

Training Manual for Promoting Circular Economy Practices in Schools

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About the CGIAR Food Frontiers and Security Program

The CGIAR Food Frontiers and Security Program is a transdisciplinary Science Program focused on catalyzing systemic transformation across three frontier food systems: fragile and conflict-affected settings, urban and peri-urban environments, and small island states. The Program is anchored in four Areas of Work (AoWs), including the Future Food Systems Lab, which synthesizes insights across geographies to drive innovation, resilience, and equity. Its research addresses compounding risks like climate shocks, displacement, and urbanization, working through inclusive partnerships to co-create solutions that are locally grounded and globally relevant.

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Front cover photo: Labeled bins for source-segregation of solid waste in a Ghanaian School (*Photo credit:* Eric Nartey)

Back cover photo: Organic waste composting (*Photo credit:* Freepik)

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Content

Introduction	1
About this Guide	1
How to use this Guide	1
Chapter 1: Theoretical Background	2
Section 1: Introduction to the Concept of Waste	2
Section 2: Introduction to Waste Management	7
Section 3: Public Health and Safety	13
Section 4: Introduction to Linear and Circular Economy of Waste Management	15
Section 5: Implementing circular Bioeconomy in Waste Management	17
Section 6: Circular Bioeconomy Applications: Case Studies and Best Practices	18
Chapter 2: Facilitating the Training	23
Section 1: Integrating RRR into school program	23
Section 2: Training the schools	26
2.1 Preparing for the training	26
2.2 Beginning the training	27
2.2.1 Training opening and introduction of trainers	27
2.3 Ending the training	29
Chapter 3: Training Modules	31
Section 1: Basic Education Program (4 – 15 years)	31
Sub-section 1: Kindergarten (4 – 6 years) + Lower primary school (6 – 8) + Upper primary school practical guides (8 – 12 years)	32
Sub-section 2: Junior high school + (12 – 15 years)	35
Bibliography	41



List of Tables

Table 1. Volumes of the guide	1
Table 2. Examples of good management practices	10
Table 3. Examples of bad management practices	11
Table 4. An example of a session plan	25
Table 5. Theoretical background links to training modules	27

List of Figures

Figure 1. Waste Hierarchy. Source: IWMI	7
Figure 2. Segregating waste into different categories. Source: IWMI	8
Figure 3. Color-coded trash bins for waste segregation. Source: IWMI ..	9
Figure 4. Correct way of throwing garbage	9
Figure 5. Wrong way of throwing garbage. Source: IWMI	9
Figure 6. Wrong way of throwing plastic in color-coded bin	9
Figure 7. Correct way of throwing paper in color-coded bin. Source: IWMI	9
Figure 8. Correct way of throwing plastic in color-coded bin	10
Figure 9. Wrong way of throwing plastic in color-coded bin. Source: IWMI	10
Figure 10. Linear economy of waste. Source: adapted from Wautelet (2018)	15
Figure 11. Circular economy of waste. Source: http://circular-waste.eu/ ..	16
Figure 12. Recovered resources from waste for circular economy. Source: IWMI	17

List of Boxes

Box 1. A scenario in our homes	18
Box 2. Examples of RRR slogans	23
Box 3. Getting started for the schools' program	27
Box 4. Team composition	28
Box 5. Icebreakers, warm-ups and energizers	29
Box 6. Training session evaluation	30



List of Photos

Photo 1. Wastewater from industries	3
Photo 2. Fumes from industries	3
Photo 3. Paper waste.	4
Photo 4. Electronic waste.	4
Photo 5. Food waste.	5
Photo 6. Mixed waste.	5
Photo 7. Cocoa pod husk waste.	6
Photo 8. Animal manure	6
Photo 9. Source segregation of waste	8
Photo 10. Air pollution	13
Photo 11. Water pollution	14
Photo 12. Land pollution	14

List of Acronyms

3R	Reduce Reuse and Recycle
ACARP	Accra Compost and Recycling Plant
BNARI	Biotechnology and Nuclear Agriculture Research Institute
BSF	Black Soldier Fly
CE	Circular Economy
CBE	Circular Bioeconomy
CGIAR	Global Research Partnership for a Food-Secure Future
CHP	Combined Heat and Power Generator
IWMI	International Water Management Institute
JVL	Jekora Ventures Ghana limited
PM	Particulate Matter
PTA	Parents and Teachers Association
RRR	Resource Recovery and Reuse
TAC	Trimark Aquaculture Centre
ToT	Trainer of Trainers
UPA	Urban and Peri-urban Agriculture
VOCs	Volatile Organic Compounds
YKMA	Yilo Krobo Municipal Assembly



Introduction

Waste is being generated by everyone everywhere. Waste comes from our homes, schools, colleges, hospitals, markets, industries, agriculture and commercial places. Waste management is a challenge for many developing countries worldwide including Ghana, because of rapid urbanization and change in consumption patterns and social behavior. In Africa, countries are engulfed with high volumes of waste generation, high costs involved in disposal and management. To address the challenges posed by increasing urbanization on food security and resource usage, circular bioeconomy innovation hubs have been established in Africa and Asia by the CGIAR initiatives on Resilient Cities and Nature Positive solutions.

In Ghana, the innovation hub has created a virtual platform and a network of stakeholders that showcases, enhances, and promotes existing circular bioeconomy innovations while fostering the development of accessible new innovations. For all participating partners see Agbefu et al. (2024). One of the core mandates of the hub is to supply demand-driven capacity building of stakeholders. Under this mandate is the “Resource Recovery and Reuse (RRR) for Schools and Youth Program” (Agbefu and Amoah, 2022). This program is designed to create awareness and influence behavior change among schoolchildren and youths on circular bioeconomy principles through targeted capacity building training and education.

The program aims to introduce RRR (including waste reduction) concepts to schoolchildren and students at both pre-tertiary and tertiary levels, respectively. This is achieved by creating awareness and building the capacity of the children through interactive workshops and practical projects. We hope to instill in the next generation of Ghanaian youth sustainable waste management skills (e.g. source separation, circular economy etc.), which will trigger behavioral changes in schools as the primary target. As a secondary target, the program is expected to prompt and eventually lead to behavioral changes in homes at the communal level.

About this Guide

This guide was developed to help guide the implementation of sustainable waste management and circular economy programs in schools. It was designed to aid teachers, trainer of trainers (TOTs) and practitioners in acquiring the necessary knowledge base and tools in facilitating training of school children in adopting and practicing circular economy principles of waste management in schools. It was designed as an implementation guide for schools in Ghana but can be used in other schools in Africa to promote circular economy. The guide can also be used for the training of members of Parent Teacher Associations (PTAs) and community-based environmental or social clubs or groups. The guide was developed for use by trainers/facilitators who do not necessarily have much background in circular economy but who have been involved with delivering training.

How to use this Guide?

To use this guide, the facilitator(s)/trainer(s) should carefully go through the three main volumes (see Table 1) to obtain the basic background information about the concepts and the various steps specified under the sections to be used during the training.

Table 1. Volumes of the guide

Volume	Content
1	Theoretical background
2	Facilitating the training
3	Training modules or practical guides

Chapter 1: Theoretical Background

This part of the guide should serve as refresher material for the trainers who may have received training in the past on waste management, resource recovery and reuse (RRR) and would like to brush up on their understanding.

This is also useful for trainers who are completely new to the concepts of waste management, to grasp some basic understanding of the topic before training. The sessions under this volume cover the concept of waste, what does waste management mean? how we define linear and circular economy, which waste materials are useful and what can be done to transform them into useful materials.

Section 1: Introduction to the Concept of Waste

1.1 Definition of waste

The concept of waste is broad, and the definition can be very biased. This is so because what is considered a waste to one person may be considered as a valuable material to another person. The general definition for waste is any unwanted and unusable material that is of no use.

1.2 Classification of waste

Waste can either be classified by their state as either solid, liquid, or gaseous. Some examples are:

Solid Waste



Garbage



Plastic waste



Paper waste

Liquid Waste



Industrial liquid waste



Faecal sludge (human waste)

Gaseous Waste



Fumes from vehicle exhaust



Industrial smoke

Sources: Urban Plants (2022), Genesis water Tech (2023), Bigstockphoto.com, iStockphoto.com, <https://legontoday.com/ug-lecturer-tells-students-to-avoid-food-waste-to-secure-rations/>

Waste can also be classified by the material type e.g.: glass, paper, metal, etc. or by waste source e.g.: household, commercial, agricultural, industrial, etc. For the purposes of this guide, emphasis would be placed on solid waste and their classification as biodegradable or non-biodegradable.

1.3 Sources of waste or waste generation

Waste can be generated from various sources. These sources can be broadly classified into four types: Industrial, Commercial, Domestic, and Agricultural.

Industrial waste

This is the waste produced by industrial activity, which includes any material that is rendered useless during a manufacturing process such as that of factories, mills, and mining operations. Types of industrial waste include dirt and gravel, masonry and concrete, scrap metal, oil, solvents, chemicals, scrap lumber, even vegetable matter from restaurants. Industrial waste may be solid, semi-solid or liquid in form. It may be hazardous waste (some types of which are toxic) or non-hazardous waste (Maczulak 2010).



Photo 1: Wastewater from industries (source: <https://www.mirror.co.uk/all-about/peter-simpson>)



Photo 2: Fumes from industries (source: Freepik)

Commercial waste

Commercial waste refers to waste produced by a business on its premises. It includes waste from trade sites, offices, recreation centers, educational premises, and entertainment establishments. Commercial waste is distinct from household, agricultural, or industrial waste. It typically excludes waste generated from households, agricultural operations, or construction activities. Unlike residential waste, commercial waste is not collected by municipalities. As such, it is not to be disposed of alongside domestic waste.



Photo 3: Paper waste (source: Freepik)



Photo 4: Electronic waste (source: Freepik)

Domestic waste

Household waste, or domestic waste, refers to the garbage produced daily by individuals or families from their homes. This encompasses many materials, including food scraps, paper, glass, metals, plastics, and garden waste. Understanding what household waste, the first step towards effective household waste management.



Photo 5: Food waste (source: Freepik)



Photo 6: Mixed waste (source: Freepik)

Agricultural waste

Agricultural waste are plant residues from agriculture. These waste streams originate from arable land and horticulture. Agricultural waste are all parts of crops that are not used for human or animal food. Crop residues consist mainly of stems, branches (in pruning), and leaves. (Mohite et al., 2022). It is estimated that, on average, 80% of the plants of such crops consist of agricultural waste (PaperWise, 2022).



Photo 7: Cocoa pod husk waste (source: Freepik)



Photo 8: Animal manure (source: Freepik)

Section 2: Introduction to Waste Management

2.1 Definition of waste management

In this section, we look at the management of waste particularly about solid wastes.

Waste management refers to the processes involved in handling waste from cradle to grave. This includes the collection, transportation, disposal/recycling and monitoring of waste materials produced because of human activity. Source:

<https://www.recyclingbristol.com/waste-management-everything-you-need-to-know-about-waste-management/>

The way in which waste is managed can have a significant impact on the environment and the entire population's health, so it is vital that measures are in place to effectively manage and dispose of waste. Failure to implement appropriate waste management techniques can lead to environmental concerns and health issues.

2.2 Stages of waste management

The activities associated with the management of waste are:

- Waste generation
- Storage
- Collection
- Transportation
- Processing
- Recycling and disposal in suitable landfill.

2.3 The waste hierarchy

The waste hierarchy is a system used worldwide to manage waste in the most efficient and environmentally friendly way possible. It prioritizes different waste management practices from the most to the least favorable. Its adoption enables us to reduce waste generation, promote recycling and reuse, and reduce the environmental impact of waste.

In developing countries such as Ghana, the waste hierarchy is usually limited to disposal and in some best cases the 3R's of the waste management hierarchy as demonstrated in Figure 1.

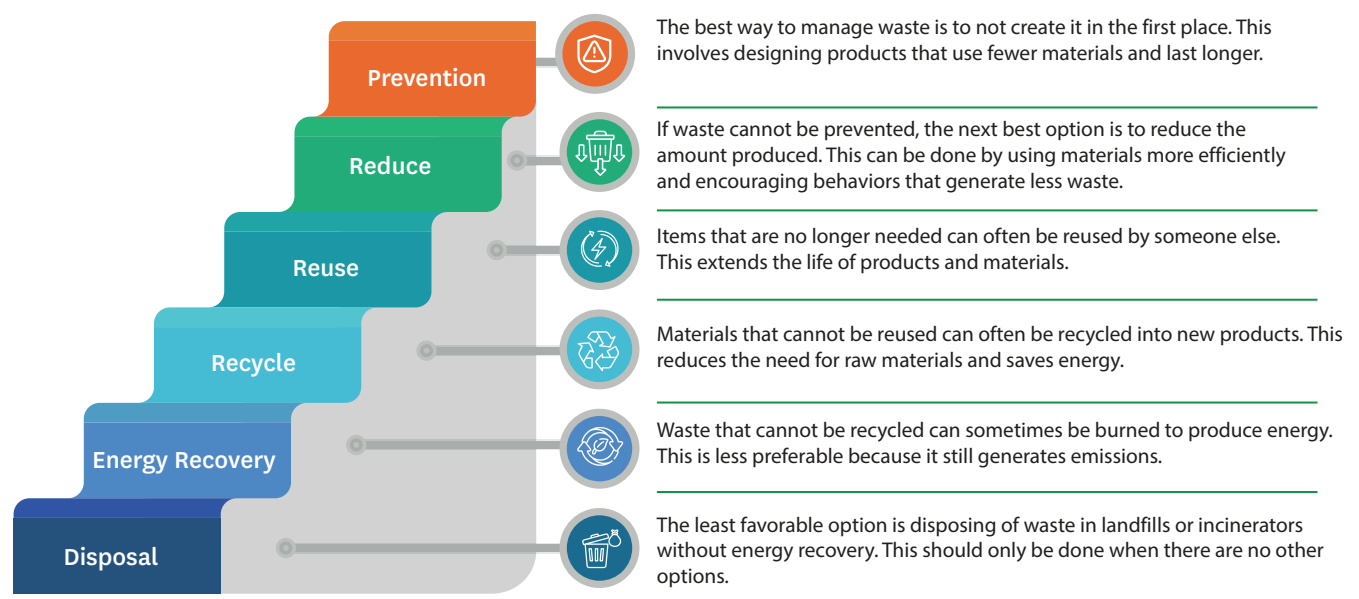


Figure 1. Waste Hierarchy. Source: Klinsman Amissah / IWMI

2.4 Waste segregation and source separation techniques

To be able to effectively manage waste and to recycle waste, the waste must be segregated or sorted out first. What do we mean by waste segregation or waste sorting? Follow the explanation in the following sections:

What is waste segregation?

Waste segregation means sorting waste into different categories as shown in Figure 2 so that it can be processed appropriately. This helps in recycling, composting, and disposing of waste more efficiently.



Figure 2. Segregating waste into different categories. Source: Klinsman Amissah / IWMI

What is source segregation?

Waste segregation means sorting waste into different categories as shown in Figure 2 so that it can be processed appropriately. This helps in recycling, composting, and disposing of waste more efficiently.



Photo 9: Source segregation of waste (source: Freepik)

This is achieved using color-coded or clearly labeled bins as shown in Figure 3. The different colors represent each type of waste material to be trashed in the bin. In Figure 3 for example, paper waste is trashed in the blue bin while organic waste is trashed in the black bin.



Figure 3. Color-coded trash bins for waste segregation. Source: Klinsman Amissah / IWMI

It is important to note that, the colors of the bins are not static and can be assigned to any waste type depending on local conditions or context. Study the following illustrations (Figures 4, 5, 7, 8 and 9) on the correct examples of disposing waste:



Figure 4. Correct way of disposing of garbage. Source: Klinsman Amissah / IWMI



Figure 5. Wrong way of disposing of garbage Source: Klinsman Amissah / IWMI



Figure 6. Wrong way of disposing of plastic in color-coded bin Source: Klinsman Amissah / IWMI



Figure 7. Correct way of disposing of paper in color-coded bin Source: Klinsman Amissah / IWMI



Figure 8. Correct way of disposing of plastic in color-coded bin
Source: Klinsman Amissah / IWMI



Figure 9. Wrong way of disposing of plastic in color-coded bin
Source: Klinsman Amissah / IWMI

Let us do a self-assessment! At home, how many of us segregate our waste? The answer is usually that we do not, or at least most of us do not. As a result, waste from our schools and homes is rarely targeted for recycling and mostly ends up for disposal in landfills.

Thus, the relevance of waste segregation at source cannot be over emphasized. Segregation is essential for effective waste management. It helps to ensure that different types of waste are handled in the best possible way.

2.5 Some examples of good waste management

In this section, we look at some common good practices throughout the stages of waste management in Table 2. Adopting some of or all these practices, if possible, can lead to good waste management practices in our schools or homes.

Table 2. Examples of good waste management practices at each stage of the waste management process.

Stage	Good practices
Waste Generation	✔ Using products with minimal packaging to reduce waste generation. ✔ Choose reusable items such as cloth bags, containers, and water bottles instead of single use materials like plastics. ✔ Donating items that are still in good condition to charities or second-hand stores.
Storage	✔ Storing different types of waste separately. Common categories include organic waste, recyclables (plastics, glass, metals, paper) and others. ✔ Clearly labeling all waste storage bins to prevent mixing of different types of waste ✔ Ensuring all waste bins have secure lids to prevent spillage and to keep pests and animals out. ✔ Regularly cleaning waste storage bins to prevent odors and pest infestations. ✔ Using protective gear, such as gloves and masks, when handling and storing waste.

Collection	✔ Establishing regular timetable that allows for frequent collection to prevent overflow and reduce odors. ✔ Using protective gear, such as gloves and masks, when handling and collecting waste.
Transportation	✔ Training workers on the safe loading and unloading of waste to avoid accidents and ensure that containers are not damaged.
Recycling	✔ Providing clear guidelines on how to separate recyclables from non-recyclables and use color-coded bins for different types of recyclables (e.g., green for glass, blue for paper, yellow for plastics). ✔ Establishing regular and reliable collection schedules for recyclables. ✔ Regularly checking for and removing contaminants that can reduce the quality of recyclable materials.
Disposal in a suitable landfill	✔ Choosing disposal sites away from residential areas, water bodies, and ecologically sensitive zones. ✔ Selecting sites with suitable geological conditions to prevent groundwater contamination. ✔ Conducting frequent inspections to identify and address issues such as leachate leaks or gas emissions. ✔ Composting organic waste to reduce the amount of waste sent to landfills and create useful byproducts.

Source: <https://www.upperinc.com/blog/waste-management-best-practices/>

2.6 Some examples of bad waste management

In this section, we look at some common bad practices throughout the stages of waste management in Table 3. All these practices must be avoided or must be stopped to improve waste management in our schools or homes.

Table 3. Examples of bad waste management practices at each stage of the waste management process.

Stage	Bad practices
Waste Generation	✔ Throwing of waste in unauthorized places, contributing to environmental pollution. ✔ Generating mixed waste without separating recyclables, and organics makes subsequent handling and recycling difficult and inefficient ✔ Over-reliance on disposable items like plastic bags, bottles, and packaging increases waste volume. ✔ Failing to find opportunities to reuse materials and products before discarding them. ✔ Not providing enough waste bins or designated areas for different types of waste, leading to improper disposal.
Storage	✔ Using bins without lids or not properly secured, leading to spillage and access by pests or animals.

	✔ Keeping waste in open areas where it is exposed to weather elements, causing decomposition, leachate, and odor problems. ✔ Overloading storage areas without sufficient space for proper organization and handling. ✔ Not regularly cleaning and maintaining storage areas, leading to accumulation of dirt, spills, and potential contamination. ✔ Storing waste in a way that allows liquids to leach into the ground, contaminating soil and water sources.
Collection	✔ Collection schedules that are not followed or are too infrequent lead to the accumulation of waste, attracting pests and causing odors. ✔ Collectors handling waste without gloves, masks, or other protective equipment, increasing the risk of injury and disease.
Transportation	✔ Waste not properly secured can spill onto roads, causing litter and potentially hazardous conditions. ✔ Failing to follow safety procedures during loading, transport, and unloading can lead to accidents and injuries.
Recycling	✔ Mixing non-recyclable materials with recyclables can contaminate the entire batch, making it unusable and leading to increased waste sent to landfills. ✔ Failing to separate different types of recyclables (e.g., plastics, metals, paper) properly can hinder the recycling process and reduce the quality of recycled products. ✔ Having too few recycling bins or collection points makes it inconvenient for people to recycle, reducing participation rates.
Disposal in a suitable landfill	✔ Disposing of waste in open, unregulated areas leads to environmental pollution, attracting pests and creating health hazards. ✔ Open dumps can produce leachate, a liquid that can contaminate soil and water sources, posing serious health risks. ✔ Burning waste, especially plastics and other hazardous materials, releases toxic pollutants and greenhouse gases into the atmosphere, contributing to air pollution and climate change. ✔ The release of harmful chemicals from burning waste can cause respiratory problems and other health issues in nearby communities. ✔ Failing to recycle or compost materials that could be reused or repurposed increases the volume of waste sent to disposal sites.

Section 3: Public Health and Safety

3.1 Pollution, Health and Safety

An effective solid waste management system is necessary to avoid public health disasters, the spread of disease by insects and vectors and adverse effects on water and air. Proper waste management is also essential to minimize pollution.

Uncollected waste and improper waste management can increase the risk of injury and infections. It can also lead to the breeding of disease causing (vector) organisms such as mosquitos, houseflies etc. Mosquitoes and flies transmit diseases. There is also the public or community nuisance due to foul odor and unsightliness. The environmental effects of improper waste management include air, water and land (soil) pollution.

3.2 Air pollution

Air pollution refers to the presence of harmful substances in the atmosphere like gases, particulates, and biological molecules, that can pose health risks to humans, animals, and the environment. Common air pollutants from improper waste management are smoke (including carbon monoxide, sulfur dioxide, nitrogen oxides), volatile organic compounds (VOCs), and particulate matter (PM).

3.3 Water pollution

Water pollution is the destruction of the water quality that makes it toxic to human and other living things in the environment for use. This is mostly affected by human activities and most often happens because of our improper waste management. Water pollution from improper waste management occurs through leachate from landfills, indiscriminate dumping of garbage in water bodies, industrial discharges, and agricultural runoff.

3.4 Land pollution

Land pollution occurs when waste materials contaminate the land, degrading its quality and posing risks to the environment and human health. Poor waste management practices, such as improper waste disposal, unregulated landfills, industrial waste dumping, excessive use of agricultural chemicals, and unmanaged construction debris, are major contributors to land pollution.



Photo 10: Air pollution (source: Muntaka Chasant)



Photo 11: Water pollution (source: Hamza Ibrahim)



Photo 12: Land pollution (source: Freepik)

Section 4: Introduction to Linear and Circular Economy of Waste Management

4.1 Definitions and practices of linear economy in waste management

The planet does not have "infinite resources", and neither does the planet have "infinite regeneration capacity". What this means is that the planet has a limited amount of natural resources and cannot endlessly recover from damage caused by human activity. Linear economy is a type of system where raw materials, mostly natural resources, are used to make products like plastic buckets or plates and when we do not use them again, they eventually end up as waste and are thrown away.

When it happens like that, products and materials are generally not used to their full potential. In a linear economy and, as the name suggests, always move in one direction – from raw material to waste. This is sometimes referred to as the take-make-waste/dispose economy. In very simple terms, raw materials are collected, transformed into products, used until they are finally discarded as shown in Figure 10.

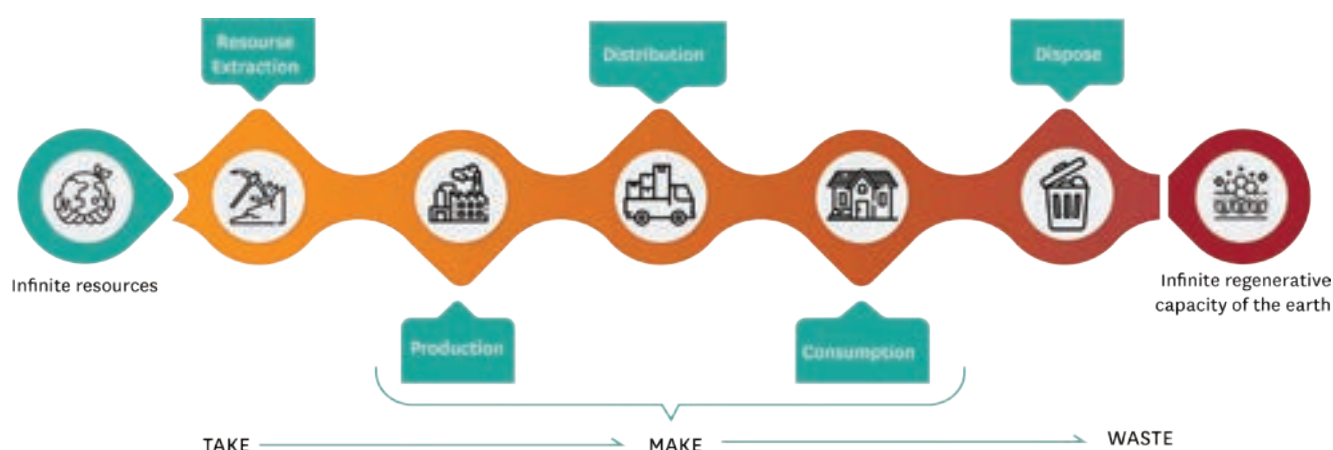


Figure 10. Linear economy of waste. Source: adapted from Wautelet (2018)

Some examples of linear economy of waste management are:

- Paper box (pizza box) used and discarded
- Excess food thrown away.
- Disposable nappies/diapers for babies are used and discarded.

4.2 Definitions and practices of circular economy in waste management

Circular economy is a system where materials never become waste and nature is regenerated. In a circular economy, products and materials are kept in circulation through processes like maintenance, reuse, refurbishment, remanufacture, recycling, and composting (Figure 11).

Circular economy aims to minimize waste and promote a sustainable use of natural resources, through smarter product design, longer use, recycling and more, as well as regenerate nature following the 3R approach of “reduce”, “reuse” and “recycle”.



Figure 11. Circular economy of waste. Source: <http://circular-waste.eu/>

Some examples of circular economy of waste management are:

- To reuse plastic bottles, containers for other purposes
- To recycle paper to produce toilet rolls.
- To give out clothes not worn to others.
- To repair broken electronic gadgets and use instead of throwing them away

4.3 Transitioning from Linear Economy to Circular Economy and Circular Bioeconomy of Waste Management

Currently, humans produce way too much waste. We make products, consume them and then throw them away, littering our planet in the process. This creates a lot of problems like pollution, diseases, and depletion of our planet's natural resources or raw materials. When we want the latest toys or clothes, we tend to throw the old ones away for brand-new ones. In school, when we buy food in Styrofoam packs, we tend to throw it away after eating. The next day we repeat the same thing. This is a wasteful approach also described as the linear economy mentioned above.

We are running out of raw materials or resources to make new things with, and we are also producing too much waste. That is why we need to move to a more circular economy – where everything has value, and nothing is wasted. Applying circular economy to waste that we generate in schools, homes, offices, and restaurants etc. will ensure that some useful resources could be extracted for other beneficial uses.

Some resources that can be recovered from our waste are organics, metal, plastic, glass, paper, and electronic waste (E-waste). These resources can be reused or recycled into other products as shown in Figure 12.

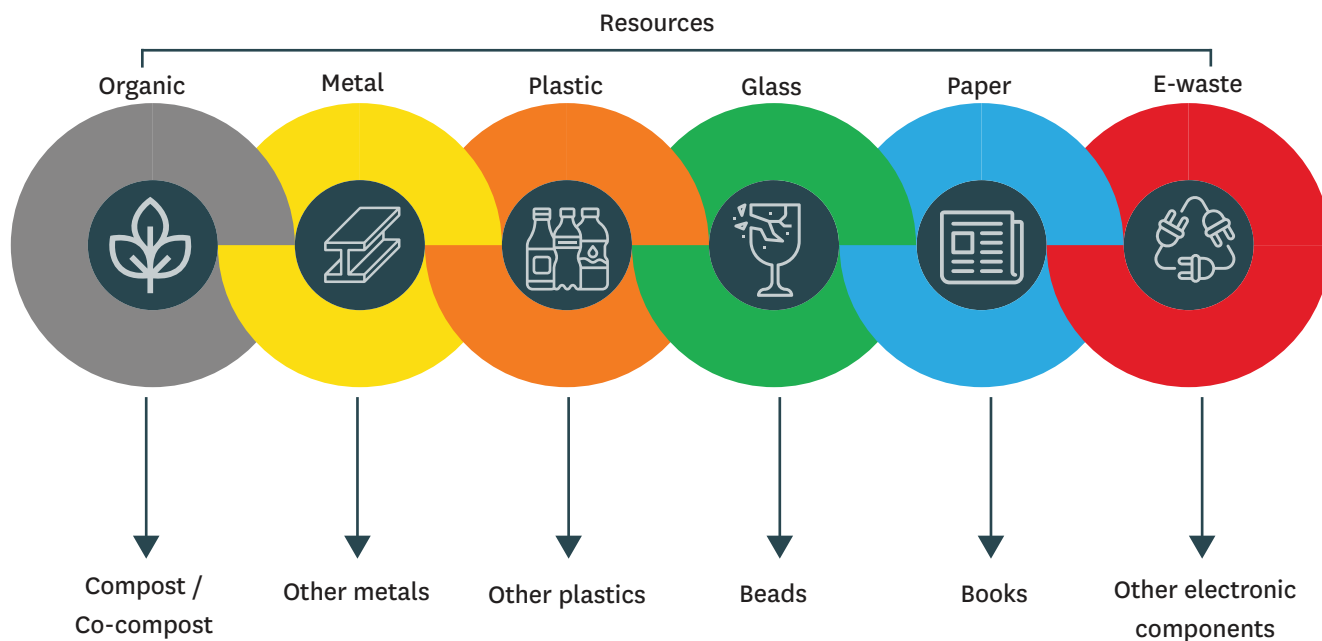


Figure 12. Examples of recovered resources from waste for circular economy. Source: Authors/IWMI

In circular bioeconomy, it emphasizes the use of renewable natural resources and focuses on minimizing waste, replacing the wide range of non-renewable, fossil-based products currently in use. The circular bioeconomy marries two key sustainability concepts. First, it involves using more renewable resources for energy, chemicals, and materials – like products made from plants. Second it works to keep those sustainable materials and products in use longer, instead of throwing them away. Developing products and processes that work with nature can protect biodiversity, create jobs, and put us on a path to sustainability.

An example of circular bioeconomy is:

- Food waste and compostable plant parts are properly diverted to industrial/community composting facilities, they become healthy, valuable soil.

Section 5: Implementing circular Bioeconomy in Waste Management

5.1 Circular bioeconomy approaches: The 3R Approach

In the previous section, we learnt about the linear economy and its impact on sustainable waste management. We also understood the circular economy concept, which aims to minimize waste and make the most of available resources by closing the loop in production and consumption cycles and reducing the use of natural resources. As knowledge keeps advancing, new concepts enhancing environmental sustainability are discovered. In this section, we explore organic waste and its potential in the circular bioeconomy approaches.

Circular bioeconomy is a vital approach to promote economic growth through the sustainable use of biological resources to create products, services, and energy. It integrates the principles of the 3R approach (Reduce, Reuse and Recycle) into the management of resources. This ensures that resources are efficiently used and reused, reducing waste and negative environmental impact. In Ghana, the circular bioeconomy approach is gaining recognition in addressing waste management challenges and promoting sustainability. Some notable efforts are bioenergy production from agricultural waste and organic fertilizer (compost) from organic wastes.

5.2 Importance of Circular Bioeconomy

Resource recovery and reuse are key principles in the circular bioeconomy approaches, aiming to turn waste materials into valuable resources. Resource recovery and reuse has significant environmental and economic impact when adopted in waste management practices.

Box 1 A scenario in our homes

You generate kitchen waste (vegetables, food stuff, fruits and leftover foods) every day. Instead of trashing this waste, you collect it into a composting bin. Over time, the waste decomposes and transforms into rich, nutrient-dense compost. You can then use this compost for your gardens to grow vegetables or ornamentals. By doing this, you have reduced the amount of waste to be disposed of, saved money on fertilizer for gardening, and have more fresh vegetables for preparing meals. It may be a small activity in your home but a significant way to contribute to the circular bioeconomy.

Globally, circular bioeconomy is widely practiced in managing food waste, agricultural residues, and other organic materials. Countries like Germany and the Netherlands have advanced systems for organic waste collection and processing. For instance, in Germany, household organic waste is collected separately and transformed into compost or biogas. This compost is then used to enrich soils, while biogas is used to generate energy, creating a closed-loop system that reduces waste and promotes sustainability.

In Ghana, organic waste recycling is gaining momentum as part of the circular bioeconomy efforts. Organizations such as SafiSana Ghana Limited, ACARP and JVL-YKMA Recycling Plant have been collecting organic waste from households and markets, transforming them into various products. We shall learn about these companies and their operations in Section 6.

Section 6: Circular Bioeconomy Applications: Case Studies and Best Practices

This section showcases some existing examples of organic waste-to-resource value chains operating in different locations in Ghana. These operations are run by mostly private entities on commercial scale. It covers from treated wastewater for aquaculture to organic biomass for fuel briquettes. These can serve or offer practical learning grounds for schoolchildren during organised field trips or excursions.

6.1 Treated wastewater for aquaculture – Trimark Aquaculture Centre (TAC)

This enterprise specializes in treated wastewater-fed aquaculture and greenhouse vegetable production. Its initial success led to expansion, now encompassing aquaculture production methods using concrete tanks, biofloc systems, and re-circulatory aquaculture systems.

Technology in use

Fish production: waste stabilization pond system, biodigesters, concrete tanks.



Photo : Mark Yeboah-Agyapong, TAC

Products

Fish (Broodstock, Fingerlings and table size fish) & Vegetables



Photo : Mark Yeboah-Agyapong, TAC

Location

Kumasi, Ghana.

<https://cbeih.iwmi.org/living-labs/>

6.2 Faecal sludge and food waste treatment for co-compost (organic fertilizer) – JVL-YKMA Recycling Plant

A Public-Private Partnership between Jekora Ventures Limited and the Yilo Krobo Municipal Assembly that recycles source-separated foodwaste from the markets, faecal sludge from public and private toilets to produce compost for food and a cleaner environment.

Technology in Use

Faecal Sludge Treatment: Unplanted sludge drying beds.

Co-compost: Dried faecal sludge and source separated food waste as feedstock. Heap composting system and manual turning is employed for compost production.



Photo : Dzifa Agbefu, IWMI

Products

Compost



6.3 Conversion of organic waste to animal feed using Black Soldier Fly (BSF) – Biotechnology and Nuclear Agriculture Research Institute (BNARI)

The facility integrates various stages of the BSF lifecycle, into waste management to transform organic waste into valuable resources such as protein-rich larvae for animal feed and nutrient-rich compost from Frass, the residue of BSF digestion. This approach minimizes waste, maximizes resource recovery, and contributes to the circularity of the waste management process.

Technology in use

Locally manufactured BSF production facility including, substrates mixer, solar larvae drier, larvarium and double decker adult cages and a composting facility for frass processing.



Photo : Enoch Ofori, BNARI

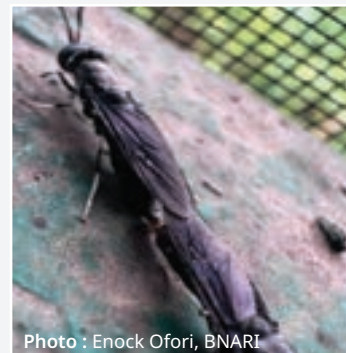


Photo : Enoch Ofori, BNARI

Product

larval meal, defatted larval meal, dried larvae and compost



Photo : Enoch Ofori, BNARI

Location

Kwabanya, Ghana,
<https://cbeih.iwmi.org/living-labs/>

6.4 Recycling faecal sludge and organic waste for renewable energy (biogas) – Safisana Ghana Limited

Safisana designs, builds, and operates recycling plants, that turn faecal and organic waste from vulnerable communities and industries into renewable energy and organic fertilizer. The business model operates as a utility and offers governments and industries a circular and cost-efficient solution for waste treatment that generates long-lasting impact (<https://safisana.org/>).

Technology in use

Compost: Foodwaste windrow composting systems using mechanize turning. Waste-to-Energy: Production of biogas from faecal sludge and other organic waste streams using an anaerobic biodigester & Combined Heat and Power Generator (CHP) for electricity generation. Vegetable and Seedling Production: Greenhouse farming system Unplanted Sludge Drying Beds and Waste Water Stabilization Ponds: Further treatment of digestate from the digester.



Photo : Enoch Ofori, BNARI

Technology in use

Renewable, compost energy (Biogas to Electricity), Vegetable and Seedling Production



Photo : Simon Sakyi, Safisana Ghana Limited

Location

Adjei-Kojo Ashaiman, Ghana,
<https://cbeih.iwmi.org/living-labs/>

6.5 Utilizing organic biomass for fuel briquette – JVL-YKMA Recycling Plant

The plant is a public-private partnership between Jekora Ventures Limited (JVL) and the Yilo Krobo Municipal Assembly (YKMA) that recycles woodwaste and rice husk from the mills to produce non-carbonized briquettes.

Technology in use

Briquette: Utilizing sawdust and rice husk as feedstock, solar drying and a non-binder additive mechanism is employed for briquette production.



Photo : Eric G. Nartey, IWMI

Technology in use

Non-carbonised briquette



Photo : Eric G. Nartey, IWMI

Location

Akorley-Somanya, Ghana
<https://cbeih.iwmi.org/living-labs/>

6.6 Conversion of municipal solid waste into compost and other recyclables – Accra Compost and Recycling Plant (ACARP)

ACARP offers an integrated solution for MSW with a state of the arts material recovery facility. The plant sorts and produces high-quality organic compost for agricultural use, along with recyclable products for local and international markets.

Technology in use

Mechanized MSW sorting facility
Mechanized windrow composting facility
Plastics palletisation system
Material recovery facility
Leachate treatment facility



Photo : ACARP

Technology in use

Compost, Liquid Manure &
Plastic Pellets



Photo : ACARP

Location

Adjen Kotoku, Ghana.
<https://cbeih.iwmi.org/living-labs/>

Chapter 2: Facilitating the Training

This part of the guide outlines how school's resource recovery and reuse initiatives or circular economy program can be implemented and integrated into schools' program. It offers easy to follow steps and suggested activities that can be adapted to different contexts of existing schools. This is useful for trainers or volunteers who are completely new to working with schools or could also serve as supplementary resource for volunteers already working with schools.

Section 1: Integrating RRR into school program

In this section, we are going to learn some practical steps in adopting and practicing resource recovery and reuse (RRR) in schools. The program is not just about teaching students how to sustainably manage waste in schools only but also that students can take the learnings and ideas to their homes. It's about inspiring a generation to see the world differently. In other parts of Africa, results indicate that incentives could support the link between school programs and households. The school could, for instance, initiate competitions between classes and schools regarding the quantity of recyclables students bring to school on a weekly or monthly basis. This would help involve parents and other members of the households in a playful way in the circular discussion.

1.1 What you must do

1.1.1 Assemble a Club

Planning for RRR program in a school would need a club to be formed in the school. This should include primarily students, teachers, school administrators and representatives of other relevant stakeholders depending on the school setup. This is to ensure the success and sustainability of the program. This club is responsible for membership promotion, specific RRR programs implementation, education, mentorship, and schools RRR projects. The clubs should adopt and learn some slogans to guide and remind us of the importance of RRR in schools. See some examples in Box 2.

Box 2 Examples of RRR slogans

1. Waste RRR..... Reduces the amount of waste going into landfills
2. Waste RRR..... Saves energy
3. Waste RRR..... Creates jobs
4. Waste RRR..... Saves natural resources
5. Waste RRR..... Reduces pollution
6. Waste RRR..... Provides raw materials for industries
7. Waste RRR..... Makes a difference

1.1.2 Analyze the waste

Assessing the school's waste stream must be done and preferably by the Club. This is to identify the type, quantity, and/or origin of the potential recyclable materials. This information can assist the Club with formulating the school's RRR goals and logical needs for waste segregation and/or other needed materials.

1.1.3 Identify a RRR project or hauler for segregated waste

It is critical to determine how the segregated materials (e.g., paper, food leftovers etc.) can be recycled and used in the school or how those materials that cannot be used within the school will be removed from the school. The following steps must be taken before a successful RRR program can begin.

The first is to identify which material can be recycled and used within the school like for example, composting leftover food and other organic wastes into compost which can be used to grow lawns and ornamental plants in and around the school.

The second is to look for local collectors and processors for such segregated materials in the school's district who may collect these materials. If there are no local recycling services in the school district, then your school may contact the District Assembly for assistance in locating collectors in the area.

1.1.4 Establish a recycling goal

The Club should collect the waste data from analyzing waste and set a school RRR goal(s) based on the data. Make sure the goal is attainable and start slowly. Make sure the material or materials you identify for recycling can be managed and processed locally.

1.1.5 Organize the waste segregation and collection system

Map the waste collection route or location of traditional waste bins in classrooms, library, cafeteria in the school. Determine the space needed (inside classrooms and on compound) for the branded bins to implement the waste segregation program. This will help the team to determine how many bins to make available and the ideal placement of the bins. Share the map of the proposed waste bin locations with parents, students, teachers, and school administration for feedback.

The Club must plan in conjunction with the School Administration for collection and storage. The following ideas for moving segregated materials can be implemented:

- Assign a student from each classroom to empty the classroom bin as part of a daily routine to the main storage bin.
- The club can assume the responsibility of moving the storage bins for recycling in the school or for the local collectors and processors.

1.1.6 Educate and Promote

The entire school will need information on how and what to recycle from time to time. This can be influenced by weather conditions (seasonality), cafeteria menus etc. Presentations to inform, made at a school assembly or in individual classrooms, should include the following: the locations of the collection and storage bins, the materials that can be recycled, how the system will work and the benefits of RRR.

Remember that in each school year students, teachers, school staff, and parents will need information about the program. Creating a recycling logo, slogan, and/or theme is a creative and unified way to promote the program. This can be done by students each year or during the initial start-up year.

1.1.7 Begin Recycling

If the above steps have been followed, then the RRR program is off to a GREAT start! Do not forget to keep the goal(s) with all the milestones surpassed in a prominent spot in your school to motivate the students, teachers, parents, and staff to achieve the goal. The goal(s), along with the results, is a powerful tool to include in a grant or award application.

1.1.8 Evaluate, Expand and Celebrate the RRR program

If the above steps have been followed, then the RRR program is off to a GREAT start! Do not forget to keep the goal(s) with all the milestones surpassed in a prominent spot in your school to motivate the students, teachers, parents, and staff to achieve the goal. The goal(s), along with the results, is a powerful tool to include in a grant or award application.

Evaluate: Review the RRR program and goal at least once a year. There is always room for improvement. Provide a survey to teachers, students, school staff, and parents for ideas about improving the program (example survey items: container appearance, use, and location; adequate education/promotion; collection frequency, etc.).

Expand: Once the RRR program is operating effectively, the team/club may investigate additional ways to reduce, reuse, and/or recycle. There could be additional “Green” school initiatives such as water conservation, energy conservation, air quality improvements, etc.

Celebrate: Recognition awards should be given to outstanding individuals, class, and/or grade level in the program. In addition, recognition and appreciation should be given to the RRR team/club members. Organize an event or festival to celebrate reaching and/or surpassing the school recycling goal. The school can become a model for others in the country. Lastly, apply for local, regional and/or national awards to recognize your school RRR program.

1.2 Who you should do it with

This RRR in School program cannot achieve success without the full involvement and participation of certain key actors. The first is the schoolchildren in the school. The program must be extended to all the schoolchildren in the school without any form of discrimination or bias. It takes all the schoolchildren to be informed and involved to ensure peer-to-peer policing of the program to achieve success. Teachers are also equally important to the success of the program. Teachers’ involvement and commitment are critical to inspiring the schoolchildren to take the program seriously. The school administration’s commitment to this course is also necessary.

The benefits of the RRR in School program:

- Global sustainability awareness created in school children today for the leaders of tomorrow.
- Help sustain the environment for the future generations.
- Prevent or minimize pollution created by waste generated everyday.
- Save energy in manufacturing, transportation, and disposal of products.
- Decrease greenhouse gas emissions, which contribute to global climate change.
- Conserve natural resources such as timber, water, metals, and fossil fuels.
- Reduce the need for landfilling and incineration, which are expensive to operate and maintain.

Section 2: Training the schools

The facilitators or trainers are responsible for maintaining a comfortable learning environment for schoolchildren. The trainers should therefore be very familiar with this training manual, the materials and activities before each training session so that they feel confident about the content and process.

2.1 Preparing for the training

In preparation, the following questions should be considered and answered to ensure that everything is in order before the start of the training:

- Where is the venue for the training?
- Is the venue suitable for the training?
 - Is the room spacious enough to accommodate the expected number of participants?
 - Is there enough ventilation?
 - Is there enough light in the room?
- Are there any transport arrangements to make?

The second is to look for local collectors and processors for such segregated materials in the school's district who may collect these materials. If there are no local recycling services in the school district, then your school may contact the District Assembly for assistance in locating collectors in the area.

- Have enough resources for the training been arranged for/procured e.g. learning materials, flip charts, stationery?
- Is any additional equipment required?
 - Projector?
 - Public address system?

Refer to Box 3 for some tips on getting started for a school's program.

Activity



Set up learning materials, flip charts, illustrations, projectors, if necessary, in classrooms etc.

Step 1

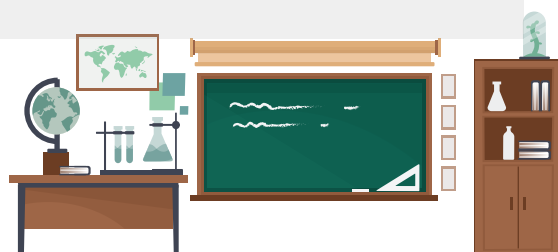
- ☑ Checking the venue (classroom) and possible demonstration site.
- ☑ The training team should inspect the training venue for adequate space to accommodate all trainees for effective contact time.
- ☑ The training team must ensure that sitting arrangements give maximum prominence or visibility to the facilitator during the training session.
- ☑ The team should check for site demonstration of waste types.
- ☑ Solicit the support of school staff to help in interpretation, demonstrations as it may require.

Step 2

- ☑ Checking the knowledge resources and materials
- ☑ The training team should familiarize themselves with the knowledge resource provided.
- ☑ Training team prepares training materials for e.g., flip charts, illustration charts that may be necessary.

Note

- ☑ The steps indicated in Box 1 should be carried out days ahead of the scheduled schools training.
- ☑ It would be good for some demonstration activities involving waste composition analysis.



2.2 Beginning the training

2.2.1 Training opening and introduction of trainers

The training must start with a brief welcome from the host school. In cases where the training is not for the entire school, such as selected classrooms in the school, a brief welcome from the class teacher should be appropriate. This gives the opportunity to drive greater buy in from the school children or students and set the stage for the host school or class to give any additional information or any special arrangements to the training team.

Introduction of trainers

Members of the training team must introduce themselves and briefly tell the school about their background and training, emphasizing their enthusiasm for the opportunity to work with the students. It is ideal for the training team to have the composition described in Box 4.

Box 4 Team composition

Activity

Trainers using this manual for training would play several roles within the team to enhance training outreach:

Expert

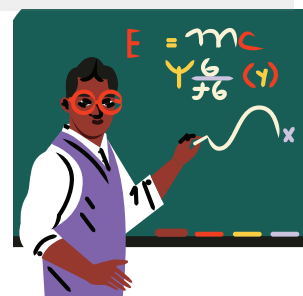
the trainer transmits knowledge and skills, answers questions (or promises to obtain information later) and clarifies misconceptions.

Socializing agent

the trainer strives to share fun facts and examples

Facilitator

the trainer leads the sessions in such a way that the school children are encouraged to participate fully in acquiring the new knowledge and skills being introduced to them.



Purpose of training and Session plan

Make sure that the purpose of the training is clear to the schoolchildren. The training covers different aspects of sustainable waste management and circular economy to be delivered in different sessions. Share the session plan or timetable with the participants. A simple session plan can be as simple as shown in Table 4.

Table 4. An example of a session plan

Session topic:	Making a compost heap
Session time:	30 – 60 minutes per session
Period:	5 – 10 weeks per term/semester
Sequence/frequency:	Once a week

Setting out ground rules

It is important at the beginning of every training workshop to introduce icebreakers and also set out what the ground rules will be. As a form of icebreaking, schoolchildren should suggest and agree on the basic rules that everyone should follow to help the training go smoothly. Ask participants to suggest some basic ground rules. Refer to Box 5 for some tips.

Activity



Introduction to session and setting ground rules

Step 1

- Facilitator warms-up the trainees.
- When the trainer first walks into classroom, trainees may not react favorably. By ‘warming up’ the school children with enjoyable icebreakers or energizers, it helps children relax, be more responsive, and participate more positively.
- Some suggested energizers could be dancing together or singing popular song. Ice breakers could be playing a little game.

Step 2

- Facilitator set out ground rules.
- Set out some ground rules such as, being attentive during the session, be participatory, asking questions after the speaker finishes.
- Additional ground rules could be added based on the local context.

Note

- Use energizers frequently during training session, whenever the children look sleepy or tired or to create a natural break between activities.
- Try to choose games that are appropriate for the local context and encourages team building. Think carefully, for examples games that involve touch, particularly of different body parts.



Training modules and schedules

Refer to Volume 3 on the training modules and

2.3 Ending the training

There should be short evaluations of the training at the end of each session/topic or every day to make sure the trainers are made aware of problems or any suggestions for improvement. Refer to Box 6 for tips on training evaluations.

A more thorough evaluation should be done at the end of entire training program. This can be done through questionnaires or project work.

Activity

Session evaluation

Step 1

- ☑ The facilitator and the socializing agent both conduct an end of session evaluation.
- ☑ The evaluation should be immediately after completion of activity 3.
- ☑ The evaluation is based on the learning objectives for the session. A set of evaluation questions should be asked the trainees. Where trainees can complete forms, the same questions will ask of them.

Step 2

- ☑ Compiling the feedback.
- ☑ Take note of the answers provided by the trainees in the case where they are verbally asked. Take note of the correct and incorrect answers.
- ☑ Where forms are completed, collate the feedback to feed into future decisions.

Note



Chapter 3: Training Modules

This part of the guide details modules that should be used for the training either in the classroom level or at the school club level. The modules are on different topics, and it presents how these modules should be taught. Each module is supported with a resource box which includes video links, graphics, cartoon, handouts and further reading to aid the teacher in the teaching of the modules. These modules are applicable to basic school training only. Table 5 below shows how the theory part (background information) discussed in Volume 1 in this guide relates to the modules discussed in this section.

Table 5. Theoretical background links to training modules

Topics in Volume 1 (Theoretical background)	Linked to Training modules
Introduction to concept of waste	Module on subtopic 1.1 and 1.2 in Sub-section 1 and 2
Introduction to waste management	
Public health & safety	Module on subtopic 1.1 in Sub-section 1
Introduction to linear & circular economy of waste management	Module on subtopic 1.2 in Sub-section 2
Implementing circular bioeconomy in waste management	Module on subtopic 1.3 in Sub-section 2
Circular economy applications	Module on subtopic 1.1 in Sub-section 1 and 2
	Module on subtopic 2.1 – 2.3 in Sub-section 2

Section 1: Basic Education Program (4 – 15 years)

General module time plan

Time:	30 – 60 minutes per subtopic
Period:	5 – 10 weeks per term/semester
Sequence:	Once a week

Sub-section 1: Kindergarten (4 – 6 years) + Lower primary school (6 – 8) + Upper primary school practical guides (8 – 12 years)

Learning objective: Show understanding of waste materials and how they come about and how to classify waste based on sources.

Subtopic 1.1 Waste materials and how they come about (50 min)

Module on subtopic 1.1

Activity 1

Observe and describe different kinds of waste in the environment

Step 1

- ☑ Show pictures or videos of different waste types and ask questions on sources of those waste (6 min).
- ☑ With guidance, let the learners identify the local sources of the waste seen in the photos or videos (15 min).
- ☑ Give an introductory presentation which explains what waste is and the risk of poor waste management (10 min).
- ☑ Show them polluted places from waste and ask them questions about it and how to avoid this (10 min)
- ☑ Use energizers to create natural breaks between steps of the training (4 min).

Note



Resource box

Video links	
Games	https://www3.epa.gov/recyclecity/
Handouts	https://www.epa.gov/students/resources-teachers-starting-planet-protectors-club
Further readings	https://www.epa.gov/recycle/reduce-reuse-recycle-resources-students-and-educators https://www.nea.org/professional-excellence/student-engagement/tools-tips/waste-hero-free-resources-teaching-recycling-creating-zero-waste-and-building-circular-economy

Activity 1

Identify and classify waste materials that can be sorted at source.

Step 1

- ❏ Make a quick recap of subtopic 1. Taking the learners from the known to the unknown (5 min).
- ❏ Show pictures or videos of color-coded bins where different colored bins are used to store a type of waste. Give them pictures of different types of waste and ask them to identify which colored bin will store the waste they have after the video (15 min).
- ❏ Give an introductory presentation which explains what sorting of waste is and why it is important for us to sort our waste and store in the different colored bins (10 min).
- ❏ Work in groups to sort waste materials in the classroom or school environment into paper, plastic, food waste and others (15 min).
- ❏ Draw and color the bins and paste in the classroom. Use this activity to explain the different sizes of bins (10 min).
- ❏ Conclusion, acknowledgement, and distribution of gifts (5 min).

Note

Use energizers to create natural breaks between steps of the training.



Subtopic 1.3 Useful materials that can be gotten from waste (40 min)

Module on subtopic 1.3

Activity 1

Describe and group waste materials for recycling or reuse.

Step 1

- Exhibit some materials (beads, takeaway rubbers, compost, etc.) made from recycled materials and ask them to mention or guess what material these were made from (10 min).
- Show videos of the recycling of plastic, paper, compost and how the products are used in everyday life. Relate the lesson with everyday experiences and link it to sorting waste (15 min).
- Ask them to identify what materials can be recycled in the school and in their homes (10 min).
- Conclusion, acknowledgement, and distribution of gifts (5 min).

Note

Use energizers to create natural breaks between activities of the training.



Resource box

Further readings

<https://www.epa.gov/recycle/reduce-reuse-recycle-resources-students-and-educators>

<https://www.nea.org/professional-excellence/student-engagement/tools-tips/waste-hero-free-resources-teaching-recycling-creating-zero-waste-and-building-circular-economy>

Sub-section 2: Junior high school + (12 – 15 years)

Learning objective: Show understanding of sustainable waste management systems and practices and to apply it in an environment.

Subtopic 1.1 Waste materials and how they come about (180 min)

Module on subtopic 1.1

Activity 1

Observe and describe different kinds of waste in the environment.

Step 1

- ❑ Show different pictures or videos of materials and ask learners to identify ‘waste’ among them (5 min).
- ❑ With guidance, let the learners identify the elements of waste, what makes one material waste and the other not waste (10 min).
- ❑ Let the learners mention different waste in their environment and together organize them into types based on physical characteristics, sources etc. (10 min).
- ❑ Discuss how to manage types of waste and explain the science underlying it (10 min).
- ❑ Show them polluted places from waste and ask them questions about it and how to avoid this (10 min).
- ❑ Conclusion, acknowledgement, and distribution of gifts (5 min).

Activity 2

Exhibit knowledge and skill for management practices of types of waste in the environment.

Step 2

- ❑ Learners work in groups (maybe four or five groups in a class) and distribute flip charts and color pencils for project work (5 min).
- ❑ For the project work, research and discuss information in each group on good waste management practices and use it to carry out a project to make their environment clean (20 min).
- ❑ Each group presents their project work for the class. Discuss the practices and approaches and highlight science and innovation (20 min).
- ❑ Conclusion, acknowledgement, and distribution of gifts (5 min).



Resource box

Further readings

<https://www.epa.gov/recycle/reduce-reuse-recycle-resources-students-and-educators>

<https://www.nea.org/professional-excellence/student-engagement/tools-tips/waste-hero-free-resources-teaching-recycling-creating-zero-waste-and-building-circular-economy>

Subtopic 1.2 Introduction to Linear and Circular economy

Module on subtopic 1.2

Activity 1

Apply information and knowledge from these concepts to waste management.

Step 1

- ❏ Give an introductory presentation which explains what Linear economy and circular economy of waste and why it is important (10 min).
- ❏ Refer to the group project work in subtopic 1 activity 2 to discuss whether they are linear or circular economy in practice (15 min).
- ❏ Show short videos on Circular economy and circular bioeconomy (10 min).
- ❏ Conclusion, acknowledgement, and distribution of gifts (5 min).



Resource box

Games

<https://www3.epa.gov/recyclecity/>

Further readings

<https://www.epa.gov/recycle/reduce-reuse-recycle-resources-students-and-educators>

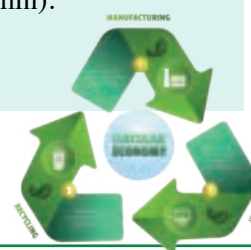
<https://www.nea.org/professional-excellence/student-engagement/tools-tips/waste-hero-free-resources-teaching-recycling-creating-zero-waste-and-building-circular-economy>

Activity 1

Apply information and knowledge to recover useful materials from waste.

Steps

- ➊ Outline approaches of waste management in promoting sustainable management, waste hierarchy, 3Rs etc. leading to waste sorting (10 min).
- ➋ Explain waste sorting at source and discuss the benefits. Also brainstorm on why we are not able to sort our waste from source (15 min).
- ➌ Show a video on sorting of waste from source. Discuss how the activities can successfully be implemented in our schools and homes (10 min).
- ➍ Show short videos on Circular economy and circular bioeconomy (10 min).
- ➎ Conclusion, acknowledgement, and distribution of gifts (5 min).



Resource box

Handouts

<https://www.epa.gov/students/resources-teachers-starting-planet-protectors-club>

Further readings

<https://www.epa.gov/recycle/reduce-reuse-recycle-resources-students-and-educators>

<https://www.nea.org/professional-excellence/student-engagement/tols-tips/waste-hero-free-resources-teaching-recycling-creating-zero-waste-and-building-circular-economy>

Broad topic area 2: Understanding composting operations

Learning objective: Show understanding of the basic principles of composting and the composting processes, as well as the key issues to consider in selecting feedstock and conditions suitable for a school setting.

Subtopic 2.1 The composting process

Module on subtopic 2.1

Activity 1

Apply information and knowledge to describe/explain the process of composting

Steps

- ❑ Define or explain in very simple terms what composting is and what it is about (10 min).
- ❑ Explain the composting process including the various phases (3 phases) (10 min).
- ❑ Describe the different composting technologies and show photos or video(s) (10 min).
- ❑ Describe/explain how to select the best technology to fit the local situation (10 min).
- ❑ Describe factors to be considered in selecting the best composting technology to be used (10 min)
- ❑ Conclusion, acknowledgement, and distribution of gifts (5 min).



Resource box

Handouts

<https://www.epa.gov/students/science-fair-fun-designing-environmental-science-projects>

<https://nepis.epa.gov/Exe/ZyPDF.cgi/P10oFEA5.PDF?Dockey=P10oFEA5.PDF>

Further readings

<https://www.epa.gov/recycle/reduce-reuse-recycle-resources-students-and-educators>

<https://www.nea.org/professional-excellence/student-engagement/tools-tips/waste-hero-free-resources-teaching-recycling-creating-zero-waste-and-building-circular-economy>

Subtopic 2.2 Building/Forming compost piles

Module on subtopic 2.2

Activity 1

Using selected organic wastes to form compost piles

Steps

- Describe/explain weighing to determine the right proportion or ratio of different organic waste to be used in forming the pile. (15 min).
- Explain why and how to apply the waste in layers. If possible, demonstrate with some practical (10 min).
- Describe how to mix the right amount of different composting materials before the pile formation (10 min).
- Describe how to ensure the right moisture content and how to adjust the moisture levels in the heaps. If possible, demonstrate with practical (15 min).
- Conclusion, acknowledgement, and distribution of gifts (5 min).



Resource box

Handouts

<https://nepis.epa.gov/Exe/ZyPDF.cgi/P10oFEA5.PDF?Dockey=P10oFEA5.PDF>

Activity 1

Apply information and knowledge to explain how to monitor the composting process

Steps

- ❑ Explain why a successful compost stabilization process depends on maintaining a controlled environment for the process, which include (30 mins):
 - o Moisture content,
 - o Aeration,
 - o Nutrient content (Carbon-Nitrogen ratio),
 - o Temperature,
 - o pH.
- ❑ Explain sorting and sieving matured compost (10 min).
- ❑ Storage of matured compost (5 min).
- ❑ Applying compost to crops (10 min).
- ❑ Conclusion, acknowledgement, and distribution of gifts (5 min).



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