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CircuWasteVETAfrica

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EXECUTIVE SUMMARY

This deliverable presents the outcomes of the stakeholder mapping and skills gap analysis conducted in Ghana, Namibia, São Tomé, and Angola, within the framework of the CircuWasteVETAfrica project. It includes the work done on the identification and profiling of key stakeholders, ranging from SMEs to public institutions and local authorities actively involved in the circular waste supply chain. It shows the concrete result of the stakeholders mapped based on their roles, influence, and engagement potential, providing a strategic overview of the institutional ecosystem shaping the sector.

The document also includes the mapping exercise that laid the groundwork for the skills gap analysis, highlighting key areas where capacity needs to be strengthened to support the development of a strong and sustainable circular economy. It also guides the development of the project modules and includes a heatmap matching the needs with the key expertise of each VET partner.

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ABBREVIATIONS

AfDB	African Development Bank
CWVA	CircuWasteVETAfrica
EU	European Union
GWM	Green Waste Management
ILO	International Labour Organization
MSW	Municipal Solid Waste
NGOs	Non-Governmental Organizations
R&D	Research and Development
SSA	Sub-Saharan Africa
TVET	Technical Vocational Education Training
UNWPP	United Nations Population Projections

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1. INTRODUCTION

This document presents key findings from the stakeholder mapping and skills gap analysis conducted in the first six months of the CircuWasteVETAfrica (CWVA) project by Work Package 4. These findings form the analytical backbone for subsequent project activities. Specifically, it lays the groundwork for the development of targeted training modules, the creation of a TVET partner expertise heatmap, and the establishment of strategic partnerships—all of which are central to ensuring the long-term relevance, impact, and sustainability of the project's outcomes. It offers a structured and comparative overview of the main actors operating across the circular waste management value chain in the four partner countries: Ghana, Namibia, São Tomé and Príncipe, and Angola. The study explores their institutional roles, levels of influence, and current and potential contributions to green skills development and employment generation, especially for youth and informal sector workers.

The document offers key insights into how prepared various stakeholder groups are to engage in or benefit from green and circular economy-related vocational training. It identifies both strengths and bottlenecks in the current system, guiding the co-design of training content that is relevant, responsive, and replicable.

Beyond its immediate function in programme design, this report contributes to the strategic positioning of CWVA as a scalable model for inclusive and sustainable development. The findings will help ensure that the project's deliverables, particularly the training courses, are not only tailored to national contexts but also aligned with broader policy goals, such as the EU Green Deal, Africa-EU Strategic Partnership, and national strategies for climate resilience and youth employability. Ultimately, this document is a key enabler for fostering low-carbon, circular, and digitally enabled urban environments across the continent.

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2. BACKGROUND

Africa is undergoing a rapid transformation marked by accelerating urbanisation, population growth, and shifting consumption patterns—all of which contribute to rising levels of municipal solid waste. At the same time, these trends have exposed critical gaps in infrastructure, regulatory enforcement, and workforce capacity—underscoring the urgent need for targeted vocational training in waste and resource management. The informal handling of waste remains widespread, and formal systems often struggle with inefficiencies, limited reach, and lack of investment.

Yet, the continent holds enormous potential to transition towards a circular economy model, with growing opportunities in areas like composting, plastic upcycling, and community-based recycling initiatives. one in which waste is viewed not as a burden but as a resource. Estimates suggest that up to 90% of municipal solid waste in African cities is recyclable, but current recycling rates remain below 10%, primarily due to systemic barriers such as inadequate sorting systems, limited access to technology, and insufficient training.

A key barrier to progress is the gap between existing skills and the evolving demands of green waste management. This misalignment hinders the sector's ability to grow sustainably. Across much of Sub-Saharan Africa, vocational education remains supply-driven and slow to adapt to evolving labour market demands. Training institutions often lack the technical infrastructure, updated curricula, and pedagogical support needed to equip learners with practical, market-relevant competencies, particularly in areas such as resource recovery, waste valorisation, digital innovation, and environmental compliance.

Moreover, workforce participation is often fragmented along lines of gender, age, and formality. Youth unemployment remains high—over 40–50% in countries like Namibia and Angola—highlighting the urgent need for accessible, targeted vocational training. Simultaneously, the underrepresentation of women and marginalised groups limits the inclusivity of current systems, reinforcing cycles of poverty and exclusion.

As African cities continue to expand, local governments face growing pressure to deliver essential services, including waste collection and treatment, with limited administrative and financial capacity. Strengthening human capital, particularly through targeted TVET reform and inclusive skills strategies, is increasingly seen as a cornerstone for environmental sustainability, economic resilience, and social equity.

This challenging context highlights the urgency of CWVA's mission to build responsive, inclusive skills ecosystems that directly support green transition goals., laying the groundwork for scalable, context-sensitive solutions that can meet Africa's development and climate priorities simultaneously.

2.1. CURRENT STATE OF WASTE MANAGEMENT IN AFRICA WASTE GENERATION AND RECYCLING RATES

Despite the growing urgency of environmental sustainability—particularly in climate resilience and public health—waste management systems in much of Africa remain underdeveloped and highly inefficient.. Although an estimated 80–90% of municipal solid waste (MSW) is technically recyclable, including plastics, paper, metals, and organic matter, less than 4% is currently recycled. The vast majority is deposited in uncontrolled or semi-controlled dumpsites, where it contributes to pollution, greenhouse gas emissions, and resource loss.

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A major contributor to this inefficiency is the lack of appropriate sorting, collection, and processing infrastructure—limiting not only material recovery but also job creation and skills development in the recycling sector. As a result, economic opportunities are missed, and valuable materials that could support local industries and reduce import dependency are lost to landfills.

The informal sector, particularly reclaimers and waste pickers, plays an essential yet undervalued role in diverting waste from final disposal. However, their work remains largely unregulated, under-supported, and disconnected from formal value chains. Unlocking the full potential of circular waste practices will require structured mechanisms to integrate informal workers—supported by inclusive training programmes, safer working conditions, and formal recognition of their contributions..

Progress in this area continues to face critical barriers, including:

- Fragmented policy and regulatory environments that lack enforcement capacity;
- Low public awareness and limited community engagement in sustainable waste practices.
- Insufficient investment in scalable, innovative technologies for material recovery;
- And the low prioritisation of the circular economy in national strategies and public budgets.

Together, these gaps underscore the need for coordinated action—linking institutional reform, financial investment, and skills development—to transition African waste systems from linear disposal models to more regenerative and inclusive circular practices.

2.2. NEEDS ANALYSIS AND SPECIFIC OBJECTIVES

The transition to a circular waste economy across Angola, Ghana, Namibia, and São Tomé and Príncipe requires a workforce equipped with relevant technical, digital, and environmental skills. This includes both the formal and informal sectors, especially micro- and small enterprises (Micro-SMEs) that serve as key actors in local waste value chains.

Country-Specific Challenges and Priorities

Angola generates approximately 6.4 million tons of solid waste annually, with Luanda alone producing around 6,000 tons daily—a volume that far exceeds the city's processing capacity. Environmental leakage is widespread, with plastic and organic waste entering waterways due to storm runoffs and sewer overflows. The government has responded by establishing a national working group to combat plastic pollution and draft a plastic ban strategy. Biodegradable waste comprises 26.5%–45.9% of household waste, depending on income level. Notably, 99% of the waste workforce is male, underscoring the need for inclusive training programmes and gender-sensitive policies in the sector..

Namibia has outlined its priorities in the National Solid Waste Management Strategy (2017), which calls for increased recycling and capacity building across all levels of waste governance. Waste management is closely tied to the country's tourism sector, which is the second-largest contributor to national GDP. The strategy emphasises the need to strengthen technical and managerial skills within municipal, governmental, and private sector actors to support sustainable waste governance.

São Tomé and Príncipe generate around 129,355 kg of municipal solid waste per day, or 0.79 kg per capita. Approximately 81.1% of this waste is improperly managed. Of the daily plastic waste generated (about 16,751 kg), more than 80% is not recovered, with 335 kg/day leaking into the environment. As an island nation with

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delicate ecosystems, São Tomé faces unique challenges in balancing biodiversity preservation with sustainable tourism—highlighting the urgent need for skilled local professionals in waste recovery and environmental management.

Ghana is experiencing rapid urbanisation and industrialisation, which has led to significant increases in solid waste generation, particularly in urban centres like Accra and Kumasi. According to national estimates, Ghana generates around 12,710 tons of municipal solid waste daily, with only 10–15% currently collected and properly disposed of. Informal waste pickers—locally known as 'kayayie' or scrap dealers—play a crucial role in collection and recycling, yet remain excluded from formal systems, pointing to the need for structured training and integration mechanisms. Despite policy efforts such as the National Plastics Management Policy (2020) and several local initiatives on recycling, the country continues to face infrastructure gaps, fragmented institutional mandates, and insufficient public education on waste separation and reuse.

Ghana's TVET institutions have limited resources, and many programmes lack a specific focus on green skills or waste-related training. Although digitalisation efforts are underway, there remains a strong need to better align vocational training with the realities of environmental management and the circular economy. Additionally, youth unemployment remains a pressing issue, particularly in informal settlements and urban peripheries where waste-related work could offer accessible pathways to employment.

Skills Gaps and Labour Market Mismatches

Across all four countries, TVET systems face a range of shared challenges:

- The "missing middle": Many young people leave school without entering further education or training.
- Underfunded VET institutions with limited infrastructure and outdated curricula.
- A shortage of qualified trainers who possess both pedagogical and industry experience.
- Persistent gender stereotyping in training offers: technical trades for men, caregiving and tailoring for women.
- Weak connections between TVET outputs and private sector needs, resulting in perceived irrelevance of VET pathways.
- Few opportunities for practical, hands-on learning experiences within real or simulated work environments.

High youth unemployment exacerbates the need for demand-driven skills development:

- Angola: ~53% of youth (15–24) are unemployed.
- Namibia: ~46%, almost triple the global average.
- São Tomé e Príncipe: ~15.3% (2022).
- Ghana: ~19.7%, with much higher rates in informal urban areas and among women.

Barriers such as gender disparity, lack of career guidance, poor access to training, and misalignment with labour market demand continue to prevent young people from accessing stable, green employment.

2.3. THE URBANISATION TREND POSES NEW CHALLENGES

In recent decades, cities in Africa have grown by over 4% per year, almost doubling their original population between 2000 and 2015 (OECD/SWAC, 2020). They are likely to see further population growth, which is estimated to reach 1.5 billion urban dwellers by 2050 (UNWPP, 2019). Such rapid growth would challenge any

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local government—especially in Africa, where administrative and financial capacities are particularly limited.. Local governments are required to provide infrastructure and services for a population in constant change and growth. Meeting even basic urban needs—such as waste collection and sanitation—requires sustained public investment and long-term infrastructure planning.. Angola: urban population: 68.7% of total population (2023); rate of urbanisation: 4.04% annual rate of change (2020-25 est.) - Namibia: urban population: 54.9% of total population (2023); rate of urbanisation: 3.64% annual rate of change (2020-25 est.) - Sao Tome urban population: 76.4% of total population (2023), rate of urbanisation: 2.96% annual rate of change (2020- 25 est.).

African TVETs are challenged by both internal and external hurdles. The recent analysis conducted by the African Development Bank (AfDB) and the International Labour Organisation (ILO) - "Building pathways to sustainable growth, Strengthening TVET and productive sector linkages in Africa" - acknowledges common challenges across African TVET systems, including:

- A supply-driven approach that is poorly aligned with labour market needs
- Limited training on modern, globally relevant skills
- A perception of TVET as a second-tier option for academically weaker students
    - Underrepresentation of women in key professional sectors
- Limited access to TVET for individuals from low-income households
- Low training quality due to poorly trained instructors, lack of digital skills, and outdated training materials

Nevertheless, the TVET Mapping survey included in the report showed that a **majority of private and public employers indicated that they perceive staff with TVET training as more productive and consider the presence of staff with TVET qualifications to be an important factor when deciding whether to introduce new technologies into the workplace**. Similarly, government officials generally expressed satisfaction with the competencies acquired through TVET. However, they noted a **low level of engagement and collaboration in curriculum design, skills definition**, and the assessment of both teachers and learners.

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3. METHODOLOGY

This section presents the approach and methodology adopted to conduct the Skills Gap Analysis Survey within the framework of the CircuWasteVETAfrica project. The purpose of this activity was to identify existing workforce capabilities, pinpoint critical skill gaps, and initiate a structured dialogue with key stakeholders in the Green Waste Management (GWM) sector across the four participating countries: Angola, Ghana, Namibia, and São Tomé and Príncipe.

The methodology followed a two-phase approach. First, each national partner conducted a **stakeholder mapping exercise**, identifying organisations and institutions with a relevant role in the waste management value chain, ranging from policy-making bodies and local authorities to training providers, private sector actors, NGOs, and informal worker associations. This step ensured recognition of all key players and that the project's outreach accurately reflected each local context.

Once the relevant stakeholders were identified, partners proceeded to the **second phase: the design and distribution of a Skills Gap Questionnaire**. This tool served two main purposes: to collect detailed data for analysis and to engage stakeholders by incorporating their perspectives into the project design. It provided a structured way to collect data on current skills, training needs, and sectoral challenges, while also opening a communication channel with stakeholders to foster their engagement in the future activities of the project (i.e. Stakeholders' Workshop to be conducted in Namibia towards the end of Year 1, and the subsequent one in Angola in Year 2; co-located with project meetings in person; the on-the-job experience of the students enrolled in the programme in Year 2; participation in the public-private collaboration activities in Year 2).

The overall objective of this analysis was to generate reliable, **evidence-based insights to inform the co-design of targeted training programmes and related capacity-building initiatives**. By basing future interventions on real data from the field, the project ensures that its outputs are demand-driven, relevant, and contextually appropriate.

This methodology was deliberately designed to be inclusive and systematic, combining quantitative and qualitative approaches to data collection, analysis, and validation. This approach also enhances the credibility and usefulness of the findings for VET institutions, employers, and policy-makers, who will be essential in implementing the project's training solutions..

3.1. OBJECTIVES

The primary objective of the Skills Gap Analysis Survey, coordinated by SWA, VIS, PRSD, and CFPSTP, was to assess the current skills and competencies present within the green waste management sector across Angola, Ghana, Namibia, and São Tomé and Príncipe. The survey aimed to:

- Identify critical skill gaps and capacity needs affecting both formal and informal sector actors.
- Gather stakeholder perspectives on training priorities and preferred delivery formats.
- Strengthen stakeholder engagement and alignment with the CircuWasteVETAfrica project goals; and
- Generate evidence-based recommendations to inform the development of demand-driven training modules aligned with each country's Vocational Education and Training (VET) framework.

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The insights derived from this exercise serve as a key foundation for the co-design of practical, relevant, and inclusive training pathways that directly respond to labour market needs and systemic challenges in the circular waste economy.

3.2. STAKEHOLDER IDENTIFICATION AND SAMPLING

To ensure the relevance and representativeness of the survey, stakeholders were identified through a mapping process led by each partner in their respective countries. The selection criteria focused on organisations and individuals with direct involvement or demonstrated interest in green waste management, ensuring a broad range of perspectives across the circular waste value chain.

Participants included:

- Sector employers and industry representatives;
- TVET institutions, trainers, and academic staff;
- Government agencies and policy-makers at national and local levels;
- NGOs, environmental organisations, and civil society groups;
- Informal sector actors and community-based waste initiatives.

A purposive sampling approach was applied to prioritise participants with substantial experience and sectoral knowledge. This enhanced the quality of insights collected and contributed to the reliability of the findings.

3.3. DATA COLLECTION

Data were collected using a structured questionnaire designed to capture both quantitative and qualitative information. The tool included:

- Multiple-choice questions to assess current skills, role profiles, and organisational focus;
- Likert-scale items to evaluate the perceived importance and availability of key competencies;
- Open-ended questions to gather nuanced perspectives on sector-specific challenges, capacity needs, and training preferences.

The questionnaires were distributed electronically (via email), using the stakeholder lists compiled during the mapping phase. Each partner managed follow-up actions, including reminder emails and direct outreach, to maximise participation. The data collection period spanned approximately four to six weeks, allowing respondents sufficient time to engage thoughtfully with the questions.

3.4. DATA ANALYSIS

A mixed-methods approach was adopted for data analysis to ensure depth and robustness of interpretation:

Quantitative data: These data (from multiple-choice and Likert-scale responses) were analysed using descriptive statistics, including frequency counts, percentages, and mean scores, to summarise current skill levels and perceived importance of specific technical and soft skills.

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Qualitative responses: These data (from open-ended questions) were subjected to content analysis. Responses were coded, categorised, and synthesised to identify recurring themes related to training needs, institutional barriers, delivery preferences, and broader sectoral challenges.

In addition to trend identification, the analysis specifically focused on pinpointing capacity gaps, i.e., discrepancies between existing competencies and those required to meet the evolving demands of the circular waste management sector.

3.5. VALIDATION AND REPORTING

During the validation process, project staff engaged key stakeholders to verify the questionnaires, ensuring the accuracy, relevance, and credibility of the preliminary findings. This step ensures that the insights derived from data are aligned with the realities of the stakeholders' experiences, expectations, and contextual knowledge. Typically, preliminary findings—derived from both quantitative data, such as surveys, and qualitative data like interviews and focus group discussions—are shared with stakeholders, including educators, administrators, policymakers, and community representatives. These stakeholders review the findings, provide insights, clarify ambiguities, and highlight any discrepancies or overlooked factors. Their feedback is crucial for contextualising the data, validating interpretations, and ensuring that the findings are meaningful and applicable.

A comprehensive report was compiled, integrating quantitative results and qualitative insights, to inform curriculum development and capacity-building initiatives. Reporting systematically synthesises and communicates the study's findings clearly and comprehensively to inform decision-making and guide practical actions in curriculum development and capacity-building.

3.6. LIMITATIONS

As with any data collection process, certain limitations were encountered:

- Response bias, particularly in self-assessment of skills;
- Limited sample size in some countries or stakeholder groups;
- Uneven representation, especially from the informal sector or remote regions.

To mitigate these risks, the consortium engaged in targeted outreach, personalised follow-up, and careful respondent selection to ensure diversity and relevance in the survey population.

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4. STAKEHOLDER INFLUENCE AND INTEREST MAPPING

4.1. INTRODUCTION

Effective stakeholder engagement is essential for driving systemic change in the green waste management sector. In the context of CircuWasteVETAfrica, stakeholder mapping plays a critical role in identifying the actors who influence and implement policy, provide training, deliver services, or engage directly in waste recovery and recycling activities. This exercise aims to create a shared understanding of the key players, their interests, influence, and potential contributions to building a more inclusive, circular, and skills-driven green waste economy.

By defining roles and engagement potential, the mapping process lays the groundwork for future collaboration, fostering co-ownership, policy alignment, and cross-sector partnerships to support the sustainable implementation of training programmes and circular economy strategies.

4.2. STAKEHOLDERS IDENTIFICATION

Stakeholders were identified across a wide spectrum of institutional and operational roles, reflecting the complexity of the green waste value chain. The six main stakeholder groups include:

- Government Agencies: Ministries, regulators, and public authorities involved in environmental policy, waste services, and funding.
- Private Sector: Established waste management firms, emerging recycling businesses, startups, and technology providers.
  Non-Governmental Organisations (NGOs): Civil society actors advocating for sustainability, equity, and community empowerment.
- Vocational Education and Training (VET) Institutions: Formal and informal training providers that deliver skills and capacity building.
- Research and Development Bodies: Universities and research centres contribute data, innovation, and evidence for decision-making.
- Community Groups and Informal Sector Actors: Local associations, cooperatives, and individuals involved in collection, sorting, and reprocessing.

This broad categorisation helps ensure that both high-level decision-makers and grassroots implementers are accounted for in project planning and implementation.

4.3. STAKEHOLDERS INFLUENCE & INTEREST MAPPING

Stakeholders were further analysed based on two key dimensions:

- Influence: Their ability to shape policy, allocate resources, or direct sector development.
- Interest: Their level of engagement, commitment, or dependence on the outcomes of circular waste management efforts.

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The matrix below provides a simplified view of how these actors were classified:

STAKEHOLDER TYPE	HIGH INFLUENCE, HIGH INTEREST	HIGH INFLUENCE, LOW INTEREST	LOW INFLUENCE, HIGH INTEREST	LOW INFLUENCE, LOW INTEREST
Government Agencies	Ministry of Environment	Ministry of Finance	Local municipal departments	Other government bodies
Private Sector	Major recycling companies	Large corporations	Startups in waste management	Unrelated private entities
NGOs	Environmental advocacy groups	Policy-focused NGOs	Community-based NGOs	General advocacy groups
VET Institutions	Specialized green waste training centers	General VET schools	Independent training consultants	General education bodies
Research Institutions	Universities with waste R&D	Non-specialized universities	Independent researchers	Uninvolved institutions
Community Groups	Organised waste collector associations	Informal waste workers' unions	Small cooperatives	Individuals

TABLE 1: STAKEHOLDERS' INFLUENCE & INTEREST MAPPING

4.4. COLLABORATION OPPORTUNITIES & STAKEHOLDERS' ROLES

The stakeholder mapping exercise highlighted the diverse and complementary roles various actors play, which are crucial for advancing a successful circular waste economy. Public institutions, private companies, education providers, and community organisations each have unique contributions to make, both individually and through collaboration.

Government agencies and policymakers are central to setting the regulatory framework for sustainable waste management, ensuring enforcement, allocating public funds, and facilitating inter-institutional dialogue. Through enabling regulation and financial incentives, they can create the conditions for investment in infrastructure, skills development, and innovation. The private sector brings critical capabilities in service delivery, technology, and employment creation. Waste management companies and recycling firms contribute

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strategically by providing training placements, participating in curriculum development, and implementing inclusive hiring practices. Their involvement is essential to ensure that training programmes remain aligned with real labour market needs and technological trends. NGOs and advocacy groups are instrumental in raising public awareness, mobilising communities, and ensuring that marginalised voices—especially informal workers, women, and youth—are included in planning and implementation processes. They can act as facilitators, linking civil society with policy-makers and training institutions, and promoting sustainability through behavioural change campaigns. TVET institutions and research organisations hold the mandate and expertise to design and deliver skills development interventions. By engaging with employers and local authorities, they can ensure that training modules are responsive and adaptable to changing market demands. Research bodies also offer valuable data and innovation that can inform evidence-based planning and policy.

Finally, community groups and informal actors—though often operating at the margins of formal waste systems—play a vital, yet under-recognized, role in waste collection and recovery; their upskilling and formal integration are essential to improving both livelihoods and system effectiveness. Supporting their upskilling and integration into formal systems not only improves livelihoods but also enhances the overall effectiveness and inclusivity of the circular economy transition.

4.5. BARRIERS & OPPORTUNITIES FOR SECTOR GROWTH

While the stakeholder mapping process highlighted several promising collaboration pathways, it also brought to light several structural barriers that must be addressed to unlock the sector's full potential. Weak enforcement of existing policies, combined with overlapping mandates and fragmented responsibilities among institutions, creates confusion and undermines effective sector governance. This creates uncertainty for both investors and training providers, and can hinder coordination between key actors.
In parallel, limited access to financing severely constrains small-scale enterprises, community initiatives, and informal operators, restricting their capacity to expand, invest in training, and adopt new technologies.

The analysis also identified a pronounced skills gap across the value chain. **Many workers, particularly in the informal sector, lack formal training opportunities and are excluded from structured upskilling pathways**. Vocational training providers frequently face **outdated curricula and insufficient practical exposure** to current waste management challenges, weakening the relevance of their programmes and graduates' employability—an issue that targeted curriculum reform and stronger private sector partnerships could address. Yet, the sector also offers multiple growth opportunities. Strengthening partnerships between VET institutions and private companies can support the development of demand-driven training programmes, while increasing access to donor funding and government grants can boost investment in both infrastructure and skills. The expansion of technology transfer mechanisms connecting research institutions with SMEs and start-ups can accelerate innovation and adoption of circular practices. Finally, targeted policy incentives can stimulate the creation of green jobs and promote inclusive business models.

Tapping into these opportunities requires a coordinated, multi-stakeholder approach that leverages existing capacities while addressing structural weaknesses. The CircuWasteVETAfrica project is positioned as a strategic catalyst, fostering coordinated action that aligns skills development with national and regional circular economy objectives and climate resilience priorities.

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5. IDENTIFYING SKILLS GAP

The CircuWasteVETAfrica project undertook a comprehensive skills gap analysis with **24 organisations spanning Ghana, Namibia, São Tomé, and Angola, aiming to identify critical workforce deficiencies hindering the transition to a modern circular economy**. The analysis revealed that **the most significant gap lies in advanced waste treatment technologies, cited by 26.8% of respondents**. This indicates a clear need for investment in upskilling workers with technical expertise in modern waste management systems and equipment.

Financial management emerged as the second-largest gap (18.3%), reflecting widespread challenges with budgeting, cost control, and securing or managing funds essential for sustainability initiatives. Equally important were deficiencies in policy development and implementation (16.9%) and sustainable resource management (14.1%). These findings highlight a systemic need for strategic planning and policy literacy within the sector.

While technical areas dominate the identified gaps, softer skills and systems-level thinking are also underrepresented. Skills in stakeholder collaboration and understanding of circular economy principles were mentioned less frequently (11.3% and 9.9% respectively), suggesting that while technical operations are a priority, cross-sector engagement and holistic sustainability concepts are not yet well integrated. A few respondents (2.8%) cited other gaps, such as knowledge in renewable energy and consumer-based waste reduction, reflecting emerging but currently niche focus areas.

The analysis highlights a critical dual challenge: **advancing technical expertise while simultaneously strengthening leadership, financial acumen, policy understanding, and innovation capacity**. Neglecting either dimension risks undermining organisations' ability to drive a successful and sustainable circular waste transition.

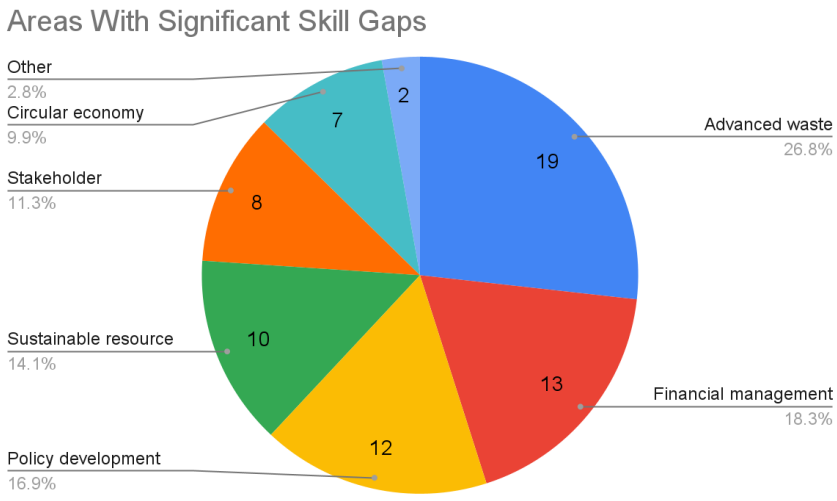

FIGURE 1: A CHART SHOWING AREAS WITH SIGNIFICANT SKILL GAPS

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5.1. CURRENT SKILLS AND COMPETENCIES

The analysis revealed that staff across surveyed waste management organisations possess a solid foundation of essential operational competencies in waste management. *Technical knowledge of waste management processes and adherence to environmental compliance were the most frequently reported skills, each present in 20.7% of organisations—highlighting the sector's established capacity for fundamental operational tasks.* These foundational capabilities are essential to basic waste handling and regulatory adherence and show that the sector has built a good starting point for technical operations.

In addition, 17.2% and 16.1% reported competencies in community engagement and health and safety protocols, respectively. This reflects an understanding of the sector's need for outreach and operational safety. In contrast, crucial skills like project management (10.3%), research and development (9.2%), and particularly data analysis and reporting (4.5%) were much less common, underscoring a significant gap in analytical and strategic capacities. This indicates a major need to boost analytical capacity and evidence-based planning in circular waste management initiatives.

Regarding staff proficiency levels, 50% of respondents rated their workforce at a level 4 (strong), while 29.2% gave a level 3 (moderate), and only 16.7% assessed their staff at level 5 (excellent). This reinforces the perception that while staff members are competent, many are not operating at peak performance or are lacking in advanced and emerging skills.

While the workforce demonstrates solid technical foundations, urgent investment is needed to cultivate advanced skills in innovation, strategic planning, and data-driven decision-making—essential components for driving sustainable, circular waste management systems in the partner countries. Strengthening these areas will be critical for achieving sustainable, circular waste management systems across the partner countries.

5.2. TRAINING AND DEVELOPMENT NEEDS

The training and development needs identified through the survey directly correspond to the skills gaps and workforce capabilities previously analysed, highlighting clear priorities for targeted intervention. Priority areas include **advanced waste treatment technologies, financial and project management, and policy development**—all of which require specialised training programs and updated curricula. These topics are not only technically demanding but also vital for scaling sustainable practices and ensuring regulatory compliance in a transitioning economy.

Digital tools were another high-priority training area, especially for educational institutions. Trainers at PRSD in Ghana emphasised the need for digital integration in the classroom and competency-based learning models. Similarly, CFPSTP in São Tomé prioritises upskilling in entrepreneurship and digital pedagogy. This underscores the dual need for technological literacy and modern teaching approaches in vocational education.

Pedagogical development also emerged as a key area of interest, with institutions highlighting the importance of training in classroom management, conflict resolution, Design Thinking, and personalised learning strategies—essential for VET instructors tasked with supporting diverse and dynamic student populations.. These skills are especially important for VET instructors who must tailor instruction to diverse student needs while fostering innovative thinking. Institutions in Angola, such as INEFOP and Don Bosco, emphasised the need for ongoing technical specialisation, reflecting their concern about staying updated in a fast-changing job market.

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In terms of logistics, most institutions expressed readiness to host training sessions and have access to training spaces and personal digital devices. Nevertheless, **infrastructure disparities—such as limited access to up-to-date equipment, reliable internet, and digital learning materials in centres like Don Bosco—pose serious challenges.** Bridging these gaps is essential to ensure that training delivery is both effective and equitable across all participating countries. Addressing these limitations will be key to delivering effective and equitable training programs across the region.

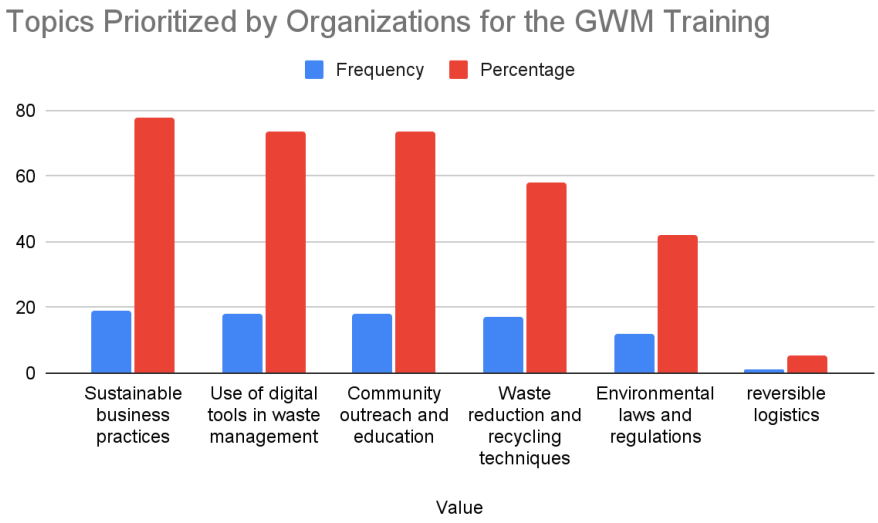

FIGURE 2: A CHART SHOWING TOPICS PRIORITISED BY ORGANISATIONS

5.3. KEY CHALLENGES AND GAPS IDENTIFIED

Budgetary constraints represent the most pervasive and systemic challenge identified, affecting 18 of the 24 surveyed organisations. This financial limitation severely hinders the ability of institutions and enterprises to invest in staff training, equipment, and curriculum updates. Without sustainable funding models or access to external support, even well-identified training needs remain unmet.

Closely linked to financial constraints is the **insufficient availability of relevant training programmes**, highlighted by 16 respondents. Limited funding restricts both the development and delivery of high-quality, context-specific learning opportunities—particularly in rapidly evolving fields like digitalisation and modern waste treatment. This is particularly problematic in fast-evolving fields such as waste treatment and digital technologies, where ongoing professional development is essential.

Organisations also reported a shortage of qualified candidates (12 mentions), **highlighting a talent pipeline issue**. Many potential hires lack the technical or pedagogical skills necessary for the sector's future growth. Additionally, the pace of technological change and limited access to updated information (each cited by 8 respondents) make it difficult for even well-trained staff to stay current.

A few organisations also mentioned challenges related to insufficient employee numbers and weak industry partnerships. These problems not only exacerbate existing skill gaps but also reduce institutional capacity to absorb new knowledge and innovations. Addressing these multifaceted barriers will require systemic reforms—ranging from sustainable funding mechanisms and public-private partnerships to stronger industry linkages and targeted investment in VET infrastructure. CircuWasteVETAfrica can play a catalytic role by piloting scalable solutions and fostering collaboration between training providers, policy-makers, and industry actors.

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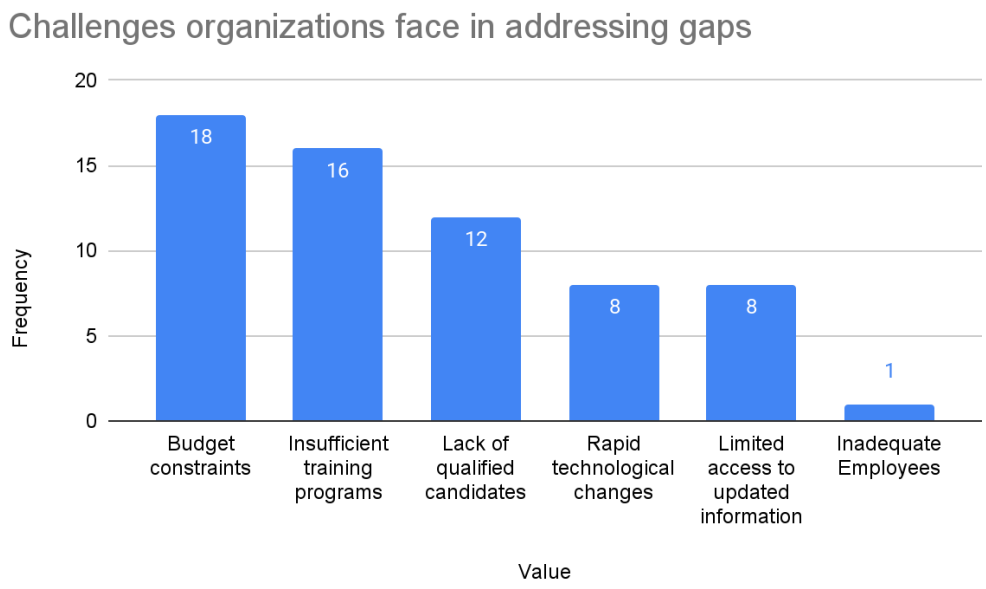

FIGURE 3: A CHART SHOWING THE CHALLENGES ORGANISATIONS FACE

5.4. FINDINGS

The geographic and institutional composition of the respondents provides important context for interpreting the findings and gauging the representativeness of the skills landscape. Of the 24 organisations surveyed we had nine from Ghana, eight from Namibia, five from São Tomé, and two from Angola. Waste management companies made up the largest % of respondents at 37.5%, followed by vocational education and training (VET) institutions at 25%. This diversity reflects the industrial and educational sides of the circular economy value chain.

Surveyed organisations identified **several priority topics for further training and collaboration**. These included sustainable business practices (19 mentions), digital tools for waste management (18), and community outreach and education (18). Recycling and waste reduction techniques were also highly prioritised (17), showing an interest in practical, day-to-day operational improvements.Conversely, reverse logistics and more advanced circular economy concepts received limited attention, suggesting a knowledge or awareness gap that could hinder the development of closed-loop systems and innovation in waste recovery.

When asked about their **willingness to support training and capacity-building initiatives, organisations showed a strong interest in direct engagement**. A majority (34.8%) expressed willingness to deliver guest lectures or workshops, while 30.4% were open to contributing to curriculum development. Additionally, 21.7% offered to provide internships or apprenticeships, though fewer organisations were equipped to offer site visits or combined services.

These findings demonstrate a **strong appetite for collaboration** and a growing awareness of the skills needed to advance the circular economy. However, they also point to the need for better coordination, funding, and program design to turn intent into impact. While stakeholder willingness is high, structured coordination, targeted funding, and well-designed collaboration frameworks are needed to translate this intent into tangible, sustained capacity-building outcomes—areas where CircuWasteVETAfrica can provide critical leadership.

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5.5. COLLABORATION OPPORTUNITIES AND ROLES

Building on the survey findings around training gaps and institutional readiness, the CircuWasteVETAfrica project also uncovered encouraging levels of commitment from various organisations across the participating countries to support skills development and practical learning. Several institutions expressed a strong willingness to offer on-the-job training opportunities, which are vital for bridging theoretical knowledge with real-world application. Among them are Das Biogas, Ecohezz Home Décor Accessories, Aman-Sark Skills Development Institute, and Recycle Up! from Ghana; Okakarara Vocational Training Centre and OVTC from Namibia; and the Câmara Distrital de Mé-Zochi in São Tomé. These organisations are positioned to provide trainees with immersive work-based learning environments that enhance employability and practical skills in waste management and circular economy practices.

Additionally, a significant group of organisations has committed to **hosting in-person workshops** on sustainable practices, vocational instruction, and circular economy innovations.. These include organisations from Angola (e.g., ADRA–Angola, Associação Nação Verde), São Tomé (e.g., Camara Distrital de Lobata, Camara de Água Grande), Namibia (e.g., Rent A Drum, Recycle Namibia Forum, Plastic Packaging (PTY) Ltd), and Ghana (e.g., Nana Serwaa Garment Industry and Skills College, Jajil Institute). These institutions offer valuable human and technical resources and play a crucial role in the dissemination of context-specific knowledge and best practices.

Bio Bags Plus Unipessoal Lda has also expressed readiness to facilitate mentorship programmes. Mentorship provides learners with guided exposure to industry experiences, fosters professional development, and builds leadership within the circular economy ecosystem. Such personalised learning pathways not only improve individual skill development but also help build a pipeline of future trainers and green entrepreneurs—key objectives of the CircuWasteVETAfrica initiative.

The study found multiple avenues for strengthening collaboration across public, private, and educational sectors. **In São Tomé, the 64% employability rate achieved by CFPSTP through robust public-private partnerships (PPPs) positions it as a regional benchmark. Its internship-driven model offers valuable lessons for peer institutions** in Ghana and Angola, where collaboration mechanisms remain limited or underdeveloped.

PRSD in Ghana has begun mapping industry partners but lacks comprehensive data on employment outcomes, limiting its ability to refine its programs to meet market demands. Despite individual efforts, collaboration across the region remains fragmented and uneven. For instance, while Angola's INEFOP maintains several internship partnerships, the Don Bosco Dondo Centre has experienced declining outcomes due to weakened industry ties. Similarly, PRSD in Ghana has initiated stakeholder mapping but lacks reliable data on graduate employability, hampering program adaptation.

Across the board, stakeholders expressed strong interest in modules focused on pedagogical upskilling, circular innovation, and PPP development. Trainers were especially motivated to participate in training programs that align with these themes. Institutions also indicated they have the physical space and human resource capacity to support such efforts, provided funding and infrastructure challenges are addressed.

The findings show that successful collaboration ultimately depends on aligning incentives, clarifying roles, and building trust between institutions and industry. By engaging stakeholders in co-designing curricula, co-hosting training sessions, and supporting entrepreneurial initiatives, CircuWasteVETAfrica can foster a more integrated and responsive skills ecosystem for the circular economy in Africa. The proactive engagement of institutions across the four countries provides a strong entry point for CircuWasteVETAfrica to co-create employment-focused training ecosystems—ensuring that circular economy skills development is both inclusive and industry-aligned.

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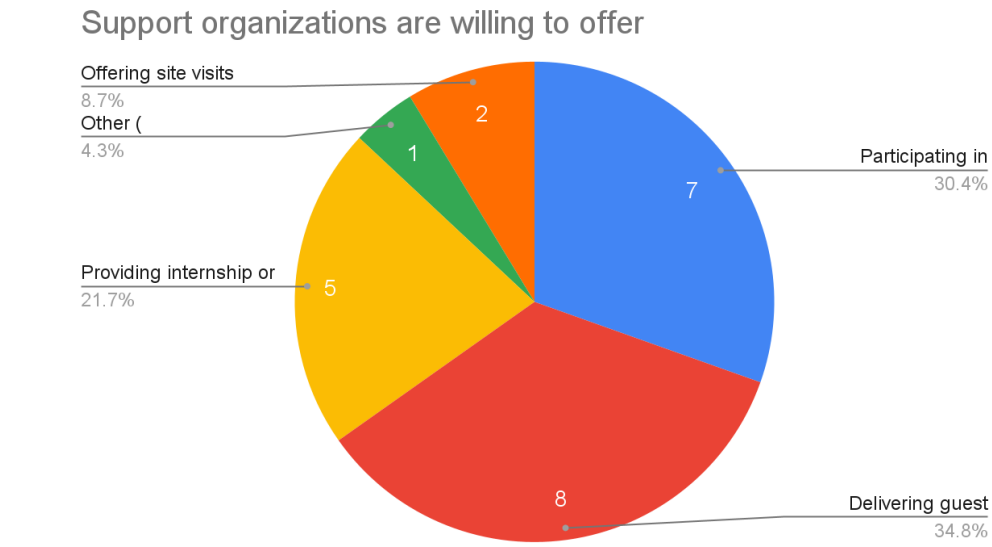

FIGURE 4: A CHART SHOWING SUPPORT ORGANISATIONS ARE WILLING TO OFFER

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CONCLUSIONS

The stakeholder mapping and skills gap analysis across 24 organisations in Ghana, Namibia, São Tomé, and Angola (list of the organisations provided in the Annexes) revealed that waste management companies and VET institutions are key actors in the circular economy value chain. The organisations prioritised training topics such as sustainable business practices, digital tools for waste management, community outreach, and waste reduction techniques, underscoring strong regional demand for applied skills and scalable operational improvements.. Moreover, there is a demonstrated willingness among stakeholders to actively participate in capacity-building efforts through guest lectures, curriculum development, and internships, signalling a robust appetite for collaboration.

These findings underscore the importance of coordinated efforts, strategic funding, and tailored program design to translate stakeholder interest into tangible impact. By empowering vocational institutions and integrating informal reclaimers into formal systems, while fostering cross-sector partnerships, the initiative aims to unlock Africa's vast recyclable resource potential, supporting local economies, creating green employment, and reducing reliance on landfilling.

Through targeted capacity-building, innovative business models, and inclusive stakeholder engagement, CircuWasteVETAfrica seeks to catalyse a regional transition towards a circular economy, creating meaningful employment, enhancing resource efficiency, and preserving natural landscapes for generations to come.

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APPENDIX A

ORGANISATIONS INVOLVED IN THE SKILL GAPS ASSESSMENT

ORGANISATION NAME	TYPE OF ORGANISATION	LOCATION (CITY, COUNTRY)
Adra, Angola	Non-Governmental Organisation	Luanda - Angola
Associação Nação Verde	Non-Governmental Organisation	Angola, Luanda
TrashSmart	Waste Management Company	Kumasi
DasBiogas and Construction Ltd	Waste Management Company	Ghana
Bio Bags Plus Unipessoal Lda	Waste Management Company	São Tomé e Príncipe
Ike-Dian fashion	Waste Management Company	Ejura-Seyeredumase
ECOBLASA	Waste Management Company	Santana
Okakarara Vocational Training Centre	VET Institution	Okakarara, Namibia
Camara Distrital de Lobata	Government Agency	S. Tomé - Cidade de Guadalupe - Distrito de Lobata
Plastic Packaging (PTY) Ltd	Packaging company that does mechanical recycling of plastics	Windhoek & Okahandja, Namibia
Camara de Água Grande	Government Agency	São Tomé
Câmara distrital de Mé-zochi	Government Agency	São Tomé
Nana Serwaa Garment Industry and Skills College	VET Institution	Kumasi, Ghana
Aman-Sark Skills Development Institute	VET Institution	Ashanti, Ghana
Jajil Institute	VET Institution	Oforikrom, Ghana
Recycle Up! Ghana	Non-Governmental Organisation	Fumesua, Ghana
Rent A Drum	Waste Management Company	Windhoek, Namibia

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Recycle Namibia Forum	Non Profit, membership driven association	Windhoek, Namibia
FRONTIER MULTI INDUSTRIES	Waste Management Company	Windhoek, Namibia
Ministry of Environment, Forestry and Tourism	Government Agency	Windhoek, Namibia
COSDEF	VET Institution	Swakopmund, Namibia
OVTC	VET Institution	Okakarara, Namibia

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APPENDIX B

GAP ANALYSIS SURVEY FOR CIRCUWASTEVETAFRICA GREEN WASTE MANAGEMENT

Dear [Participant],

Thank you for participating in this survey to identify Green Waste Management sector skill gaps. Your insights will be invaluable in developing a course under the CircuWasteVETAfrica project that addresses the specific needs of employers and Vocational Education and Training (VET) institutions.

SECTION A: ORGANISATION INFORMATION

1. **Organisation Name**

2. **Type of Organisation**
- Waste Management Company
- VET Institution
- Government Agency
- Non-Governmental Organization
- Other (Please specify)

3. **Location**
- City
- Country

4. **Number of Employees**

- 1-10
- 11-50
- 51-200
- 201-500
- 501 and above

5. **Primary Areas of Operation:**

- Waste Collection
- Waste Treatment
- Recycling
- Hazardous Waste Management
- Training and Education
- Policy and Advocacy
- Other (Please specify)

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SECTION B: CURRENT SKILLS AND COMPETENCIES

6. What are the key skills and competencies currently present in your organisation? (Select all that apply.)

- Technical knowledge of waste management processes
- Environmental compliance and regulations
- Health and safety protocols
- Data analysis and reporting
- Community engagement and awareness
- Research and development
- Project management
- Other (Please specify)

7. How would you rate the proficiency of your staff in the following areas? (Rate on a scale of 1 to 5)

- Technical operations: [1] [2] [3] [4] [5]
- Regulatory compliance: [1] [2] [3] [4] [5]
- Use of technology and digital tools: [1] [2] [3] [4] [5]
- Communication and interpersonal skills: [1] [2] [3] [4] [5]
- Problem-solving and innovation: [1] [2] [3] [4] [5]

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SECTION C: IDENTIFYING SKILL GAPS

8. In which areas do you observe significant skill gaps within your organisation or the industry?

- Advanced waste treatment technologies
- Circular economy practices
- Sustainable resource management
- Policy development and implementation
- Financial management in waste projects
- Stakeholder collaboration
- Other (Please specify)

9. What challenges do you face in addressing these skill gaps?

- Lack of qualified candidates
- Insufficient training programs
- Budget constraints
- Rapid technological changes
- Limited access to updated information
- Other (Please specify)

SECTION D: TRAINING AND DEVELOPMENT NEEDS

10. Which topics would you prioritise for inclusion in a Green Waste Management training program?

- Waste reduction and recycling techniques
- Environmental laws and regulations
- Sustainable business practices
- Use of digital tools in waste management
- Leadership and management skills
- Community outreach and education
- Other (Please specify)

11. What training formats do you find most effective?

- In-person workshops
- Online courses
- On-the-job training
- Seminars and conferences
- Mentorship programs
- Other (Please specify)

12. How often does your organisation invest in staff training and development?

- Quarterly
- Bi-annually

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- Annually
- As needed
- Rarely

SECTION E: COLLABORATION AND SUPPORT

13. Is your organisation interested in collaborating with VET institutions?

- Yes
- No
- Maybe (Please specify)

14. What type of support would you be willing to offer?

- Providing internships or apprenticeships
- Offering site visits or tours
- Participating in curriculum development
- Delivering guest lectures or workshops
- Providing funding or resources
- Other (Please specify)

SECTION F: ADDITIONAL INSIGHTS

15. What emerging trends or technologies in Green Waste Management should be considered?
16. Do you have any additional comments or suggestions?

Thank you for your feedback.

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