6	15.9	23.6	13.3	0	**1238**	**2**
E-Waste	252.9	736.9	0	1.9	26.2	14.9	0	**1032.8**	**1.6**
Other	214.2	172	23	10.9	15.4	8.7	63	**507.1**	**0.8**
Green plant materials	229.1	73.7	51.6	1.9	29.1	16.6	67.5	**469.5**	**0.7**
Medical Waste				363.5				**363.5**	**0.6**
Total	**29747.7**	**24564.4**	**2090.2**	**1086**	**1968.8**	**1123.3**	**2251.2**	**62831.5**	
Percent Total	**47.3**	**39.1**	**3.3**	**1.7**	**3.1**	**1.8**	**3.6**		**100.0**

'Use' or Final Treatment and/or Disposal (Tonnes/year)

(tonnes/year)

	Households	Commercial	Industries	Health Centres	Institutes	Gov. offices	Vegetable Markets	Total
Landfill	10124.4	12600.3	482.3	145.7	606.3	346	1572.7	**25877.8**
Environment	7748.9	1255.7	353.8	195.1	570.7	325.6	4.3	**10454**
Recycle/reuse	3509.2	3833	932.5	85.8	133.7	76.3	440.2	**9010.8**
Export	1188	4757.2	0	15.2	44.6	25.4	146.7	**6177.1**
Burn	6182.8	1569.1	0	280.5	456.5	260.5	0	**8749.5**
Compost	894.9	313.5	0	0	0	0	0	**1208.4**
Other treatments	99.5	235.5	321.5	363.5	156.9	89.5	87.3	**1353.9**
TOTAL	**29747.7**	**24564.4**	**2090.2**	**1086**	**1968.8**	**1123.3**	**2251.2**	**62831.5**

6 Analysis and discussion of waste accounts for Bhutan

6.1 Physical waste account

From the waste survey we know the amounts of the various waste types produced by various economic activities. More detailed discussion of the results from supply table to show:

a) Amount of waste generated by the country by category from highest to lowest (Ex: in 2019 total waste generated was 62831.5 tonnes, with food waste accounting for 45.9% followed by plastics, with 17.1% and paper and cardboard at 15.8%. The top 3 made up almost 78.8% of the total waste of the country. Whereas, glass waste at 5.3% and remaining categories are all less than 4%. Meanwhile, the e-waste, other waste and green plants and were least generated at 1.3% ,1.2% and 1.1% respectively.

b) Amount of waste generated by economic sectors (follow analysis above): The survey revealed that the country's total solid waste generation in a year was 62831.5 tonnes. Of total waste generation, almost 50 percent of it comes from households, followed by commercial units at 40 percent. Whereas remaining sectors generates less than 5% and the health center generated least at 1.72%.

From the waste accounts we can also more easily see the types of waste treatment used by each of the economic units. More detailed discussion of the results from table above to show:

a) Waste disposed/treated of total waste generated: around 41% goes to the landfill; about 17% went to the environment ; around 14% each went to recycle/reuse and burn; around 10% were exported and with least share of 2% each were compost and other treatment category as given in figure below.

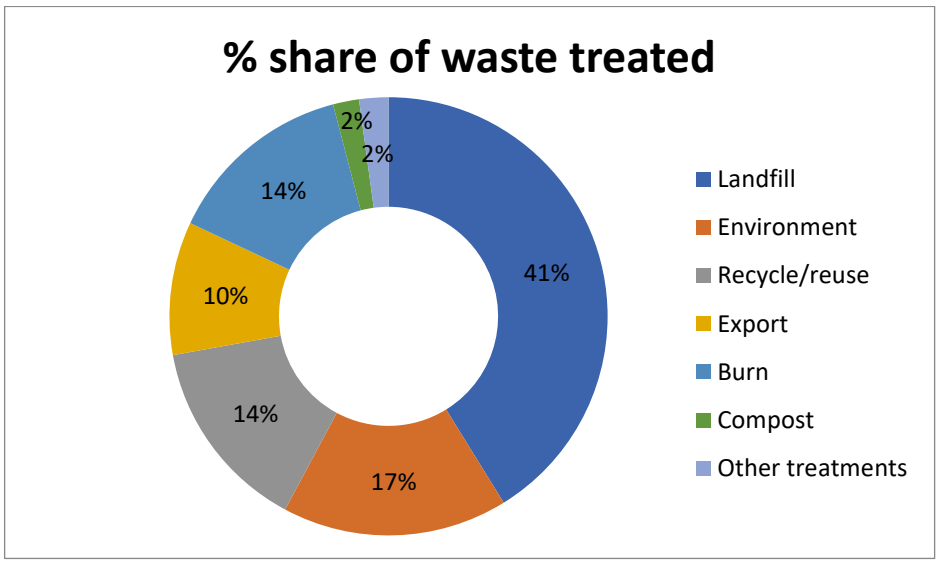

Figure 1: Percentage share of waste treated under different treatment methods

b) Waste disposed/treated by economic sectors: Waste generated by household were mostly disposed to landfill; etc. For the commercial sector, most of the waste goes to the landfill and recycling, etc. for

industries, most of the waste were recycle/reuse; etc. whereas for remaining sectors most waste goes to landfill.

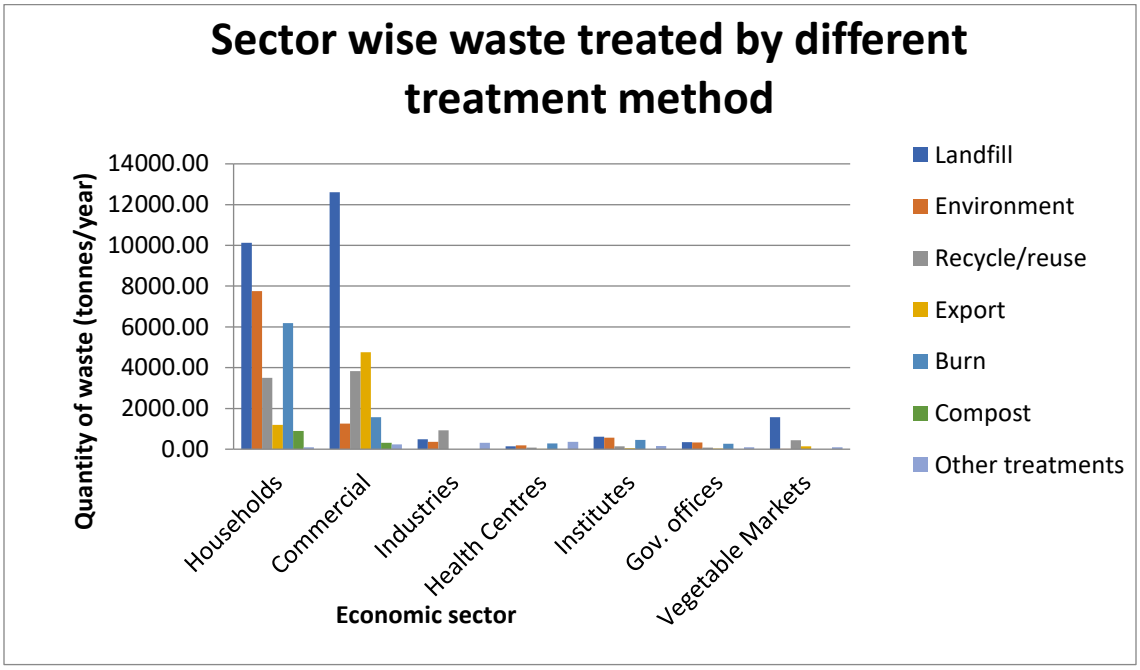

Figure2: Waste disposal/treatment method by different sectors 2019

And from the 'use' table we can see that households and commercial have the most waste that goes untreated to the environment or is burned. Food waste from households and commercial activities are also major sources of landfilled and dumped waste.

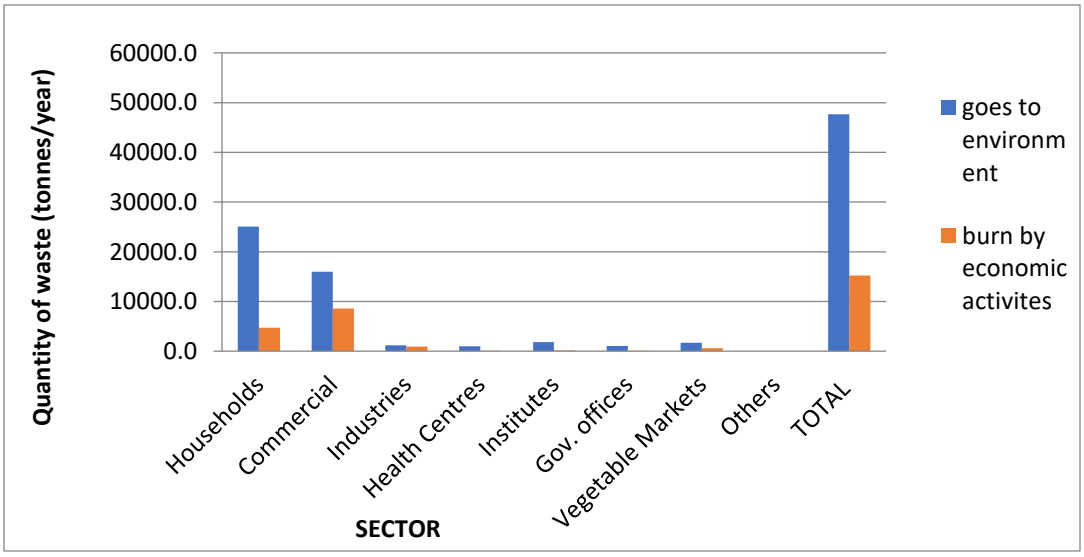

Figure 3: Waste dumped in open space/pit and burned by sectors 2019

As shown in figure 3 above, most of the waste that is either going back to the environment (legal or illegal dumping) or burned is from households and commercial sectors. This is not surprising since almost 90 percent of the total waste produced comes from these two sectors.

6.2 Economic waste accounts

A supply and use table showing the supply of waste services in the supply table, and the purchase of those services as intermediate consumption for industries, and as final consumption for households and government can be a useful way to identify which sectors of the economy are using waste services. From Chapter 7 in the Annual Environmental Account-2020' report (NSB, 2020 AEA) some of the costs related to ISIC 38 Waste collection, treatment and disposal activities have been identified. At this time, there are no data relating to the purchases of these services available for entering in the Use Table. But the following SUT example can be used when data become available. Rows can be added for more details in ISIC 38, and specifically ISIC 38.3 Materials Recovery which covers recycling could be of interest. The household budget survey can be used to obtain expenditures on waste collection services and other expenditures related to waste such as waste bins. Business surveys can ask about expenditures for waste collection and treatment.

Table 3. Monetary Supply and Use Table for Waste collection, treatment and disposal

				Industries				Rest of World	Taxes less subsidies	Actual Final Consumption		TOTAL
Nu. Million BTN	Commercial	Industries	Health Centres	Institutes	Govt. offices	Vegetable Markets	ISIC 38 Waste collection, treatment & disposal activities			House-holds	Govt.	
Supply Collection and Treatment services							53.61					
Intermediate consumption and final use Collection and Treatment services	a	a	a	a	a	a				a	a	

a = purchases of waste collection and treatment services by the different economic entities.

7 Challenges encountered, lessons learned and next steps

7.1 Challenges encountered

With the restriction in movement because of pandemic, visiting the waste management companies physically to collect on information on waste treatment was not possible. There was also no complete information on the list of waste handlers since most are operating informally. It was challenging to get a complete data since the accounting was carried out mainly based on some vague assumptions.

7.2 Lessons learned

Multi-purpose data systems serving user needs – plan for more than one use of the data BEFORE the survey plans are made. Needed larger sample to be able to present results in ISIC groupings rather than the non-standard groupings of the waste survey.

7.3 Next steps

Since Bhutan's 12th Five-Year Plan (2019-2023) defines a number of national level indicators data to help monitor the development towards these goals are needed. One indicator was defined as the absolute amount of solid waste (in tonnes) that is recycled. The waste survey did not produce figures for this indicator. In this project, the recycling amounts were estimated for the different sectors by using the amounts of waste collected and then the recycling rate (1/3) of the waste collectors. As the recycling options improve in Bhutan, additional data would need to be collected if there are collection centers for recycling certain fractions that are separated at the source and kept separate from the mixed waste to allow for easier recycling and cleaner fractions.

In the future, it will be important to keep up with the changes in the waste collection, waste handling, and recycling efforts to be sure that changes in these systems will be captured by the how the waste data is collected.

8 Dissemination of Results:

a) To be published in Annual Environmental Accounts report-2021; b) To be uploaded on office Website

The results of the waste account should provide basis to measure the performance of the waste management program and provide recommendations for improvement.

9 Plans for future compilation:

Bhutan is looking forward to conduct more comprehensive waste surveys in the future to address the data requirements and data gaps in the waste accounts earlier compiled. Particularly, in next round of waste survey in addition to what has been compiled in first waste survey, the quantity of waste treated under different treatment groups by ISIC will be pursued in consultation with waste management companies.

10 Acknowledgements

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11 Abbreviations

ISIC	International Standard Industrial Classification of all Economic Activities
SEEA-CF	System of Environmental-Economic Accounting 2012—Central Framework
UNESCAP	United Nations Economic and Social Commission for Asia and the Pacific

12 References and resources

Bhutan's waste survey report:
Nation's Waste on the Scale: National waste inventory survey (NWIS-2019) Bhutan (2019): National Statistics Bureau of Bhutan
http://www.nsb.gov.bt/publication/download.php?id=1568

Bhutan's 'Annual Environmental Accounts'
Annual environmental accounts: AEA-2020: National Statistics Bureau of Bhutan

SEEA-CF:
United Nations, European Union, Food and Agriculture Organization of the United Nations, International Monetary Fund, Organization for Economic Co-operation and Development, The World Bank, (2014): System of Environmental-Economic Accounting 2012—Central Framework. New York: United Nations. (Various language translations available here: https://seea.un.org/content/seea-central-framework)

SEEA Technical Notes: Water Accounting – version 27 October 2017
United Nations Statistical Division, (2017):
https://seea.un.org/sites/seea.un.org/files/water_note_final_27-10-17_clean_0.pdf

ISIC Manual:
United Nations (2008): International Standard Industrial Classification of all Economic Activities (ISIC), Rev. 4. Statistical Papers, Series M, No. 4/Rev. 4.
https://unstats.un.org/unsd/classifications/Econ/Download/In%20Text/ISIC_Rev_4_publication_English.pdf

Annex 1:
Excel file on customized SUT developed by Julie Hass for Bhutan's waste account

Annex 2: SUT tables on a per day basis

Table 1: Supply Table

(kg/day)

Categories	Households	Commercial	Industries	Health Centres	Institutes	Gov. offices	Vegetable Markets	**Total**
Food Waste	40399.8	23891.4	1315.4	654.8	2055.7	1170.4	4359.9	**73847.4**
Plastics	16251.2	11912	770.4	535.8	1149.2	654.3	462.6	**31735.6**
Paper and Cardboard	8410.9	8614.4	2243.7	493.1	1307.8	744.7	771.1	**22585.6**
Glass	3480.1	7739.5	265.9	54.4	113.3	64.5	9.9	**11727.5**
Sanitary Waste	4743.3	2086.3	3.4	82	114.4	66.8	159.1	**7255.3**
Metals	1825.6	5249.4	243.1	16.7	115.5	67.4	0	**7517.7**
Textiles	2151.6	1884.4	53.5	53.8	177	103.3	1.7	**4425.3**
Wood	358.6	2422.8	159.6	5.2	102.5	59.3	45.6	**3153.6**
Rubber	1972.3	807.6	467.3	43.4	64.7	36.6	0	**3391.9**
E-Waste	692.8	2019	0	5.3	71.8	40.9	0	**2829.6**
Other	586.8	471.1	62.9	29.8	42.1	24	172.7	**1389.3**
Green plant materials	627.6	201.9	141.3	5.2	79.9	45.5	185.1	**1286.3**
Medical Waste				996				**996**
Total	**81500.5**	**67299.7**	**5726.5**	**2975.3**	**5393.9**	**3077.7**	**6167.7**	**172141.2**

Table2: Use or 'final treatment' Table

(kg/day)

Treatments	Households	Commercial	Industries	Health Centres	Institutes	Gov. offices	Vegetable Markets	**Total**
Landfill	27738.2	34521.4	1321.4	399.3	1661.2	947.9	4308.8	**70898.2**
Environment	21229.7	3440.2	969.2	534.6	1563.4	892.1	11.7	**28641**
Recycle/reuse	9614.2	10501.5	2554.9	235	366.4	209.1	1206.1	**24687.1**
Export	3254.7	13033.4	0	41.7	122.1	69.7	401.8	**16923.5**
Burn	16939.3	4299	0	768.6	1250.8	713.7	0	**23971.3**
Compost	2451.9	858.8	0	0	0	0	0	**3310.7**
Other treatments	272.5	645.3	880.9	996	429.9	245.3	239.3	**3709.3**
TOTAL	**81500.5**	**67299.7**	**5726.5**	**2975.3**	**5393.9**	**3077.7**	**6167.7**	**172141.2**