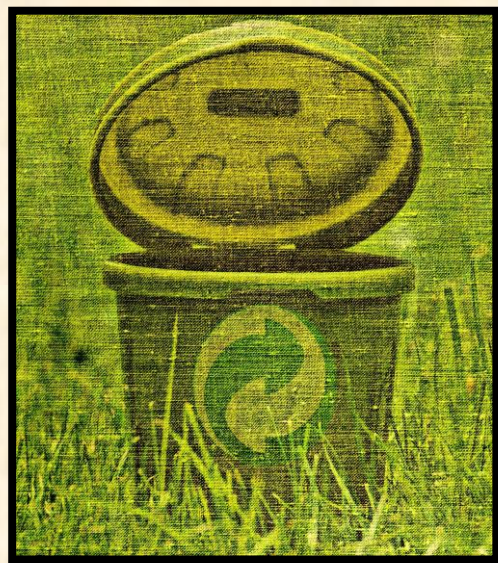


SOLID WASTE ACCOUNTS



Chapter 3

Solid Waste Accounts

“Waste isn’t waste until we waste it.”

- Will. I. Am

Introduction

3.1 India, the second most populous country has showcased its advancement in all sectors of life, after independence. India is at its fastest phase of economic development, marching from ‘developing’ to ‘developed’. Many economic developments on social welfare, health, infrastructure, technology etc. take natural input for its processing and leaves residual to the environment. While looking at the progress in economic indicators, the country can’t ignore some of the glaring issues which pop up due to the residuals leaving behind as process of economic development.

3.2 The rapid urbanization and expansion of economic activity in the country has increased both consumption and imports and as a consequence is placing significant pressure on the management of all forms of residuals in India. These residuals are normally disposed in open dumps creating nuisance and environmental degradation which cause a major risk to public health and the environment. The long-term environmental strategy of the country, based on principles of sustainable development, may not be feasible to achieve without considering the problems of planning and resolving inadequate waste management. The importance of planning in municipal waste management is reflected in the fact that the management plans have to integrate the most appropriate option for the environment, considering economic, technical, social and environmental factors. Analysis of different waste management options allows decision makers to use different instruments to consider more acceptable options and make decisions about the optimal option to satisfy their specific needs. The basis for initiating the decision-making process depend upon waste generation and waste composition data (qualitative & quantitative) in a given territory within a certain time.

3.3 Champions of the Earth, the UN’s highest environmental honour, celebrates outstanding figures from the public and private sectors and from civil society whose actions have had a transformative positive impact on the environment, and was awarded to Hon’ble Prime Minister Shri Narendra Modi, in the year 2018. Recently India has taken another step for the fulfilment of its commitment to the protection of environment by banning single-use plastics in India with effect from July 2022. In order to monitor the progress made on the commitment, it is necessary to consolidate the information / statistics related to waste in terms of generation, treatment, recycle and reusable and also 4Rs principle (Reducing, reusing, recycling and recovering) to generate the waste accounts and indicators. The preparation of waste accounts and indicators are useful in

organizing information on the generation of waste and the management of flows of waste to recycling facilities, to controlled landfills or directly to the environment. Measures of the amount of waste in aggregate or of quantities of specific waste materials may be important indicator for assessing the environmental pressure and create demands for the policy marketers to take corrective measures for protective nature on sustainable basis.

3.4 As a beginning, NSO started with Solid Waste Accounts leaving apart effluents and air emissions, which are other two components of Residual Accounts. Central Pollution Control Board (CPCB), the nodal agency for developing standard and keeping a watch of residuals and its treatment, collects data related to all the three, ie. solid waste, effluents and air emissions.

Solid Waste Accounts Framework

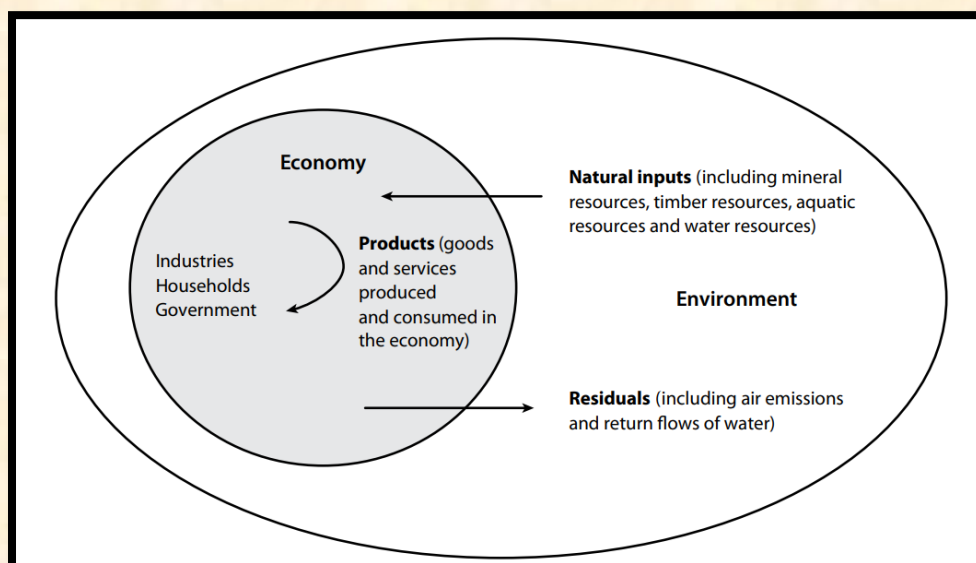
3.5 Solid waste accounts are useful in organising information on the generation of solid waste and the management of flows of solid waste to recycling facilities, to controlled landfills or directly to the environment. Measures of the amount of waste in aggregate or of quantities of specific waste materials may be important indicators of environmental pressure. The construction of solid waste accounts allows these indicators to be placed in a broader context with economic data in both physical and monetary terms.

3.6 Solid waste covers discarded materials that are no longer required by the owner or user. Where the unit discarding the materials receives no payment for the materials then the flow is considered a residual flow of solid waste. Where the unit discarding the materials receives a payment but the actual residual value of the material is small, for example in the case of scrap metal sold to a recycling firm, this flow is considered a product flow of solid waste. Discarded materials sold as second-hand products; for example the sale of a second-hand car or furniture will be treated as flows of products and will not be treated as solid waste. In the determination of whether a material is a second-hand product, consideration may be given of the extent to which the receiving unit can use the product again for the same purpose for which it was conceived. In practice, in many countries, statistics on solid waste is based on legal and administrative lists of materials determined to be solid waste. However, the principles above provide a basis for the measurement of solid waste in countries where legal or administrative processes concerning waste do not exist or are limited in scope.

3.7 “Physical flow Accounts” of System of Environmental Economic Accounting (SEEA) explains in detail the recording of different physical flows—Natural inputs, Products and Residuals and are placed within the structure of a physical supply and use table (PSUT).

3.8 The flows from the environment to the economy are recorded as natural inputs (e.g, flows of minerals, timber, fish and water), flows within the economy are recorded as product flows (including additions to the stock of fixed assets) and flows from the

economy to the environment are recorded as residuals. The following diagram shows the relationship between inputs, products and residuals within the environment.



3.9 The Central Framework organizes and integrates the information on the various stocks and flows of the economy and the environment in a series of tables and accounts: (a) supply and use tables in physical and monetary terms showing flows of natural inputs, products and residuals; (b) asset accounts for individual environmental assets in physical and monetary terms showing the stock of environmental assets at the beginning and the end of each accounting period and the changes in the stock; (c) a sequence of economic accounts highlighting depletion-adjusted economic aggregates; and (d) functional accounts recording transactions and other information about economic activities undertaken for environmental purposes. The analysis of these data can also be extended by linking the tables and accounts to relevant employment, demographic and social information.

3.10 In Physical supply and use tables (PSUT), physical flows are recorded by compiling supply and use tables in physical units of measurement. These tables, which are commonly known as physical supply and use tables (PSUT), are used to assess how an economy supplies and uses energy, water and materials, as well as to examine changes in production and consumption patterns over time. In combination with data from monetary supply and use tables, changes in productivity and intensity in the use of natural inputs and the release of residuals can be examined. The PSUT structure is based on the monetary supply and use tables described above with extensions to incorporate a column for the environment, and rows for natural inputs and residuals.

3.11 Residuals are flows of solid, liquid and gaseous materials, and energy, that are discarded, discharged or emitted to the environment (e.g., emission to air) by establishments and households through processes of production, consumption or accumulation but may also flow within the economy, as is the case when, for example, solid waste is collected as part of a waste collection scheme. The basic form of Physical

supply and use table for solid waste accounts is given in the Figure 3.1 and Figure 3.2 below:

Physical Supply Table for Solid Waste										
	Generation of Solid Waste							Rest of the world	Flows From the environment	Total supply
	Waste collection,treatment and disposal industry					other industries	Households			
	Landfill	Incineration		Recycling and reuse	Other treatment					
		Total	Of which: incineration to generate energy							
Generation of Solid Waste Residuals										
Waste 1										
Waste 2										
Waste 3										
.....										
.....										
Other Waste										
Generation of Solid Waste Products										
Waste 1										
Waste 2										
Waste 3										
.....										
.....										
Other Waste										

Dark Grey cells are null by definition

Figure 3.1: Basic form of Supply Table for Solid Waste Accounts

Physical Use Table for Solid Waste										
	Intermediate Consumption, collection of residuals						Final Consumption	Rest of the world	Flows to the Environment	Total supply
	Waste collection,treatment and disposal industry					other industries				
	Landfill	Incineration		Recycling and reuse	Other treatment					
		Total	Of which: incineration to generate energy							
Collection and disposal of solid waste residuals										
Waste 1										
Waste 2										
Waste 3										
.....										
.....										
Other Waste										
Use of Solid Waste Products										
Waste 1										
Waste 2										
Waste 3										
.....										
.....										
Other Waste										

Dark Grey cells are null by definition

Figure 3.2: Basic form of Use Table for Solid Waste Accounts

3.12 The first table is the physical supply table and the second table is the physical use table. The first part of the supply table, "Generation of solid waste residuals", shows the generation of solid waste by industries and households. It also shows the supply of solid waste from the rest of the world (recorded as imports) and also solid waste recovered

from the environment (for example, oil recovered following an off-shore oil spill, debris collected following a natural disaster, or the excavation of soil from locations at which hazardous chemicals were used).

3.13 Similarly, the first part of the use table, “Collection and disposal of solid waste residuals”, shows the collection and disposal of solid waste by various activities within the waste collection, treatment and disposal industry and by related activities in other industries. It also shows the flow of solid waste to the rest of the world as exports and the flow of solid waste direct to the environment. The columns of the table highlight the various activities of the waste collection, treatment and disposal industry. These are landfill operation, incineration of solid waste (of which incineration of solid waste to produce energy is separately identified), recycling and reuse activities, and other treatment of solid waste. More industry detail can be provided depending on analytical requirements and available information. It is noted that the accumulation of waste in landfill sites is not presented in a distinct accumulation column as in the general PSUT. This is done such that all information on the waste collection, treatment and disposal industry can be presented as a single group.

3.14 In the second part of the supply and use table, which talks about “Generation of solid waste products” and “Use of solid waste products” respectively, the flows of solid waste that are products rather than residuals are recorded, following the distinction described above. The flows recorded here relate to cases when a solid waste product is identified at the time of disposal by the discarding unit. The flow is recorded in the second part of the supply table matched by a use of solid waste products in the second part of the use table. Sales of scrap metal would be recorded in this way. Sales of products manufactured from solid waste, or simply obtained from waste collection, should not be included. For example, paper discarded by households that is collected by a charitable organisation and subsequently sold in bulk to a paper recycling firm, is only recorded in the solid waste account in respect of the initial flow of solid waste from households to the charitable organisation.

Solid Waste Accouts in India

3.15 In India, Solid Wastes are classified in to 6 components by Law namely (i) Municipal Solid Waste (ii) Hazardous Waste (iii) E-waste (iv) Bio-medical Waste (v) Plastic Waste and (vi) Construction and Demolition Waste. Due to non-availability of adequate data in the form in which it is required, NSO India prepared the PSUT of Delhi, the national Union capital territory of India on an experimental basis. Delhi has 5 Urban Local Bodies (ULB) and data was collected from Delhi Pollution Control Committee (DPCC) for the year 2020-2021. The basic deviation from SEEA-CF in preparation of PSUT for Delhi is on “products”. As per SEEA if any residual fetches any value while discarding an item, it will no longer be treated as ‘waste’ but will be treated as ‘product’ in the PSUT which cannot be followed in the Indian case as data on many items like batteries, e-waste, plastic waste etc has been given by the recycler who obtains these items by making nominal payments or at free of cost and no such segregated data is available.

3.16 It may also be noted that the data pertaining to different types of wastes are obtained by the authorised collectors of the same and so there may be an overlapping of data pertaining to a particular type of waste. For example, the data on plastic waste generated is obtained mainly from recyclers, which they might have received from ragpickers or segregators who did it from Municipal Solid Waste. Since no such segregated information is available, the data is placed as itself under the assumption that the volume of such waste may be negligible.

Municipal Solid Waste (MSW)

3.17 Municipal solid waste includes garbage (highly decomposable objects, such as food), trash (bulky items, such as tree branches or old appliances), and rubbish (slowly decomposable items, such as paper, glass, or metal objects) and plastic items. In accordance with the Provision 24 (4) of the Solid Wastes Management Rules, 2016, the Central Pollution Control Board (CPCB) is preparing a Consolidated Annual Report (CAR) based on the annual report submitted by SPCBs/PCCs in compliance of Solid Waste Management Rules, 2016.

3.18 Since data on waste generated disaggregated by households and other sources was not available with the municipal bodies of Delhi, NSO requested one of the municipal bodies to collect waste data disaggregated by sources for 15 days. It was found that about 85% of MSW is generated by households and only 15% are contributed by others. This ratio was applied on the total generation of MSW for the year 2020-2021 to get the figures under these two categories. The data was available in Tons Per Day (TPD), which was converted to Tons per annum as a common unit for all the solid wastes. The State level aggregated figures provide data on “land fill” and “processed” and further segregation of “processed” is not available.

3.19 In 2020-2021, the 5 ULBs in Delhi generated 10990 TPD (40,11,350 tonnes per annum) of Municipal Solid Waste out of which 5457 TPD (19,91,805 tonnes per annum) is processed/ treated. This is around 49.65% of the total solid waste generated and the rest 50.35 % of the MSW is sent for land filling i.e., 5533 TPD (20,19,545 tonnes). For processing the MSW, Delhi have 19 composters, 1 vermi-composting plant, 13 biogas plants and 3 RDF/Pelletization plants at various places with total capacity of 17,70,990.95 Tonnes per annum. In addition, there are 3 waste to energy plants with a capacity of 4550 TPD (1660750 tonnes per annum) with power generation of 59 MW per annum are also functioning. Further many composting plants are under set up and will be operational in limited time. There are 3 MSW dumpsites in Delhi and continuous monitoring of these dumpsites are in operation. Efforts are carried out to reduce the landfill as much as possible by creating new processing facilities with a total capacity of 7680 TPD (28,03,200 Tonnes per annum). This will be addressing the quantity of MSW sent for land fill and will take care of the future generation also.

Hazardous Waste

3.20 The Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016 (HOWM Rules, 2016) stipulates that the occupier handling hazardous or other wastes and operator of the disposal facility shall submit the annual returns to the concerned State Pollution Control Board/ Pollution Control Committee (SPCB/PCC) by 30th June of every financial year. Based on reports submitted by SPCB/PCC, Central Pollution Control Board prepared a consolidated review report on management of hazardous and other wastes and submit the same to the Ministry of Environment, Forest and Climate Change before 30th December once in every year in accordance with the provisions stipulated under Rule 20 of the HOWM Rules, 2016.

3.21 Only for hazardous waste CPCB has state-wise and district-wise data as per the SEEA-CF (Ref. to Figure 3.1). However, this kind of data is not available for other wastes. Further, in Delhi for which the accounts have been attempted in this publication, treatment or disposal facility is not available.

E-Waste

3.22 In Delhi, at state level, data on total waste collected in KGs is available and no recycling of e-waste is permitted in Delhi. Even though refurbishing and dismantling is permitted, no information on the quantity of waste recycled or exported by the units are available. Delhi PCC has granted permission to two refurbishers, 2 dismantlers and 110 bulk consumers. Of the total e-waste generated in 2020-21, refurbishers have collected 28606 KG (28.6 tonnes) of e-waste, where the bulk consumers collected 581,526.30 KG (581.5 Tonnes)

Bio Medical Waste

3.23 Bio-medical Waste has been regulated under Biomedical Waste Management Rules, 2016 as notified under Environment (Protection) Act, 1986 by the Ministry of Environment Forest & Climate Change. These Rules were first notified in the year 1998 and then revamped in the year 2016 to implement these rules more effectively and to improve the collection, segregation, processing, treatment and disposal of bio-medical wastes in an environmentally sound management thereby, reducing the bio- medical waste generation and its impact on the environment. These Rules has mandate of preparation of Annual Inventory of biomedical waste generation, its collection, treatment and disposal. Under Rule 13, every Occupier and Common Biomedical Waste Treatment Facility Operator is required to prepare annual inventory for biomedical waste management. Further, State Pollution Control Boards and Pollution Control Committees shall compile and submit the Annual Report to Central Pollution Control Board for the preceding year before 31st July of every year. Central Pollution Control Board shall compile, review and analyse the annual data submitted by SPCBs / PCCs and submit the same to Ministry of Environment Forests & Climate Change.

3.24 Much information is available in the annual report of Delhi PCC on bio medical waste as mostly the same is generated from hospitals/clinics or veterinary hospitals. The generation of Bio Medical waste in different category (yellow, Red blue and White) are available and regarding treatment also information on different processes is available. The quantity of waste treated under different methods are reported in different units.

Plastic Waste

3.25 As per rule “17(3)” of Plastic Waste Management Rule, 2016 (as amended) each State Pollution Control Board or Pollution Control Committee (SPCC or PCC) shall prepare and submit the Annual Report to Pollution Control Board on the implementation of these rules by the 31st July of each year. Also, as per provision “17(4)” of PWM Rules, 2016 (as amended), the Central Pollution Control Board shall prepare a consolidated report on use and management of plastic waste and forward it to the Central Government along with its recommendation by 31st August of each year. Information was collected from the returns submitted by 5 ULBs as it is having much disaggregated information. As mentioned earlier, a deviation from the definition of residual in SEEA, the data reported under plastic waste may or may not have fetched some value, but being treated as residual and the accounts are prepared. The data is reported in different units (other than the unit specified in the return) and much information on the “processing part’ is not available. In Delhi, there are total 840 Producers, plastic/ multilayer manufacturing/ recycling units in the UT. Door to Door waste collection system from households is done by Municipal Staff and the collected waste is sent to ‘Waste to Energy’ plants and recycling units. Data on Plastic waste generated as obtained through the returns filed by recyclers to the PCC has been shown separately as Plastic waste in the PSUT. Recyclers might have received the plastic waste from rag pickers. However, a part of this plastic waste is also included in the MSW since waste data of MSW is not disaggregated by type of waste.

Construction and Demolition Waste

3.26 Being one of the metropolitan cities, generation of C&D waste is much higher in comparison to others. The entire waste is getting processed and a considerable portion is re-used. No further information could be obtained from the annual return of C&D waste as required in the SEEA format. However, it is expected that in future such information can be obtained after taking up the matters with the concerned authorities.

Solid Waste Accounts- Delhi

3.27 The supply and use table of solid waste accounts for the year 2020-21 is presented in the **Table 3.1 and Table 3.2** below:

Table 3.1: Physical Supply Table – Solid Waste Account

In tonnes

Sl. No	Items	Households	Industry	Shops/ restaurants	Imports	Others	Total
Generation of Solid Waste Residuals							
1	Municipal Solid Waste	3432817		578533			4011350
2	Bio Medical Waste		11380				11380
3	Hazardous Waste		3239				3239
4	Construction and Demolition Waste		1354749				1354749
5	E Waste		610				610
6	Plastic Waste		546592				546592

Total may not match due to rounding off

Table 3.2: Physical Use Table – Solid Waste Account

In tonnes

Sl. No.	Items	Landfill	Incineration	Recycling & Reuse	To Environment	Exports	Waste to Energy	Others/ Inventory	Total
Collection and Disposal of Solid Waste Residuals									
1	Municipal Solid Waste	2019545		1991805					4011350
2	Bio Medical Waste	244@	3930	3557	389			3261	11380
3	Hazardous Waste*					366		2874	3239
4	Construction and Demolition Waste			1354749					1354749
5	E Waste *								
6	Plastic Waste	202751		135234	87600		121007		546592

*: No treatment and disposal facility available in Delhi.

@: Quantity of ash generated after incineration and sent for landfill is shown under landfill and excluded from incineration.

Total may not match due to rounding off

3.28 It can be observed that more than 99.5 % wastes out of total waste are generated as Municipal solid waste and out of which more than 85% is contributed by households. There is a need to develop such an ecosystem which can reduce the generation of MSW by various methods including awareness, reuse, recycle and encourage decentralised processing (may be at household level or at Resident Welfare Association (RWA) level

etc). From the use table, it can be observed that half of the MSW is used for land filling and half is getting processed. This issue can be addressed by increasing the waste treatment mechanism, segregation of wastes and other innovative methods. Further from the generation and processing of plastic waste, it can be inferred that more than 16 % of the generated waste are not being collected, which means that it has gone to the environment and there by polluting the environment. A PSUT of Solid Waste accounts will help in identifying this kind of issues as it is data driven.

Conclusion

3.29 Waste management is gaining paramount importance as it is a threat to civil society as well as for the environment. Better data will give better information on waste generation which will lead the policy makers to take decisions on RRRR (Reduce, Reuse, Recycle and Recover). As initiated by CPCB, an MIS portal for fetching the information from grassroot level will help to aggregate the information at any level and also to answer questions like who generate, what type and what treatment is being given. This will help in addressing some of the perineal problems in solid waste management and the Solid waste accounts will help in identifying methods to address these problems. A time series accounts on Solid Waste will be helpful in identifying the trend in 'generation & processing' of waste. This will further help in estimating the generation of solid waste in different types which in-turn will be helpful for the policy makers to take empirical decision on the number and capacity of treatment plants to be set up. Innovative methods and latest technology can be embraced to address the challenges which will ultimately lead to reducing the burden on environment and help in the preparation of Global/National level indicator(s) of SDG. However, residual accounts can be prepared only if data is available at the required level. This can be ensured by CPCB while developing the MIS portal for various types of solid wastes. Meantime, the Ministry will continue to make efforts in stabilizing the methodology and reducing the data gaps in consultation with stakeholders.
