

GreenVETAfrica

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D4.1. Learning Materials

Methodology for the Development of Course Content

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Abstract	This deliverable presents the logic and methodology adopted for developing course content for training beneficiaries of the GreenVETAfrica Vocational Training Course in Technical Foundation in Waste Management. It details how the content was adapted based on insights from the skills gap analysis report. By integrating these insights, the training content is tailored to meet industry needs, addressing specific gaps identified in the report. This approach ensures that the training program is relevant and effective in equipping beneficiaries with the necessary skills and competencies to thrive in the green waste management sector.
Keywords	Waste management, skills gap analysis, Green Waste Management VET programme, TVET, ToT, Learning Materials, Modules



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EXECUTIVE SUMMARY

As West Africa economies advance and accelerate production, the waste generated inevitably increases. To effectively manage this waste, it is necessary to invest in increasing the technical skills of the workers in the Waste Management Industry, while leveraging advancements in technology. This also involves understanding the various types of waste, handling, processing, and recycling, and applying modern equipment and technologies to improve these processes. Additional challenges are to be taken into account, such as understanding how the equipment and machinery work and how to operate, maintain, and repair them. The Skills Gap Analysis Report (D2.3), conducted in the first phases of the project, identified the required technical skills, which will also translate to youth employment in the waste management sector. Using this analysis as a foundation, the project developed a curriculum and training content for the GreenVETAfrica Vocational Training Program to bridge the identified skills gaps and to foster the transition to the job market.

This deliverable highlights the methodologies and approaches used in developing the course content for the GreenVETAfrica Vocational Training Program. Our approach ensures that the training program is relevant to the regional Green Waste Management industry's needs and effectively equips beneficiaries with appropriate skills and competencies in Nigeria and Ghana, as well as in other West African markets. This deliverable includes:

- Training of Trainers (ToT): Detailing the selection and preparation of trainers to ensure they are well-equipped to deliver the course content effectively.
- Training Curriculum: Outlining the structured framework of the course, designed to address the specific technical skills identified as necessary for the waste management sector.
- Course Delivery Methodology: Describing the pedagogical approaches and instructional strategies used to impart knowledge and skills.

By integrating insights from the skills gap analysis and employing a comprehensive development methodology, the training content is tailored to meet the evolving needs of the waste management industry. This ensures that the GreenVETAfrica Vocational Training Program remains relevant and impactful, providing youth with the skills and knowledge required to excel in this vital sector.

Assessment of the impact of the training programme, aiming at evaluating the effectiveness of the training and gather feedback for continuous improvement, is in progress at the time of writing this deliverable. The assessment results will be presented in Deliverable Pilot Programme Evaluation (D4.2, due at M22).

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ABBREVIATIONS

ToT Training of Trainers

TVET Technical Vocational Educational Training

1. INTRODUCTION

In today's world, sustainability is not just an ideal to appreciate, but a crucial goal to aspire to. Achieving sustainable goals necessitates effective waste management, which involves judicious handling and disposal to maintain a healthy environment and a sustainable planet.¹ However, the increasing volume and variety of waste generated require modern equipment, machinery, and technology for better transportation, sorting, processing, recycling, and upcycling. This, in turn, demands skilled and competent individuals capable of operating, maintaining, and repairing these technologies. Therefore, to effectively manage waste, all players in the waste management sector must possess minimum skills and competencies. Acquiring these skills will also create numerous opportunities for youth in the waste management sector.

Technical and Vocational Education and Training (TVET) comprises education, training, and skills development, empowering individuals and fostering employment. Recognised as a tool for reducing poverty and enhancing national development, TVET is crucial for job creation, economic growth, and poverty alleviation². Therefore, to address the skills gap identified in the waste management sector and equip youth in Nigeria and Ghana with relevant skills to increase their prospect for employment, GreenVETAfrica has implemented a TVET program – the GreenVETAfrica Vocational Educational Training Program. The program delivered technical and business skills relevant to waste management.

The first challenge was adapting the skills gap analysis report to develop a curriculum and learning content that addresses the identified skills needs that will achieve the program's objective. The next step was to identify and equip trainers in the TVET industry in Nigeria and Ghana with the relevant skills to deliver the training content effectively. This ToT included training in pedagogy, digital upskilling, digital tools for teaching and learning, the technical foundation for green waste management, and micro-entrepreneurship skills. Deliverable D3.1 detailed the process.

Also, there was some deliberation on the best approach for the training delivery. Considering the target beneficiaries in Nigeria and Ghana, a blended or hybrid learning approach was favoured. This approach combines online live sessions, physical in-person sessions, and video recordings for those who could not attend the live sessions. This method offers flexibility and accessibility, catering to different learning preferences and schedules.

This deliverable aims to explain the comprehensive process and methodologies applied in developing and delivering the training content for the GreenVETAfrica Vocational Training Program, ensuring it is relevant and impactful in equipping the youth with the necessary skills for the waste management industry.

¹ Aditi Biswas, "What Is Waste Management? Definition, Importance, and Examples," *The Renewables* (blog), 2023, <https://therenewables.org/waste-management-definition-importance-examples/>.

² Philip O. Nwachukwu, "Poverty Reduction through Technical and Vocational Education and Training (TVET) in Nigeria," 2014, 2.

2. BACKGROUND

This section summarises the findings of the skills gap analysis report on machinery, technologies, and tools in green waste management and the identified technical skills required in the different waste management sectors.

2.1. A MAP OF TECHNOLOGIES AND SKILLS IN THE WASTE MANAGEMENT SECTOR

Waste management typically implies processes such as waste collection, waste treatment, and recycling involving different actors and professional profiles. Each stage utilises different technologies, machinery, and equipment, necessitating distinct skills for effective operation. The following paragraphs summarise the map of the technologies and skills from the skills gap analysis report.

Table 1: Technology-Skills Mapping in the Waste Management Sector

Sector Stakeholder	Technologies/ Equipment	Required Skills
Waste Collectors	Waste Segregation Equipment	<ul style="list-style-type: none"> Basic understanding of waste segregation principles; Knowledge of operation and maintenance of waste segregation equipment; Ability to identify recyclable and non-recyclable materials.
	Collection Vehicles and Equipment	<ul style="list-style-type: none"> Basic mechanical skills for vehicle operation and maintenance; Understanding of hydraulic systems; Ability to perform routine inspections, diagnose and troubleshoot mechanical issues.
Waste Treatment Facilities Operators	Sorting Equipment	<ul style="list-style-type: none"> Proficiency in the operation and maintenance of sorting equipment; Knowledge of mechanical, hydraulic and electrical components; Ability to calibrate and troubleshoot equipment.
	Shredding and Granulating Equipment	<ul style="list-style-type: none"> Competence in the operation and maintenance of shredders, granulators, and crushers; Familiarity with mechanical systems; Ability to perform preventive maintenance and repairs.
	Compacting and Baling Equipment	<ul style="list-style-type: none"> Understanding of hydraulic systems; Ability to adjust compression settings; Troubleshoot hydraulic problems; Perform maintenance tasks; Ensure safe operation.
	Incinerators and Composting Equipment	<ul style="list-style-type: none"> knowledge of combustion or composting processes; Proficiency in operating and maintaining equipment; Understanding of environmental regulations and emission control measures.
	Water Treatment Systems	<ul style="list-style-type: none"> Understanding of water treatment processes; Knowledge of operation and maintenance of water treatment equipment; Ability to monitor and control water quality parameters.

Recycling Facilities Operators	Sorting and Separation Equipment	<ul style="list-style-type: none"> • proficiency in the operation and maintenance of sorting equipment such as conveyor belts, optical sorters, and magnetic separators; • Understanding of mechanical and electrical components and systems.
	Shredding and Granulating Equipment	<ul style="list-style-type: none"> • Competence in the operation and maintenance of shredders, granulators, and crushers; • Ability to diagnose and rectify mechanical problems and conduct regular maintenance tasks.
	Compacting and Baling Equipment	<ul style="list-style-type: none"> • Proficiency in hydraulic systems; • Ability to adjust compression settings; • Troubleshoot hydraulic malfunctions; • Perform preventive maintenance.
	Material Handling Equipment	<ul style="list-style-type: none"> • Competence in operating forklifts, loaders, and other material-handling equipment; • Adherence to safety procedures for material transportation.

This detailed map of technologies and required skills highlights the diverse competencies needed across waste management sectors, underscoring the importance of targeted training programs to bridge the identified skills gaps.

3. METHODOLOGY

This section details the steps and approaches to achieving the program's objective. This includes curriculum development, training of trainers, and course content development.

3.1. DEVELOPING THE CURRICULUM TO ADDRESS THE SKILLS GAP

To effectively address the Green Waste Management market's needs and skills gap in Nigeria and Ghana identified throughout the Work Package 2, a comprehensive curriculum was developed. The training course is designed to equip trainees with the essential knowledge and skills to operate, maintain, and repair various technologies and equipment and related instructions and safety measures. Additionally, it emphasises the application of best practices for the safe handling and processing of waste and the Business Management in Green Waste Industry.

The curriculum begins with foundational education on waste, including its types, sources, and environmental impacts. It also covers the roles of various stakeholders in the waste management sector and the different processes involved in waste management, such as collection, treatment, recycling, and disposal. Understanding these fundamentals is crucial for contributing to the sector effectively.

A significant focus of the curriculum is on technical skills, including the operation and maintenance of waste management equipment such as waste segregation tools, collection vehicles, sorting and separation devices, shredders, granulators, compactors, balers, incinerators, composting units, and water treatment systems. Each module includes theoretical knowledge and practical, hands-on training to ensure comprehensive skill development.

Safety and best practices are integral to the curriculum, addressing the importance of properly handling and processing waste. Training includes using personal protective equipment (PPE), adherence to environmental regulations, and methods for ensuring safe and efficient operations.

The curriculum also explores entrepreneurship opportunities within the waste management sector, providing insights into starting and managing waste management businesses. It covers market analysis, business development strategies, and leveraging technology for innovative solutions.

It incorporates regular assessments and feedback mechanisms to ensure the curriculum's effectiveness. These tools help gauge trainee progress, identify areas for improvement, and ensure that the training remains relevant and responsive to industry needs.

Overall, the developed curriculum is designed to provide a well-rounded education that addresses the skills gap, preparing trainees to meet the demands of the waste management industry and contribute to sustainable development. The curriculum is presented in the table below.

Table 2: Course Curriculum to Address Skills Gap

Modules	Unit	Objective
Man and the Environment	Man and the Environment -	<ul style="list-style-type: none"> gain foundational understanding of essential environmental concepts, including ecosystems, biodiversity, and sustainability, understand the various ways human activities—such as agriculture, urbanisation, industrialization, and deforestation— affect the environment, explore how changes in the environment, such as climate change, pollution, and natural resource depletion, influence human health, economies, and social structures and Evaluate potential solutions to environmental problems, emphasising sustainable practices, conservation efforts, and policy initiatives.
Waste Management Hierarchy	Waste Management Hierarchy	<ul style="list-style-type: none"> learn about the different types of waste, including municipal, industrial, hazardous, and electronic waste, understand the concept of the waste management hierarchy and explore the different waste management practices, including reduction, reuse, recycling, composting, incineration, and landfilling and be able to discuss the role of policies, regulations, and technological innovations in improving waste management systems sustainably.
Recycling	Recycling	<ul style="list-style-type: none"> gain a foundational understanding of the principles and processes involved in recycling various materials, Understand the environmental, economic, and social benefits of recycling benefits of Recycling, identify Challenges and Solutions and discuss the role of policies, regulations, and technological innovations in promoting and enhancing recycling activities.
Green Waste Management	Informal Sector	<ul style="list-style-type: none"> gain adequate knowledge on Green waste management, green jobs and environmental sustainability, be able to itemize the Environmental, social, Economic and public health advantages of effective green waste management, Understand the challenges associated with green waste management and suggest potential solutions to improve efficiency and participation.
Plastic Waste Management	Plastic Waste Management	<ul style="list-style-type: none"> Gain a foundational understanding of different types of plastics, their properties, and their uses, Learn about the various methods and technologies used in recycling different types of plastic, Examine the challenges in plastic waste management and explore innovative solutions to enhance recycling efforts.
Organic Waste Management	Organic Waste Management	<ul style="list-style-type: none"> Understand what constitutes organic waste and its various sources, Explore different methods and technologies for recycling organic waste, including composting, anaerobic digestion, conversion to biogas and energy Itemize the environmental and economic benefits of effective organic waste management, Discuss the challenges associated with organic waste recycling and potential solutions to improve efficiency and participation.

Waste Disposal and Treatment	Waste Disposal and Treatment	<ul style="list-style-type: none"> Understand the different types of waste, including municipal, industrial, hazardous, and electronic waste, their sources and safe disposal in the environment. Explore various waste disposal and treatment methods, including landfilling, incineration, composting, and advanced treatment technologies Enable participants to investigate the environmental and health impacts of different waste disposal and treatment practices. Discuss challenges associated with waste disposal and treatment and explore innovative solutions to improve these processes. Equip participants with knowledge and skills to contribute to sustainable waste management practices and advocate for improved waste disposal and treatment for a cleaner, healthier, and more sustainable environment.
Environmental Sustainability and Circular Economy	Environmental Sustainability and Circular Economy	<ul style="list-style-type: none"> Understand the Key Concepts sustainability and circular economy including their principles and significance, Be able to analyze the environmental impacts of current consumption and production patterns and the benefits of adopting sustainable and circular practices, Learn about various strategies and practices that promote circular economy
Waste Management Technology	Introduction to Waste Management Equipment and Machinery	<ul style="list-style-type: none"> Recognize and name various waste management equipment and machinery commonly used in the industry. Develop a comprehensive understanding of the purpose and functionality of different waste management tools and technologies. Differentiate between various types of machinery and equipment, understanding their specific roles in the waste management process.
Safety in Waste Management Industry	Health, Safety and Environment	<ul style="list-style-type: none"> State the employer's responsibilities towards the maintenance of health and safety State the employee's responsibilities towards the maintenance of health and safety Describe in general terms the human and environmental conditions leading to accidents in the workplace and the means of controlling them Identify protective clothing and equipment suitable for given situations Identify dangerous items of clothing Identify protective equipment for non-portable powered machinery State the safe working practices to be observed when carrying out manual handling operations State the precautions to be observed when moving materials into, within and out of the workshop and on-site with mechanical lifting and ancillary equipment Identify the types and applications of lifting aids and accessories State the dangers of using faulty/misused lifting aids and techniques Describe the precautions to be taken when transporting/using ladders Identify the dangers associated with the use of electrical equipment

		<ul style="list-style-type: none"> ● Describe how the human body can become part of an electrical circuit ● Describe the procedure to be adopted when a person is in contact with a live single-phase electrical supply ● Identify the types and applications of fire-fighting equipment ● Explain the need for evacuation procedures ● Identify the precautions to be taken against contact with toxic materials, liquids, dust or fumes ● Describe the precautions to be observed when pressure testing a low-pressure ● Describe the first aid procedures required in the event of an industrial accident
Mechanical Measurement Techniques	Mechanical Measurements	<ul style="list-style-type: none"> ● Identify and describe marking out and measuring instruments and tools. ● Compare the relative degrees of accuracy of marking out and measuring equipment listed. ● Identify methods of marking out. ● Identify datum and describe methods of marking out from them. ● Describe how to avoid faults and minimise inaccuracies when marking out. ● Identify and explain the main classes of fit.
Mechanical Drives in Waste Management Machinery		<ul style="list-style-type: none"> ● Discuss the basic principles, design and construction of mechanical drive components commonly used in the industry. ● Explain the purpose of mechanical drive components. ● Gain related information on installing and maintaining mechanical drive components such as shaft, couplings, v-belts, chains, bearings & gear drives, packing & seals. ● Acquire practical skills and develop innovative installation techniques, aligning, maintaining and operating mechanical drive components. ● Observe proper work habits and safety precautions for maintenance of mechanical drive components. ● Explain the role and benefits of lubrication systems and lubricants in an industrial environment. ● Identify the type of lubricants and their applications. ● Follow the lubrication system maintenance strictly ● Observe proper and effective lubrication practice.
Hydraulic Systems in Green Waste Management Processes	Fundamentals of Industrial Hydraulics	<ul style="list-style-type: none"> ● Explain the physical principles and laws of hydraulics ● Describe laminar and turbulent flow and their effects ● Read the symbols, design and functions of the hydraulics power unit and other basic controls and working elements ● Interpret basic hydraulics schematic diagrams according to ISO standard ● Construct basic hydraulics circuits ● Show awareness of safety precautions in constructing, operating and maintaining hydraulic systems.
Business Management in the Green Waste Industry	Foundations of Sustainable Waste Management Entrepreneurship: Financial and Business Perspectives	<ul style="list-style-type: none"> ● Gain insights into the current state of the waste management industry, including challenges, opportunities, and emerging trends. ● Cultivate an entrepreneurial mindset focusing on innovation, problem-solving, and identifying business opportunities within the waste management sector.

- Acquire a strong foundation in financial principles relevant to waste management businesses, including budgeting, financial analysis, and risk management.
- Explore and formulate effective business models for sustainable waste management enterprises, considering economic, social, and environmental aspects.
- Develop effective communication skills for engaging with stakeholders, building partnerships, and conveying the value proposition of sustainable waste management initiatives.
- Develop skills to conduct market research and analysis to identify target audiences, assess competition, and determine viable market entry points.
- Craft comprehensive business plans encompassing financial projections, marketing strategies, and operational frameworks tailored to the waste management industry.

3.2. TRAINING OF TRAINERS (TOT)

In a preliminary phase of the project, under the Work Package 3 - Design the green waste management VET programmes, the Train the Trainers (ToT) program was developed to build the capacity of the VETs providers and bridge the significant skills gap within the realm of vocational education in the green waste management sector in Nigeria and Ghana. The resulting training program has been structured around five modules to equip participants with the knowledge, skills, and pedagogical tools necessary to deliver effective environmental education and entrepreneurship training. A comprehensive set of learning materials was made available, as foreseen by the [deliverable D3.1](#), through the dedicated section of the GreenVETAfrica website: <https://greenvetafrica.eu/train-the-trainers/>.

As highlighted in the [deliverable D3.2](#), the ToT program equipped over fifty trainers in Nigeria and Ghana with essential digital tools for teaching and learning, pedagogical skills, and digital pedagogy. This training ensures that trainers are well-prepared to adopt the blended approach to learning favoured by the project, engage students effectively, and deliver content creatively and stimulatingly, maximising participants' learning process and outcomes.

Additionally, the trainers received instruction on Green Waste Management and Technology and the Foundations of Micro-Entrepreneurship Skills for Micro-SMEs. This provided an overview of the training objectives and content, giving trainers the foundation to prepare for their facilitation sessions.

The conclusion of the ToT program featured a validation workshop where trainers who had met the minimum attendance requirements were invited to demonstrate the skills and knowledge they had acquired. This event served as a platform to evaluate their proficiency in various aspects crucial to effective training delivery. The assessment criteria covered several key areas, each with a point value indicative of the trainers' effectiveness. Trainers were first evaluated on the relevance of their presentation to their chosen micro topic, ensuring the content was appropriate and applicable to the specified subject matter. Depth of understanding and analysis was another critical area, measuring the trainers' ability to go beyond surface-level knowledge and provide nuanced insights into the topic. The structure and flow of the presentation were also assessed, focusing on the logical progression of ideas and smooth transitions between key points. Clarity in explaining concepts was essential, as trainers needed to communicate complex ideas concisely and coherently to ensure audience comprehension.

Furthermore, engaging the audience was a significant criterion, as it involved evaluating the trainers' communication style, delivery techniques, and overall strategies to maintain interest. The trainers' ability to encourage audience interaction was also assessed, highlighting their efforts to foster a dynamic and collaborative learning environment. The effective use of visual aids was necessary for enhancing understanding and reinforcing key concepts. Trainers who integrated technology into their presentations were evaluated on their proficiency

in using these tools seamlessly, ensuring they enhanced rather than detracted from the content delivery. The overall impact and impression of the presentation were also considered, considering factors such as engagement, clarity, and relevance. Finally, trainers were assessed on their ability to convey key messages and takeaways, ensuring the audience effectively understood and retained the central themes. Trainers judged to be successful in this exercise were awarded a certificate and became facilitators for the GreenVETAfrica Vocational Training Program.

At the end of the ToT program, a validation workshop was organised to gather the trainers' feedback about the course and the methodology proposed. A dedicated evaluation session was organised to assess the trainers' acquired competences and check who met the program requirements. Trainers were assessed using a comprehensive set of criteria to gauge their performance and effectiveness in delivering training sessions: content relevance and depth, clarity and organisation, engagement and interaction, use of visual aids or technology, and overall effectiveness. A panel of experts meticulously assessed the trainers by rating them on a scale of 1 to 5 for each criterion. Overall, the evaluation process made it possible to identify 18 Ghanaian trainers and 19 Nigerian trainers that successfully met the requirements and became the facilitators for the GreenVETAfrica Vocational Training Program.

3.3. COURSE MODULE AND TRAINING CONTENT DEVELOPMENT

Developing course modules and training content is critical to the GreenVETAfrica Vocational Training Program. This process involves creating detailed and structured educational materials to address the specific skills and knowledge gaps identified in the waste management sector. Akinbulo Ayobami, Ogunmuyiwa Rukayah, Oguntola Omolara, Ogebule Samuel and Kemi Kunle-Oyewo from LAWMA developed and facilitated training several materials – PowerPoint presentations, PDFs, and videos on the rudiments and foundation in waste management to introduce participants to the concepts of waste management, recycling, green waste management and environmental sustainability. Notably, the modules on Green Waste Management Technologies, Mechanical Drives in Waste Management Equipment and Machinery, Mechanical Measurement Techniques for Waste Management Machines, Safety in the Green Waste Management Industry, Hydraulics Systems in Green Waste Management Processes were facilitated by Agbo James, Akhigbe Israel, Olagunju Damilare, Isichie Peter, and Afeni Deji, respectively - each a beneficiary of GreenVETAfrica Train-the-Trainer Program. Additionally, Philip Boamah, Rosemary Kwofie, Philomina Afram, Elizabeth Kissi, Rita Gyamfuaa Kumi and Jonah Oppong Amaning, beneficiaries of the Train-the-Trainers Programme from the Presbyterian Relief Services and Development, Ghana developed and facilitated the training content on Business Management in Green Waste Industry. This approach not only ensured the relevancy of the content but also allowed the trainers to apply the new skills they acquired.

The GreenVETAfrica Vocational Training Program was executed over three months simultaneously in Nigeria and Ghana, covering the entire training curriculum developed for this purpose. Subsequent subsections provide an abstract of each module and its objectives.

3.3.1. MAN, AND THE ENVIRONMENT

The "Man and the Environment" module is a foundational component of the program, aimed at providing participants with a deep understanding of the interdependent relationship between human activities and the environment. This module highlights how human actions such as agriculture, urbanisation, industrialization, and deforestation significantly impact the natural world and explores the reciprocal effects of environmental changes on human societies.

The module begins by introducing essential environmental concepts, including ecosystems, biodiversity, and sustainability. Participants gain a clear understanding of how these elements interact and are affected by human activities. The module then delves into the various ways that human-induced changes, such as climate change,

pollution, and the depletion of natural resources, influence human health, economic systems, and social structures.

In addition to understanding these impacts, participants are encouraged to explore and evaluate potential solutions to the environmental challenges we face today. The module emphasises the importance of sustainable practices, conservation efforts, and policy initiatives in mitigating environmental damage and promoting long-term ecological balance.

The teaching approach in this module is multidisciplinary, drawing from ecology, geography, economics, sociology, and environmental science to provide a holistic view of the subject. Through a combination of lectures, case studies, and practical discussions, participants are equipped not only with theoretical knowledge but also with the practical skills needed to address environmental issues effectively.

Overall, the "Man and the Environment" module serves as a critical educational foundation, empowering participants to understand and address the complex environmental challenges that arise from the interaction between human society and the natural world.

3.3.2. WASTE MANAGEMENT HIERARCHY

The "Waste Management Hierarchy" module offers an in-depth exploration of the comprehensive processes involved in managing waste, including generation, handling, collection, transportation, treatment, and disposal. This module emphasises the critical role that effective waste management plays in modern society, impacting environmental health, public safety, and resource efficiency. Participants will gain a thorough understanding of various waste types, their environmental and societal implications, and the strategies and technologies used to manage waste in a sustainable manner.

The module begins by introducing participants to different types of waste, such as municipal, industrial, hazardous, and electronic waste. This foundational knowledge is crucial for understanding the diverse challenges and requirements associated with each waste category. Participants will also explore the waste management hierarchy, which prioritises practices like reduction, reuse, and recycling before considering treatment options such as composting, incineration, and landfilling.

Additionally, the module covers the role of policies, regulations, and technological advancements in enhancing waste management systems. Participants will learn how effective policy frameworks and innovative technologies contribute to more sustainable and efficient waste management practices.

By the end of this module, participants will be equipped with a comprehensive understanding of waste management complexities and strategies. They will gain the skills and knowledge needed to contribute to effective and sustainable waste management solutions within their communities and beyond.

3.3.3. RECYCLING

The "Recycling" module provides an essential introduction to recycling, highlighting its critical role in sustainable waste management. This module explores how recycling contributes to conserving natural resources, reducing pollution, and minimising landfill use. Participants will gain a thorough understanding of recycling processes, the benefits and challenges associated with recycling, and its significance within the broader context of environmental sustainability and the circular economy.

The module begins with foundational principles and processes involved in recycling various materials, offering insights into how different types of waste are processed and repurposed. Participants will learn about the environmental, economic, and social benefits of recycling, including its impact on resource conservation and pollution reduction. The module also addresses the challenges faced in recycling efforts and provides solutions to overcome these obstacles.

Additionally, the module covers the role of policies, regulations, and technological innovations in enhancing recycling activities. Participants will understand how effective policies and cutting-edge technologies support and promote recycling practices, contributing to a more sustainable waste management system.

By the end of this module, participants will have a comprehensive understanding of recycling's complexities and significance. They will be equipped with the knowledge and skills necessary to contribute effectively to recycling efforts in their communities and support the transition toward a circular economy.

3.3.4. GREEN WASTE MANAGEMENT (INFORMAL SECTOR)

The "Green Waste Management" module focuses on integrating sustainability into waste management practices, emphasising environmental stewardship and corporate responsibility. This module introduces participants to green waste management practices, technologies, and choices that prioritise environmental friendliness and sustainability. It covers the principles, techniques, and benefits associated with green waste management, highlighting its critical role in advancing sustainable waste management practices.

Participants will gain a thorough understanding of green waste management, including the concept of green jobs and the broader context of environmental sustainability. The module details the environmental, social, economic, and public health advantages of effective green waste management, illustrating how such practices contribute to overall sustainability.

The module also addresses the challenges associated with green waste management and encourages participants to propose potential solutions to enhance efficiency and increase community participation. By exploring both the benefits and difficulties, participants will be better equipped to promote and implement green waste management strategies.

Overall, this module aims to deepen participants' knowledge of green waste management, preparing them to support and advocate for sustainable practices. By fostering an understanding of green waste recycling, participants will be empowered to contribute to creating a more sustainable and resilient future.

3.3.5. PLASTIC WASTE MANAGEMENT

The "Plastic Waste Management" module addresses one of the most urgent environmental issues of our time: plastic waste. With millions of tons of plastic entering oceans and landfills annually, effective management and recycling of plastic waste are crucial. This module explores the complexities associated with plastic waste, including the different types of plastics, their environmental impacts, and strategies for reducing and recycling plastic waste. Its goal is to provide participants with a thorough understanding of how plastic recycling contributes to a sustainable future.

Participants will gain foundational knowledge about various types of plastics, including their properties and uses. The module covers the methods and technologies used in recycling different plastics, offering insights into the recycling process and its significance. Additionally, participants will examine the challenges faced in plastic waste management and explore innovative solutions to enhance recycling efforts.

By understanding and addressing these aspects of plastic waste management, participants will be equipped to contribute effectively to solving the global plastic pollution crisis. This module aims to empower individuals to play a crucial role in fostering a more sustainable and resilient future through informed plastic waste management practices.

3.3.6. ORGANIC WASTE MANAGEMENT

The "Organic Waste Management" module delves into the principles, techniques, and benefits of managing organic waste, highlighting its importance in developing a sustainable waste management system. Organic waste, including food scraps, yard trimmings, and other biodegradable materials, forms a significant part of the waste stream. Effective management of this waste is essential for minimizing landfill use, reducing greenhouse gas emissions, and generating valuable by-products such as compost and biogas.

Participants will learn about the various sources of organic waste and the methods used to manage it. The module covers different recycling techniques, including composting, anaerobic digestion, and the conversion of organic waste into biogas and energy. It emphasizes the environmental and economic benefits of effective organic waste management, including reduced pollution and improved resource efficiency.

Additionally, the module addresses the challenges associated with organic waste recycling and explores potential solutions to enhance efficiency and participation. By the end of the module, participants will have a comprehensive understanding of organic waste management processes and will be equipped with the skills to implement sustainable practices that reduce emissions and environmental impact.

3.3.7. WASTE DISPOSAL AND TREATMENT

The "Waste Disposal and Treatment" module focuses on the essential methods and technologies for managing waste in a way that minimizes negative impacts on the environment and public health. Effective waste disposal and treatment are critical for addressing the challenges posed by the increasing volume of waste generated by modern societies. This module provides a comprehensive overview of various disposal and treatment techniques, emphasizing their environmental, economic, and social implications.

Participants will gain an understanding of different types of waste, including municipal, industrial, hazardous, and electronic waste, and learn about their sources and appropriate disposal methods. The module explores a range of waste disposal and treatment options, such as landfilling, incineration, composting, and advanced treatment technologies. It also investigates the environmental and health impacts associated with these practices.

Furthermore, the module addresses the challenges related to waste disposal and treatment, encouraging participants to explore innovative solutions to improve these processes. By the end of the module, participants will be equipped with the knowledge and skills necessary to contribute to sustainable waste management practices, advocate for more effective waste disposal and treatment, and support efforts to create a cleaner, healthier, and more sustainable environment.

3.3.8. ENVIRONMENTAL SUSTAINABILITY AND CIRCULAR ECONOMY

The "Environmental Sustainability and Circular Economy" module explores the principles and benefits of shifting from a linear economic model to a circular approach, focusing on sustainability and resource conservation. This module provides a comprehensive understanding of how adopting circular economy practices can minimize waste, conserve resources, and support long-term ecological balance.

Participants will gain insight into the key concepts of environmental sustainability and the circular economy, including their fundamental principles and importance. The module emphasizes the need to move away from the traditional 'take-make-dispose' model towards more sustainable and resource-efficient practices.

It covers the environmental impacts of current consumption and production patterns and illustrates the advantages of implementing circular economy strategies. Participants will learn about various approaches and practices that promote a circular economy, integrating perspectives from environmental science, economics, engineering, public policy, and business studies.

By the end of the module, participants will be equipped to analyse and advocate for sustainable and circular practices, contributing to solutions that address environmental challenges and foster a more sustainable future.

3.3.9. SAFETY IN WASTE MANAGEMENT INDUSTRY

The Safety in Modern Waste Management Systems course offers an extensive blend of knowledge and practical skills vital for ensuring safety within contemporary waste management environments. Participants will engage with various topics, including hazardous waste identification, handling procedures, storage protocols, transportation guidelines, and compliant disposal practices in alignment with regulatory standards.

A significant emphasis is placed on equipping participants with the tools needed for practical risk assessment, mitigation strategies, emergency response planning, and utilising protective equipment. Through the course, students will gain invaluable insights into industry best practices, regulatory frameworks, and emerging trends in safety within waste management contexts.

Designed to cater to professionals across various industries involved in waste management, environmental health and safety specialists, regulatory compliance officers, and individuals seeking to enhance their understanding of industrial safety practices within modern waste management systems, this course provides a comprehensive platform for skill development and knowledge enhancement.

3.3.10. GREEN WASTE MANAGEMENT TECHNOLOGIES

The “Green Waste Management Technologies (Tools, Equipment & Machinery)” module explores the diverse machinery, tools, and equipment used across the waste management value chain. This module offers participants a comprehensive understanding of traditional and modern waste management technologies, techniques, and practices.

Participants will learn about the various tools and machinery employed at different stages of the waste management process, from collection and sorting to processing and disposal. The machinery includes balers, compactors, shredders, conveyors, and sorting machines. By examining both traditional and advanced technologies, the module highlights the evolution of waste management practices and the innovations driving sustainability in the field. This comprehensive approach ensures that participants are well-versed in the equipment necessary for efficient and sustainable green waste management.

By the end of this module, participants will have a significant understanding of the technologies that underpin green waste management. This knowledge is crucial for anyone seeking to contribute to environmentally conscious practices in the waste management industry.

3.3.11. MECHANICAL DRIVE SYSTEMS IN WASTE MANAGEMENT

The Mechanical Drives Systems in Waste Management course comprehensively explores mechanical systems crucial to modern waste management practices.

Students will understand the design, function, and maintenance of mechanical drive systems used in waste management facilities. The course covers various topics, including the principles of mechanical power transmission, selection and installation of mechanical components, and system performance optimization.

Through theoretical learning and practical exercises, students will learn to analyse, troubleshoot, and repair mechanical drive systems commonly employed in waste transport, compaction, and processing.

Upon completing the course, students will have the skills and knowledge to effectively contribute to efficient and sustainable waste management by applying mechanical drive systems.

3.3.12. MECHANICAL MEASUREMENT TECHNIQUES IN WASTE MANAGEMENT

The Mechanical Measurement in Waste Management course is meticulously designed to address the pivotal role of accurate measurement and fittings within waste management systems, aimed at enhancing participants’ maintenance skills on waste management equipment.

Throughout the program, participants will gain a comprehensive understanding of the principles underpinning mechanical measurement techniques and fittings, with a sharp focus on their practical application within waste management contexts. The curriculum spans various topics, including mechanical measurement methodologies, fittings selection and installation, and quality assurance practices.

Combining theoretical instruction with hands-on exercises, participants will develop the necessary skills to assess dimensions accurately and ensure precise fittings across a spectrum of waste management equipment and

machinery. By the course's conclusion, participants will be proficient in applying their knowledge to real-world scenarios, optimising waste management processes for heightened efficiency and effectiveness.

Armed with these newfound skills, participants will be poised to contribute significantly to improving waste management systems by implementing accurate measurement and fitting practices, ultimately fostering greater sustainability and operational excellence.

3.3.13. HYDRAULIC SYSTEMS IN GREEN WASTE MANAGEMENT PROCESSES

The Hydraulic Systems in Waste Management Systems course is meticulously crafted to delve into the foundational principles governing the control of hydraulic equipment within waste management systems. Participants undergo comprehensive instruction covering the underlying physical laws, pertinent standards and units, technical terminology, and the design principles of various essential hydraulic control elements. This extensive knowledge equips participants to proficiently operate, troubleshoot, and maintain waste management equipment such as compactors and bailers that rely on hydraulic systems.

Throughout the course, a significant emphasis is placed on instilling an acute awareness of safety precautions and fundamental maintenance principles associated with hydraulic systems in waste management applications. This holistic approach ensures that participants grasp theoretical concepts and understand their practical implications in real-world scenarios.

Integrating hands-on practical sessions with experienced trainers further enhances participants' understanding and proficiency in applying hydraulic control principles within waste management contexts. By the conclusion of the course, participants emerge equipped with the knowledge, skills, and confidence to navigate and effectively manage hydraulic systems in waste management operations, all while prioritising safety and adhering to maintenance best practices.

3.3.14. BUSINESS MANAGEMENT IN THE GREEN WASTE INDUSTRY

The Business Management module is a pivotal program component designed to provide participants with a comprehensive entrepreneurial skill. It emphasises the importance of entrepreneurial skills in fostering business ownership, adaptability, and resilience in a dynamic market environment.

The module covers essential aspects of entrepreneurship, starting with creativity and problem-solving techniques that encourage innovative thinking. Participants then explore business management and profitability fundamentals through an introduction to entrepreneurship. They learn to analyse market needs and identify growth opportunities, crucial for developing a successful business strategy.

Additionally, the module includes practical lessons on market research, teaching participants how to evaluate the viability of new products or services based on direct customer feedback. It also addresses business model development, guiding learners in creating effective plans for generating profit. Business finance is covered in detail, focusing on securing and managing funds for business operations. Finally, the module includes training on pitching business ideas to potential investors, helping participants effectively communicate their value propositions and secure necessary resources.

This module equips learners with the foundational skills to launch and manage successful micro-enterprises, providing a robust platform for entrepreneurial growth and sustainability.

3.4. TRAINING MATERIALS

Developing high-quality training materials is essential to the GreenVETAfrica Vocational Training Program and its potential replicability. These materials are designed to enhance the required knowledge and skills delivery, facilitating effective learning and skill acquisition among participants. The training materials include PowerPoint

presentations, PDF documents, and videos – usually embedded in live session presentations– designed to enhance the learning experience and cater to various learning styles.

The training materials strike a balance between theoretical knowledge and practical application. Each module includes detailed theoretical explanations followed by practical exercises and real-world examples. This approach ensures that participants understand the concepts and learn how to apply them in their professional roles. The development of these materials also allowed trainers to put into practice the new digital skills they acquired during the Training of Trainers (ToT) program. By creating and utilising digital content, trainers ensure they are proficient in modern educational technologies, enhancing their pedagogical capacity and ability to deliver the course effectively.

To cater to the diverse needs of participants, the training materials and recordings of the live sessions are made accessible to all participants on the project’s website and YouTube channel. This ensures that participants can access the materials anytime and anywhere, providing flexibility and accommodating different learning paces and schedules. The training material development process was designed to create a comprehensive, engaging, and effective learning experience. By leveraging various educational tools and resources, the GreenVETAfrica Vocational Training Program equipped participants with the necessary skills and knowledge to excel in the waste management sector. The table below shows the details of the location of training materials.

To prove the effectiveness of the proposed methodology, especially considering the potential future replicability of the training program, the consortium developed a questionnaire to gather the students’ feedback. The questionnaire will be administered online and the results of the survey will be illustrated as part of the deliverable D4.2 Pilots Programme Evaluation.

TABLE 3: SUMMARY OF TRAINING MATERIAL

Modules	Materials	Access Link
Man and the Environment	PowerPoint Presentation, Recordings of Live Session	GreenVETAfrica Vocational Training
Waste Management Hierarchy	PowerPoint Presentation, Recordings of Live Session	GreenVETAfrica Vocational Training
Recycling	PowerPoint Presentation, Recordings of Live Session	GreenVETAfrica Vocational Training
Informal Sector	PowerPoint Presentation, Recordings of Live Session	GreenVETAfrica Vocational Training
Plastic Waste Management	PowerPoint Presentation, Recordings of Live Session	GreenVETAfrica Vocational Training
Organic Waste Management	PowerPoint Presentation, Recordings of Live Session	GreenVETAfrica Vocational Training
Waste Management Technology	PowerPoint Presentation, Recordings of Live Session	GreenVETAfrica Vocational Training
Waste Disposal and Treatment	PowerPoint Presentation, Recordings of Live Session	GreenVETAfrica Vocational Training
Environmental Sustainability and Circular Economy	PowerPoint Presentation, Recordings of Live Session	GreenVETAfrica Vocational Training
Safety in Waste Management Industry	PowerPoint Presentation Recordings of Live Session	GreenVETAfrica Vocational Training
Mechanical Measurement Techniques	PowerPoint Presentation, Recordings of Live Session	GreenVETAfrica Vocational Training
Mechanical Drives Systems	PowerPoint Presentation, Recordings of Live Session	GreenVETAfrica Vocational Training
Hydraulic Systems in Waste Management Processes	PowerPoint Presentation, Recordings of Live Session	GreenVETAfrica Vocational Training

Business Management in the Green Waste Industry	PowerPoint Presentation, Recordings of Live Session	GreenVETAfrica Vocational Training
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4. CONCLUSION

The GreenVETAfrica Vocational Training Program underscores the importance of high-quality learning materials in bridging the skills gap within the waste management sector in Nigeria and Ghana. Through the development of comprehensive training modules and diverse educational resources, the program equips participants with the critical knowledge and practical skills needed to excel in green waste management.

The carefully crafted training materials, including PowerPoint presentations, PDF documents, and videos, provide a balanced mix of theoretical knowledge and practical application. This approach ensures that trainees grasp fundamental concepts and learn how to implement them in real-world scenarios. By incorporating these materials into the curriculum, the program offers an engaging and effective learning experience tailored to various learning styles and needs.

Moreover, the emphasis on digital tools and modern educational technologies enhances the accessibility and flexibility of the training. Participants can access materials anytime and anywhere, accommodating different learning paces and schedules. This flexibility is crucial for ensuring that all trainees benefit from the program, regardless of their circumstances.

Furthermore, to improve accessibility and promote knowledge sharing, the training materials are available as open-source resources. These materials are available on the project website [GreenVETAfrica Vocational Training](#) and will be published on the Smart Step e-Learning Platform [Smart Step Community](#) - an ERASMUS+ TVET project funded by the European Commission. Additionally, the resources will be shared with other relevant projects, such as the [Ecovet Project](#), which will broaden their reach and impact across the waste management sector.

The success of the program, facilitated by well-trained trainers utilising these high-quality learning materials, highlights the potential of vocational training to foster sustainable development and environmental stewardship. As participants advance with their new skills and knowledge, they are better equipped to address waste management challenges and contribute to a more sustainable future.

The GreenVETAfrica vocational training programme accreditation in Ghana and Nigeria has been initiated in both countries, aiming at fostering recognition and replicability. The accreditation process and results will be presented in the Deliverable Sustainability Strategy (D5.4, M24).

By equipping trainers with relevant pedagogy and digital skills, preparing comprehensive materials, and fostering a blended approach to learning, the GreenVETAfrica Vocational Training Program effectively addressed the immediate need for skilled professionals in the waste management sector, while ensuring that the training resources are freely accessible for wider replication and adoption.

5. REFERENCES

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