Lesson 8

Establishing an effective organic waste collection system

Learning outcomes

- The trainee knows the average daily solid waste amount per person.
- The trainee knows how much of the solid waste produced is of organic origin.
- The trainee explains the forms of solid waste.
- The trainee knows the waste management hierarchy.
- The trainee explains the advantages and disadvantages of the central solid waste management strategy.
- The trainee explains the advantages and disadvantages of the local solid waste management strategy.
- The trainee customizes the management strategy appropriate to the solid waste potential.

Instructions for the trainer

- The trainer shares theoretical knowledge through presentation.

Basic requirements: Computer, projector

8. Establishing an effective organic waste collection system

Huge amounts of solid waste are produced in urban areas. The average solid waste production is 0.6 kg per person per day. A look at the composition of solid waste from cities in low- and middle-income countries shows that readily biodegradable fractions range from 44 percent to 87 percent by weight. Levels of urbanization and modernization have a profound impact on the production and composition of municipal waste; However, some general trends, such as high organic matter content (50-90 percent), offer the opportunity for use through composting processes. The waste stream is not a homogeneous mass, but a combination of different materials (organic material, plastic, metal, textiles, etc.) that can be handled in different ways to maximize recovery. The organic waste fraction remains the largest fraction to be recovered [54].

Some common forms of solid waste are:

Solid waste: domestic and market wastes, food waste including vegetable and fruit peelings, charcoal ash. This also includes waste from institutions and commercial centres.

Horticultural and agricultural waste: garden refuse, leaf litter, cut grass, tree prunings, weeds, animal dung, crop residues, waste from public parks etc. Manure: poultry, pig, cow.

Agro-industrial waste: waste generated by abattoirs, breweries, processing and agro-based industries

Sludge and bio-solid: human faecal matter from septic tanks and treatment Plants.

There are many approaches to waste management (Figure 9). Solid waste is generally managed through landfilling, incineration, and recycling or reuse. But in developing countries, properly designed landfills are uncommon and

the cost of modern incineration is unaffordable. Therefore, the most common method of waste disposal is some form of landfill, which includes variants such as uncontrolled dumping in undefined areas, collection and disposal in unmanaged open dumps, and collection/disposal in controlled landfills. It's common to find trash collectors going door to door or lining community trash cans to collect dry recyclables. However, these collectors are more interested in inorganic recyclable materials such as plastic and glass but not organic waste. Agenda 21, adopted in Rio in 1992, states that environmentally sound waste management should include safer disposal or recovery of waste and changes towards a more sustainable model introducing integrated life cycle management concepts. It introduced a phased approach to waste management in order of environmental priority [54]. The general principle of the waste management hierarchy (Figure 9) consists of the following steps:

- Minimizing waste;
- Maximizing the reuse and recycling of environmentally sensitive wastes.
- Promoting environmentally friendly waste disposal and treatment;
- Expanding the scope of waste service.

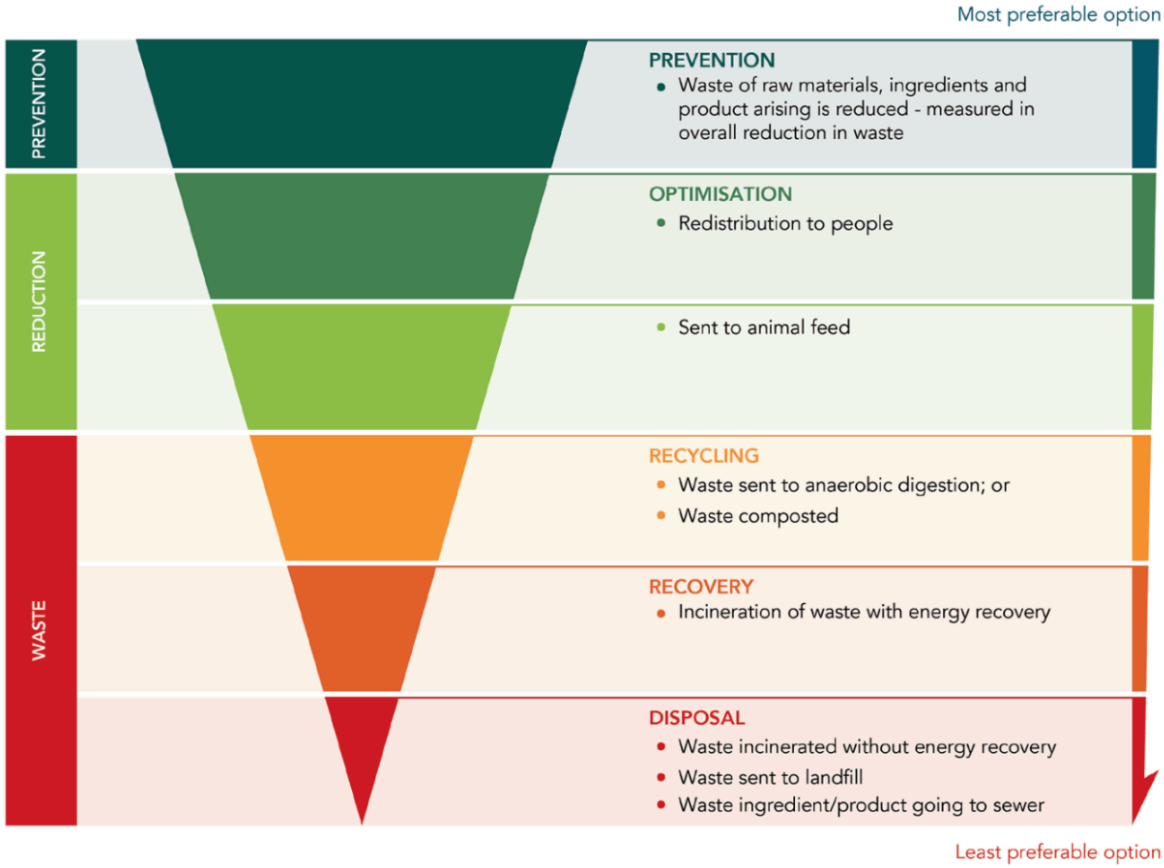

Figure 9. Solid waste management approaches [55]

After Rio, most countries generally accepted this hierarchy as a strategy towards an environmentally sound waste management system. Over the last decade, the concept of Integrated Waste Management (IWM) has evolved and is slowly becoming accepted by decision makers. IWM is based on a range of approaches to waste management, including all aspects of waste management from production to disposal and all stages in between, where technical, cultural, social, economic and environmental factors are taken into account as appropriate. Resource recovery is critical and part of this strategy [54, 56]. Current urban organic waste recycling practices include:

- Use of fresh waste from vegetable markets, restaurants and hotels and food processing industries as feed for urban livestock
- Direct application of solid waste to and from the soil

- Mining of old waste storage areas to be used as fertilizer in agricultural lands
- Application of animal manure such as poultry/pig manure and cow manure
- Direct application of human feces or biological solids to soil
- Organized composting of solid waste or composting solid waste together with animal manure or human excreta.

Whichever method is used, the microbial decomposition process releases beneficial nutrients in organic waste for soil improvement and plant growth. Composting is the process of decomposing or breaking down organic waste materials (by microorganisms such as bacteria, single-celled organisms, fungi, and invertebrates) into a valuable resource called compost. Composting is done in urban areas at different scales (large, medium, small) by various people (municipalities, NGOs, communities, individuals) and for various purposes (gardening, landscaping, farming). In the 1970s, large-scale centralized fertilization came to the fore, especially in the world. However, this has proven unsuccessful. Collecting and transporting organic waste to centrally managed sites is expensive, time consuming and energy intensive; these processes are also dependent on fossil fuel inputs, which are often heavily subsidized to ensure fuel inputs are maintained, thus increasing economic inefficiency at the macro level. Where funding comes from donor agencies, the conditions that accompany such funding often act as a barrier to good practice. In developing countries, technological know-how on financial analysis, engineering design of compost facilities and transportation schedule modeling is very limited. In addition, technological transfers of composting processes and equipment from developed countries were often made in the past without regard to local constraints, and the transferred technologies were often not applicable in the receiving country. Additionally, comprehensively planned composting stations based on supply-demand analysis are not common. In fact, waste management authorities in many developing countries do not have the "luxury" of planning for recycling; Instead, they focus their limited resources on priority needs such as “waste collection” and “safe disposal,” which consume large portions of municipal budgets in low-income countries because their cost recovery is low. The irony is that waste

disposal costs can be reduced through composting if planned well. But what seems like a logical win-win situation for city officials and farmers is rarely the reality in the developing world. This is due to various factors such as lack of affordable equipment, lack of technical personnel, frequent mechanical breakdowns and financial constraints. In the 1990s, small and medium-sized, decentralized composting-based initiatives developed. However, the transition from centralized to decentralized composting approaches is often further complicated by the lack of cross-sectoral planning (waste/planning/agriculture) in waste management. The failure of small-scale decentralized approaches to receive comprehensive government support at the national level has limited the success of studies carried out within this framework.

By far, the better composting options are those that are decentralized and use organic waste as close to the source as possible. Decentralized on-site (for commercial organic waste) and on-site (for domestic organic waste) are the preferred levels of intervention, with each intervention requiring appropriate technology at an appropriate scale. Essentially, the primary function is all about obtaining nutrients. Recycling organic matter from waste to the soil in the most efficient and effective way; hence the prioritization of backyard composting (home) and decentralized (community) approaches. Centralized municipal approaches do not have a good track record and potential economies of scale benefits have not been realized due to operational and marketing constraints.

As a result, the necessity of implementing small and regional scale, limited capacity waste management strategies stands out as the basis for establishing effective waste management systems. Collecting and recycling organic waste by each farm itself or by a cluster (network) of a certain number of farms coming together would be a correct and manageable approach. In urban areas, the establishment of small collection centers (in every street or neighborhood) by municipalities to separate organic waste at source may be a feasible solution (Figure 10 and 11).

Figure 10. City of Burnaby waste collection center [57]

Figure 11. Street-scale applications in organic waste collection [58]

With the mini-compost reactors to be established in these collection centers, the waste can be transformed into the fertilizer needed for the landscaping of that region. Or, the transfer of solid wastes, which shrink in

volume at the end of the composting process, to agricultural enterprises creates less financial burden (Figure 12 and 13).

Figure 12. Organic waste collecting and logistics for composting in city-scale [59]

Figure 13. Compost reactors for different scales (home, street, waste collecting center) [60]