Waste Technical Committee Meeting

1st Meeting Report

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List of Abbreviations

AJK	Azad Jammu & Kashmir
CTCN	Climate Technology Centre and Network
DD	Deputy Director
DGA	Director General Agriculture
EPA	Environmental Protection Agency
FBC	Fluidized Bed Combustion
GB	Gilgit-Baltistan
GGC	Green Growth Consultants
GGGI	Global Green Growth Institute
KPK	Khyber Pakhtunkhwa
LG&RD	Local Government and Rural Development
MoCC&EC	Ministry of Climate Change and Environmental Coordination
MRF	Material Recovery Facility
MSW	Municipal Solid Waste
NDC	Nationally Determined Contributions
PET	Polyethylene Terephthalate
P&D	Planning and Development
RDF	Refuse-Derived Fuel
SEED	Sustainable Energy and Economic Development
WASA	Water and Sanitation Agency

1. Introduction

A technology roadmap for NDC implementation is a strategic planning tool that provides a structured approach to identify, prioritize, and sequence the deployment of technologies to address climate change challenges and promote sustainable development. Pakistan's *Nationally Determined Contributions 2021* prioritizes technology-based interventions as a means towards climate action and calls for technology transfer and interventions for key sectors in Pakistan, including water and waste. Pakistan is committed to the incorporation of technology in its climate agenda and shaping an enabling environment for the effective incorporation of technology in its NDC implementation to ensure efficiency, inclusive access, and adequate management of its water and waste sectors. To achieve this, the Ministry of Climate Change and Environmental Coordination (MoCC&EC), through the Climate Technology Centre and Network CTCN's technical assistance, has started the development of Pakistan's Technology Roadmap for the waste and water sectors for NDC implementation.

Taking the lead from the kick-off workshop organized in February to highlight the priority subsectors and technology options, along with finalization of the Waste Technical Committee, the **1st stakeholder feedback waste technical committee meeting** took place on the 21st of March, 2024 to further assess and shortlist the technologies identified through stakeholder sensitization and desk review for the **waste** sector.

2. Objectives of the Meeting

The primary goal of this meeting is to ensure that the process to formulate the NDC Technology Roadmap is collaborative, inclusive and data-driven. The aim was to interact with the Committee to conduct a sectoral-level assessment and technology prioritization from the long list of technologies developed through prior consultation in the kick-off workshop and research phase. The three primary objectives of the meeting are listed as follows:

- **Identify and map region-specific issues in the waste sub-sectors:** Through interaction with provincial and sectoral stakeholders, we assessed and identified what issues, specific to our region and socio-economic context, had plagued the waste sector and impacted efficient and equitable management and delivery.

- **Prioritize Technologies for each identified sub-sector:** Through an interactive session, the participants were asked to select the technologies for each identified sub-sector that most suitably and effectively addressed the identified region-specific issues.

- **Identify issues that hinder the adoption of prioritized technologies in respective regions:** To assess significant barriers that hinderd the effective management and delivery of waste sector services.

This component aimed to identify region-specific issues that may arise and adversely impact the adoption and utilization of the prioritized technologies for the three sub-sectors. It sought to provide a grounded view that would help pave the way forward toward the successful uptake of the identified technologies.

3. Methodology

The meeting was held online through a pre-shared Zoom link and was attended by 15 participants of the technical committee, excluding the GGGI, GGC, and MoCC&EC teams. The technical committee was formulated by GGC with assistance from the Ministry of Climate Change & Environmental Coordination (MoCC&EC), and the list of participants from the relevant sectors was finalized by MoCC&EC, which is also attached as (**ANNEX-I)**. Following the identification of three waste sub-sectors during the kick-off workshop which took place on 22nd February 2024, a comprehensive list of technologies was formulated for each of the three sub-sectors: **Municipal Solid Waste** (MSW), **Plastic Waste**, and **Agricultural Waste**. Next, through extensive desk reviews technologies for each sub-sector were identified and supplemented through stakeholder consultations in all provinces/regions (Punjab, Sindh, Balochistan, Khyber Pakhtunkhwa, Azad Jammu & Kashmir, and Gilgit-Baltistan).

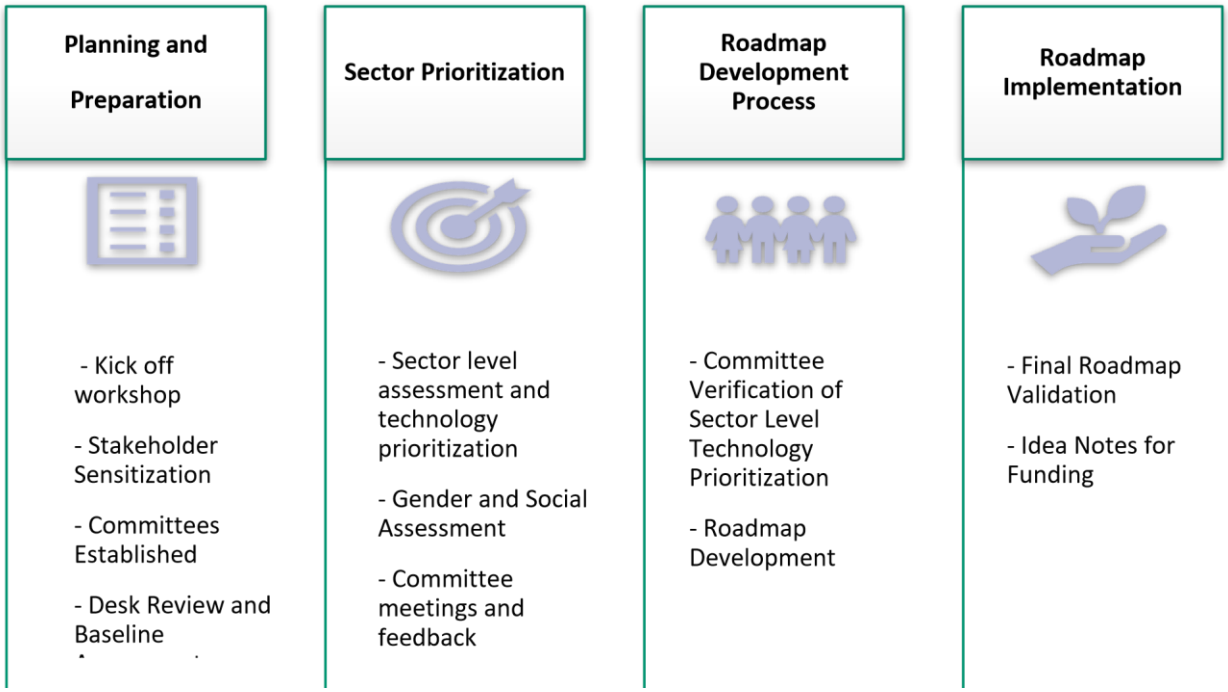
This meeting and feedback collection was conducted using three platforms: Zoom, Mentimeter, and Google Forms. During the meeting, moderators encouraged the stakeholders to verbally share their opinions, and to ensure smooth execution of this meeting and meet the objectives. Mentimeter software was utilized to hold an interactive discussion session with participants to identify waste sector issues, prioritize technologies, and identify challenges hindering implementation. This session was recorded on Zoom. Following this, a Google Form was shared with participants to record their results as well. This meeting and the recorded responses successfully facilitated the identification of prioritized technologies for each sub-sector. These were examined and assessed further.

4. Discussion and Outcomes

The following discussion and outcomes were achieved during and after the waste technical committee meeting held via Zoom with technical committee members, GGC, and GGGI team members.

4.1. Roadmap Development Process

Before the technical committee meetings, GGC, in consultation with GGGI, developed a comprehensive work plan, which could be improved upon feedback. The main activities of the roadmap development process, some of which were completed and others were in progress, are given below:



Stakeholders in the technical committee meetings inquired about the roadmap development process and the shortlisting of the sub-sectors. Queries were addressed by clarifying the roadmap development process and providing guidance about the selection process of the sub-sectors during the Kickoff meeting workshop.

4.2. Sector-Specific Issues

i) Municipal Solid Waste

- Residents are not segregating waste into different categories (organic, plastic, etc.) before disposal which hinders effective management
- The current system for collecting municipal solid waste is inefficient.
- Inadequate infrastructure exists for wastewater management, potentially leading to combined sewage and solid waste problems.
- There is a shortage of fiscal resources dedicated to addressing MSW management.
- A modern landfill site is needed for proper disposal, but the current option may be outdated.

ii) Plastic Waste

- Informal waste collectors and private companies are not collecting or recycling thin/singleuse plastics, likely due to their low value or processing difficulty.
- The volume of plastic waste is steadily increasing leading to widespread open dumping of plastic waste
- There is a lack of proper infrastructure and technology to effectively segregate, manage and recycle plastic waste.

iii) Agriculture Waste

- The practice of burning crop residues after harvest contributes to extreme air pollution.

In Khyber Pakhtunkhwa, challenges such as the proliferation of PET and single-use plastics, nonsegregation of waste at source, and a lack of awareness and technical expertise were noted. Stakeholders added that the lack of industrial presence willing and able to convert granules into polyester led to transportation to other areas, making it an expensive process that needed to be addressed. Furthermore, the waste collection, segregation, and disposal systems required urgent improvement.

In Azad Jammu & Kashmir, the absence of essential infrastructure, including sewage systems and mechanisms for plastic and municipal waste disposal, along with financial constraints, was discussed. Gilgit-Baltistan's challenges revolved around the lack of modern landfill sites, highlighting the region's need for appropriate waste disposal facilities. In Sindh, the intersection of waste management with agricultural and municipal activities was a focus, emphasizing the need for integrated strategies. At the federal level, challenges related to municipal solid waste were noted, pointing to broader governance issues in waste management. Punjab faced challenges related to crop stubble management and burning, emphasizing the need for sustainable agricultural practices to mitigate environmental pollution.

These region-specific challenges highlighted the complexity of waste management, underscoring the need for tailored solutions/technologies and collaborative governance efforts for mitigation.

4.3. Prioritized Technologies

A total of 15 responses were received from the technical committee, which includes 3 from AJK, Punjab, and GB, 4 from KPK, and 1 each from Sindh and Federal.

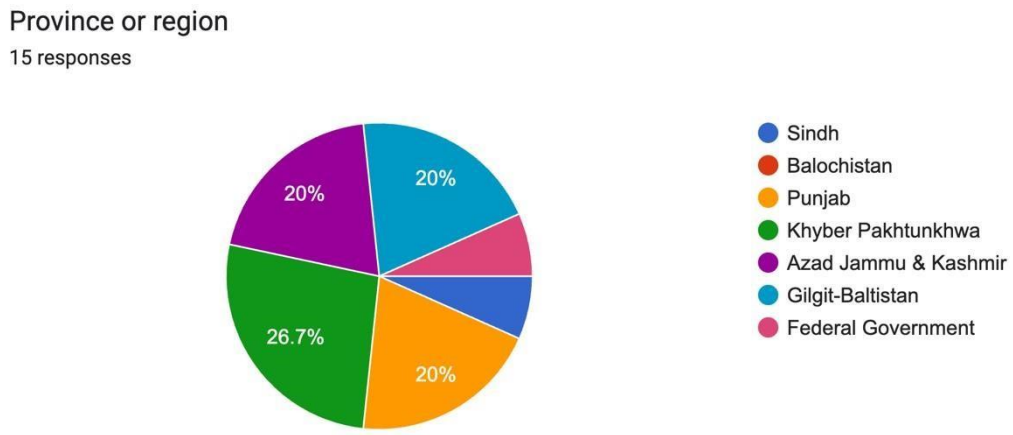
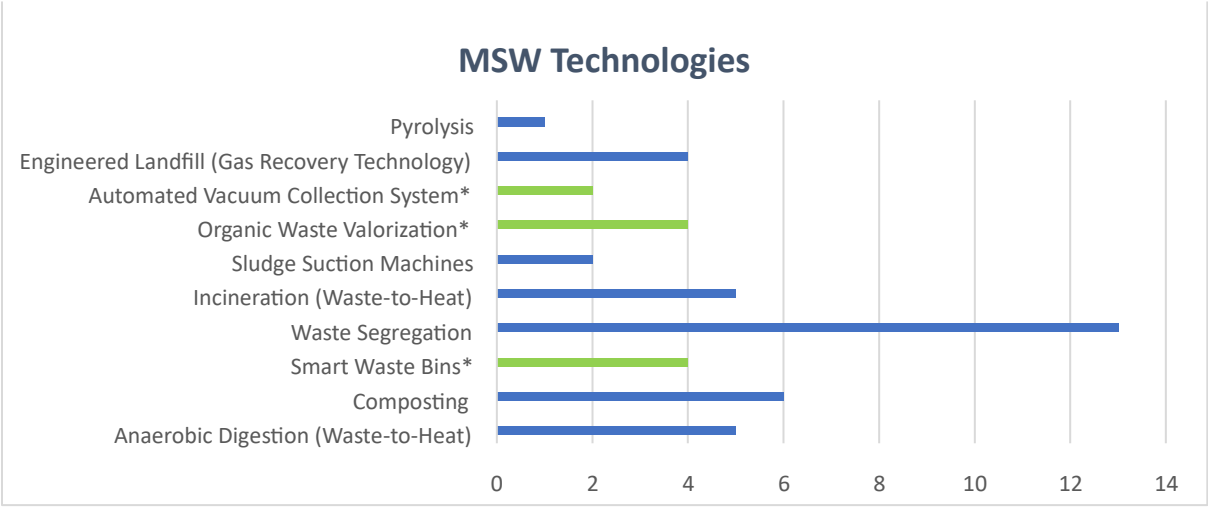


Figure 1 - Provincially Distributed Participation

The meeting discussions and feedback involved the identification and mapping of technologies, through voting by provincial stakeholders closely involved in the management and delivery of the waste sector. The technologies prioritized by the participants were as follows:

i) Municipal Solid Waste

(Emerging technologies *)



Stakeholders were given a list of technologies categorized as either existing or emerging technologies, among which they had to prioritize their preferences. The following results were yielded for the MSW sub-sector:

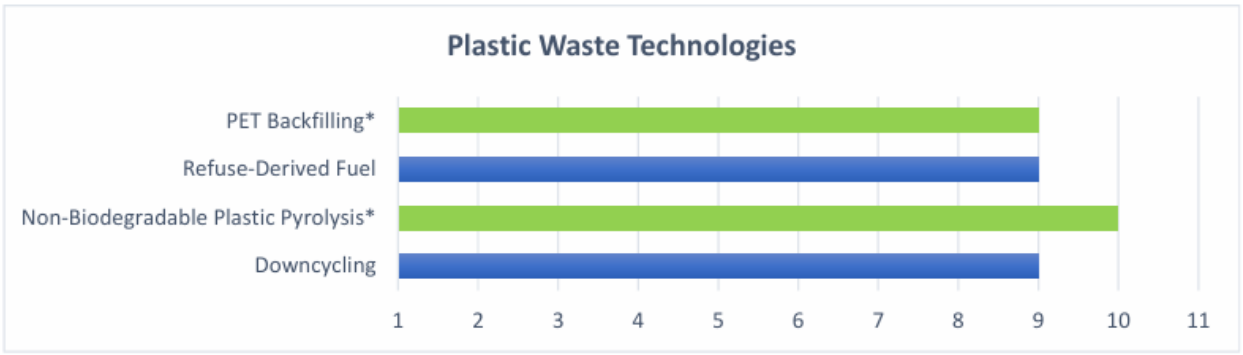
Existing Technologies: Stakeholders have shortlisted various technologies in the municipal solid waste sector to address waste management challenges. Among the existing technologies, waste segregation (13 votes) and composting, Anaerobic Digestion, and Incineration (5 votes) received

the highest number of votes, indicating their recognized importance. Waste segregation is noted as an integral step towards efficient waste management while composting symbolizes a sustainable approach to waste reduction and resource recovery. Incineration and Anaerobic digestion involve the breakdown of waste into gaseous products like methane.

Emerging Technologies: Smart waste bins, embodying the fusion of digital technology with traditional waste management infrastructure, and organic waste valorization, with 4 votes, emerged as notable technologies, reflecting the growing interest in integrating digital solutions and biological processing for waste management efficiency. Other emerging technologies like automated vacuum collection systems also received some votes (2 votes), demonstrating a shift towards innovative approaches for waste handling and resource recovery.

ii) Plastic Waste

(Emerging technologies *)



Stakeholders were given a list of technologies categorized as either existing or emerging technologies, among which they had to prioritize their preferences. The following results were yielded for the Plastic Waste sub-sector:

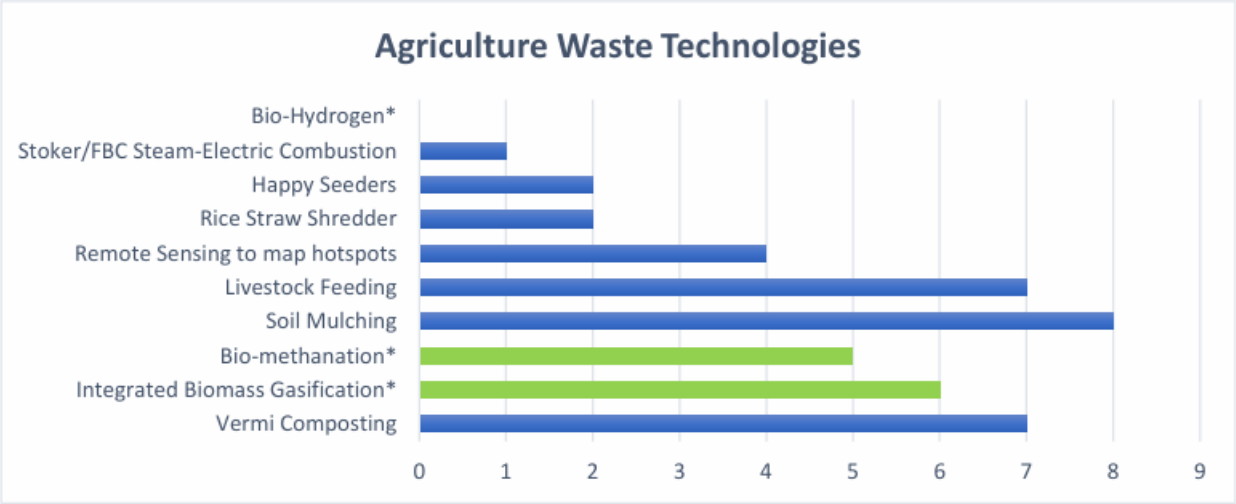
Existing Technologies: Refuse-Derived Fuel (9 votes) and Downcycling (9 votes), were the two choices in the existing technologies domain, reflecting efforts to convert plastic waste into valuable resources through thermal and mechanical processes.

Emerging Technologies: Non-biodegradable plastic pyrolysis received the highest votes (10) in emerging technologies, showcasing the interest of the stakeholders in this technology. Additionally, PET backfilling also received several votes (9), which makes it a potential solution for plastic waste management, indicating potential applications in sustainable waste disposal and construction materials.

A stakeholder from the waste technical committee meeting added that **Single-use Plastic is also a serious issue** that needs to be addressed alongside PET.

iii) Agriculture Waste

(Emerging technologies *)



Stakeholders were given a list of technologies categorized as either existing or emerging technologies, among which they had to prioritize their preferences. The following results were yielded for the Agriculture Waste sub-sector:

Existing Technologies: Soil mulching (8 votes), Vermicomposting (7 votes), and Livestock Feeding (7 votes) emerged as the top choices among existing technologies, highlighting their significance in converting organic waste and improving soil health.

Emerging Technologies: Additionally, integrated biomass gasification (6 votes) garnered the most votes as the preferred emerging technology, indicating a growing interest in utilizing agricultural biomass for energy generation. Moreover, stakeholders showed considerable support for biomethanation (5 votes), recognizing its potential in producing biogas from agricultural waste and promoting sustainable waste management practices.

Stakeholders also mentioned during the meeting that **Biochar technology** should also be included in the list, as it can prove to be a technically and economically feasible option for agricultural waste management in Pakistan.

A stakeholder also mentioned that there was a lack of a proper waste collection system for all subsectors, which needed to be addressed to utilize the full potential of all the technologies that were going to be prioritized.

4.4. Technology Specific Challenges

In the session conducted through the Mentimeter tool, participants were asked to vote for challenges that had affected the use of their chosen technologies. Multiple possible options were provided to them to vote for the highly relevant issues. For smooth execution and ensuring maximum participation, moderators encouraged the stakeholders to record their voice through verbal inputs as well. The challenges that were recorded by stakeholders verbally and through the Zoom platform are also covered here.

Verbal recorded statements of the waste technical committee meeting suggest that technological challenges hinder Pakistan's ability to implement a comprehensive and efficient waste management system. These challenges include the **lack of technology** for efficient processing of specific waste streams, such as **banana waste and slaughterhouse waste**, as well **as limited adoption** of existing technologies like **rapid composting plants**. **Shredders** should be provided for banana waste. Additionally, the high cost of waste management technologies creates a burden for service providers, while limited access to financing affects small-scale waste management initiatives, particularly for women in rural areas, Operational challenges, such as **ineffective waste collection** and **lack of proper waste segregation** at the source, exacerbate the situation. **Green loans and low-interest loans** should be provided to **women** to reduce the burden on women in rural areas. There are also gaps between the planning and implementation of waste management strategies. Policy and regulatory challenges included the absence of a system to incetivize waste reduction or penalize excessive waste generation. Furthermore, public resistance to adopting proper waste disposal practices presents a significant behavioral challenge. Limited awareness about the benefits of technologies like biochar for agriculture and recycling initiatives further compounded the issue. These challenges collectively hindered Pakistan's efforts to establish an efficient waste management system, posing environmental, health, and socioeconomic risks. In addition, a stakeholder inquired about the difference between a landfill and an engineered landfill. Their query was addressed by shedding light on the additional components such as gas and leachate collection systems in the engineered landfill, reducing the overall environmental impact.

i) Economic and Financial Feasibility

The economic feasibility of the chosen waste management technologies varied among stakeholders, as indicated by their responses. Many **stakeholders confirmed the affordability and economic feasibility** of technologies such as waste segregation, composting, waste-to-heat (anaerobic digestion), organic municipal waste valorization, and engineered landfill gas recovery. These technologies were deemed economically viable for implementation in Pakistan. Additionally, stakeholders noted the economic feasibility of technologies like sludge suction machines, vermicompost technology, and bio-methanation. However, there were instances where

certain technologies were **considered unaffordable**, as highlighted by stakeholders regarding technologies like **incineration, rice straw shredders, and automated vacuum collection systems**. Nonetheless, most stakeholders expressed confidence in the economic viability of their chosen technologies, reflecting optimism about their potential affordability and feasibility for implementation in Pakistan's waste management sector.

The availability of incentives to promote the uptake of waste management technologies varied among stakeholders, as indicated by their responses. Some stakeholders highlighted the presence of incentives such as **tax exemptions or subsidies for certain technologies**. For instance, stakeholders mentioned subsidies for waste segregation technology, composting technology, and sludge suction machines, indicating government support to encourage their adoption. Similarly, stakeholders **noted tax-free zones such as GB**, and the possibility of subsidies for technologies like incineration and smart waste bins, suggesting favorable economic conditions for implementation. However, there were instances where stakeholders expressed uncertainty about the existence of incentives, indicating a lack of knowledge regarding potential government support or incentives for waste management technologies. Additionally, some stakeholders indicated a lack of incentives for technologies like waste-to-heat (anaerobic digestion) and automated vacuum collection systems, reflecting potential challenges in promoting their uptake without supportive government policies or incentives. Overall, the presence or absence of incentives varied across technologies and regions, reflecting the diverse landscape of government support for waste management initiatives.

During the waste technical committee meeting, a stakeholder underscored a recommendation advocating for the **provision of incentives to waste picker children and adults** on the streets, encouraging them to safely dispose of solid waste. Another stakeholder added that a **system of imposing fines** on waste creation should be implied, and **small-scale cost-effective technologies** should be prioritized.

ii) Technical Feasibility

The production status of waste management technologies in Pakistan varied among stakeholders, as indicated by their responses. Some stakeholders noted that certain technologies, such as waste segregation, composting, and waste-to-heat (anaerobic digestion), are not currently manufactured in Pakistan due to **limited market demand**. However, they highlighted the mechanical engineering infrastructure in Pakistan capable of manufacturing related equipment like **material recovery facilities (MRF), rapid compost machines, biodigesters, and pyrolysis plants**. Conversely, many other stakeholders mentioned that **most technologies are available in Pakistan**, with some exceptions. Additionally, some stakeholders expressed uncertainty about the production status of certain technologies, indicating a lack of precise knowledge. Despite this, a few stakeholders affirmed the availability of certain technologies, such as waste segregation,

composting, and bio-methanation, suggesting their production within the country. However, for other technologies like incineration and smart waste bins, stakeholders indicated that they were not produced in Pakistan. Overall, the production status of waste management technologies varied across technologies and regions, reflecting the diverse landscape of manufacturing capabilities and market demand in Pakistan.

During the waste technical committee meeting, one of the stakeholders raised a question on the **environmental impacts of incineration**, which was catered to by adding that it was a suitable option for Pakistan due to the high production of organic and hospital waste.

The availability of skills to implement and utilize waste management technologies in Pakistan varied among stakeholders, as indicated by their responses. Many stakeholders confirmed the existence of necessary skills for technologies such as waste segregation, composting, wastetoheat (anaerobic digestion), incineration, and various agricultural waste management techniques. However, some stakeholders noted that while skills exist, additional capacity-building programs were required to enhance the workforce's capabilities, particularly in regions like Azad Jammu & Kashmir (AJ&K). Conversely, a few stakeholders highlighted the **lack of skills for certain technologies, such as smart waste bins and automated vacuum collection systems**. Despite this, stakeholders generally acknowledged the presence of skills for implementing and utilizing waste management technologies in Pakistan, suggesting a foundation upon which further capacitybuilding efforts could be built to meet evolving needs in the waste management sector.

iii) Legal and Regulatory Framework

The stakeholders responded to the presence of clear guidelines or regulations for their chosen waste management technologies. Some stakeholders expressed that **no tangible guidelines or policies** were encouraging the adoption of technologies like **waste segregation, composting, waste-to-heat (anaerobic digestion), organic municipal waste valorization, refuse-derived fuel (RDF), and polyethylene terephthalate (PET) backfilling.** However, regulations did not restrict their use, and certain provincial climate change policies did mention some of these technologies for adoption. Others indicated the availability of clear guidelines for technologies such as engineered landfill gas recovery, sludge suction machines, and vermicompost technology, soil mulching and livestock feeding. Rules and Acts such as the **AJK Environmental Protection Act 2000,** and the **KP assessment rules 2021** provide guidelines for the technologies mentioned, including waste segregation technology, engineered landfill gas recovery, and sludge suction machines. Additionally, stakeholders noted clear guidelines for bio-methanation and integrated biomass gasification fuel cell technologies. Conversely, some stakeholders highlighted the absence of guidelines and the need for framing regulations for specific technologies like incineration and smart waste bins. Additionally, a few stakeholders did not provide explicit information regarding guidelines or regulations for their chosen technologies, including waste segregation technology, livestock feeding, remote sensing to map hotspots, soil mulching, rice straw shredders, and an

automated vacuum collection system. These diverse responses reflected the varied landscape of regulatory frameworks influencing waste management practices among stakeholders.

iv) Effectiveness and Efficiency

The **majority of stakeholders agreed** that the **technologies discussed promote efficiency** in the management and delivery of the **waste sector in Pakistan**. Waste segregation, composting, waste-to-heat (anaerobic digestion), organic municipal waste valorization, as well as various agricultural waste management techniques, were identified as efficient methods. Additionally, stakeholders noted that technologies such as engineered landfill gas recovery, sludge suction machines, smart waste bins, and automated vacuum collection systems contribute to streamlining waste management processes. Despite some stakeholders not responding, the consensus suggested that the technologies in focus indeed enhanced efficiency in Pakistan's waste sector.

All of the stakeholders agreed that the discussed technologies contribute to **building community resilience in Pakistan**. Waste segregation, composting, waste-to-heat (anaerobic digestion), and other municipal solid waste technologies were highlighted as beneficial for enhancing community resilience. Similarly, agriculture waste management technologies such as soil mulching, biomethanation, and vermicompost technology were seen as valuable in this regard. Furthermore, plastic waste technologies including downcycling and non-biodegradable plastic pyrolysis were also recognized for their positive impact on community resilience. Despite one stakeholder not responding, the consensus among the others suggested that these technologies play a significant role in strengthening community resilience across various sectors in Pakistan.

5. Way Forward

Participant stakeholders were also asked to note their suggestions on how the prioritized technologies could be promoted in the region. Their responses were as follows:

- Initiate pilot projects in provincial capitals to demonstrate the effectiveness of the technologies in waste management.
- Encourage local production of waste management equipment for long-term sustainability and reduced dependence on imports.
- Make funding available for the adoption and implementation of waste management technologies, ensuring financial support for both public and private sector initiatives.
- Explore opportunities to access funding from the Green Climate Fund to support initiatives aimed at mitigating climate change through improved waste management practices.
- Organize awareness seminars and workshops to showcase successful projects and educate stakeholders about the benefits of adopting advanced waste management technologies.

- Invest in capacity-building programs to equip local communities and professionals with the necessary skills and knowledge to implement and utilize waste management technologies effectively.

  Offer incentives such as tax relief and fuel adjustment for businesses and organizations adopting eco-friendly waste management practices, incentivizing sustainable waste management solutions.

- Develop an adequate legal and regulatory framework through guidelines and regulate to promote and guide the utilization and adoption of noted technologies.

6. Conclusion

The 1st Stakeholder Meeting of the Waste Technical Committee led to the contribution of vital feedback from the Committee which was crucial to guide the NDC Technology Roadmap for the Waste Sector. It has enabled the successful short-listing of technologies for further assessment and analysis, advancing our progress towards the final formulation of the Roadmap.

ANNEX-I Participants list

Name	Gender	Sector	Institution& Designation	Province/ Region
1. Dr. Sardar Rafique	M	Gov	DD, EPA	AJK
2. Raja Mirza Kareem	M	Gov	DD LG& RD	Gilgit
3. Dr. Habib Jan	M	Gov	Dy Director EPA	KPK
4. Sanaullah Solangi	M	Gov	DD, Agricultural Research	Sindh
5. Malik Muhammad Akram	M	Gov	DGA (OFWM)	Punjab
6. Zamir Hassan	M	Gov	General Manager Planning WASA	KPK
7. Saira Saeed	F	Gov	Planning Officer, Planning and Development Board	Punjab
8. Muhammad Tahir	M	Gov	Additional Secretary Agriculture	KPK
9. Waqas Abdullah	M	Gov	Planning Officer, Agriculture	AJK
10. Ghulam Mustafa	M	Gov	Director Agriculture	Gilgit

11. Arshad Ashraf	M	Gov	Director CEWRI, National Food Security and Research Islamabad	Federal
12. Mishal Zahra	F	Gov	Scientific Officer, EPA	Gilgit
13. Rizwan Ali	M	Gov	Assistant Chief, P&D Board	Punjab
14. Dr. Saima Shafique	F	Gov	Director, MoCC	Federal
15. Mumtaz Ali	M	Gov	Deputy Director Legal, EPA	KPK
16. Dr. Faisal Raheem	M	Gov	SEED Certification Officer, Agriculture Dept	AJK