

MEMORANDUM

Considerations for the Treatment of Organic Waste from Lafenwa Market, Abeokuta, Ogun State, Nigeria

Dr. Jane Gilbert (International Solid Waste Association, Carbon Clarity), Tom Frankiewicz (RMI)

February 2024

PURPOSE

To evaluate the potential for separate collection and composting of organic waste generated at Lafenwa Market, Ogun State, Nigeria.

CONTEXT

Currently, up to 20% of global methane emissions stem from the disposal of organic waste in sanitary landfills and dumpsites. The latter may or may not be actively managed and lack engineered groundwater protection, leachate management, and gas migration infrastructure. In Nigeria, solid waste is disposed of at dumpsites, which are significant sources of fugitive methane emissions.

Diverting organic waste from dumpsites for alternative uses, such as composting, prevents methane emissions and reduces its environmental impact. It also creates a beneficial product, compost, that can be used as a soil improver, particularly by farmers. Food markets in Nigeria generate a considerable amount of organic waste in the form of spoiled or damaged fruit and vegetables, leaves, and stems.

BACKGROUND INFORMATION



Source: maps.google.org

Lafenwa Market is located in Abeokuta, Ogun State, which is approximately 80 km north of Lagos, and occupies an area of 16 hectares. It accommodates about 3,500 shops and stalls, of which 250 sell fruits and vegetables.

The market is open seven days a week and is managed by a committee that oversees the collection of waste among other activities. Vendors pay an annual fee of Nigerian naira ₦12,000 equivalent to US\$15 for open stalls or ₦24,000 (US\$30) for covered shops.

Every five days, there is a farmers' market which attracts 400 to 500 local farmers from the surrounding towns. Each farmer pays a fee of ₦50 (US\$0.06) for every visit, entitling them to sell their produce at the market and for their waste to be disposed of. Farmers set up their stalls on one of the few paved access roads into the market.

WASTE MANAGEMENT

Each vendor takes responsibility for keeping their shop/stall clean by sweeping their waste into small piles or receptacles. The waste is collected in a wheelbarrow by a worker paid for by the market. It is then transferred into large bins which are collected every three days by the Ogun State Waste Management Authority (OGWAMA) for disposal at the accredited dumpsite at Saje, Abeokuta.

Table 1: Waste data from Lafenwa Market

Waste composition	<ul style="list-style-type: none">• 90% organic (fruit and vegetable) waste• 5% paper and card• 5% plastic
Waste generated	2,340 tons per annum
Food and green waste volume	2,106 tons per annum

The volume of organic waste generated is greatest during the rainy season (March to October) compared with the dry months of November to February. However, there is no data to quantify this uplift.

SITE VISIT OBSERVATIONS

The market is located adjacent to the busy Ayetoro Road, with the main part of the market being set back from the road. The narrow alleyways and unstable surfaces connecting shops and stalls mean that they are only accessible on foot, precluding the use of containers larger than a 240-liter wheeled bin. Moreover, during the rainy season the surface can be very slippery.



Uneven compacted earth



Narrow alleyways connect stalls and shops

On the day of RMI's visit (October 5, 2023), only regular vendors were trading as the farmers' market was not scheduled for that day. Fruit and vegetables were sold alongside consumer goods and packaged foods. Only a small amount of waste was observed awaiting collection; organic waste was mixed with plastic packaging (particularly film).



Waste left out for collection



Stall selling peppers



Damaged peppers for disposal at the same stall

CONSIDERATIONS FOR ORGANIC WASTE COLLECTION

To effectively and efficiently divert organic waste generated at Lafenwa market for composting, several factors (see Table 1) need to be evaluated prior to implementation.

Table 2: Factors to consider for separate collection of organic waste at Lafenwa Market

Factor	Rationale	Suggestions
Target times and areas with the highest organic waste generation	Maximizes efficiency of collection	Collect organic waste only on farmers' market days
Locate bins on stable paved surfaces	Allows for safe lifting of waste into collection vehicles	Locate bins only on the paved road where the farmers' market is held
Ensure the separate collection of organic waste from other waste fractions e.g., plastics	Provides feedstock for composting and reduces contamination	Set out separate bins solely to collect organic waste
Ensure effective instruction & signage to only place organic waste in the bins	Promotes source separation of organics by the farmers, market vendors, and customers	Ensure organic waste bins are all in the same color with clear instructions on the side of the waste bin Set out separate-colored bins for residual waste collection with clear signage
Motivate farmers and market vendors to use the organic waste bins	Maximizes collection efficiency and reduces contamination	Provide compost made from the market's organic waste to farmers to use on their crops
Ensure no co-mingling of waste	Engagement of a bin guard to monitor the organic waste bin	To ensure that only organic waste is disposed in the designated bin

CONSIDERATIONS FOR COMPOSTING

Composting is a natural process that involves the controlled decomposition of organic materials by naturally occurring microorganisms, resulting in a nutrient-rich product known as "compost." It mimics the biodegradation processes found in nature but is managed to optimize the conditions for efficient and controlled decomposition. Balancing the carbon-to-nitrogen ratio, moisture levels, and porosity of the feedstock mix at the outset is important to ensure rapid composting.

By estimating the potential capacity for collecting organic waste at the farmers' market and utilizing physico-chemical data from published sources¹, each farmers' market day would require use of containers with a total minimum volume of 20 cubic meters (m³).

¹ Summarised in the annex to Rynk et al. (2022) The Composting Handbook, Elsevier.

Table 3: Estimated Organic Waste at Lafenwa Farmers' Market

	Per market day	Per annum
Estimated mass	10 tons	740 tons
Estimated volume	20 m ³	1,500 m ³

This organic waste can be composted using a simple, but effective, open-air turned windrow system. Here, organic waste is laid out in trapezoidal piles and mixed periodically using a material handling vehicle to homogenize the contents and introduce fresh air into the composting mass. As the fruit and vegetable waste is high in both nitrogen and water, it must be mixed with a dry carbon-rich “bulking” material to balance the carbon-to-nitrogen ratio, lower the moisture content, and build porosity within the piles. Untreated wood chippings, green waste², straw, and coconut husks all make good bulking materials. Sawdust from untreated wood is also a useful amendment, although it lacks structure and does not contribute to increasing porosity. A minimum of one part of bulking material should be mixed with four parts of organic fruit and vegetable waste. The basic requirements for composting are detailed in Table 4.



Source: iStock.com

Table 4: Basic Requirement for Composting

Requirement	Reason
Essential	
Area of hardstanding, preferably impermeable: 0.2 hectares or 45 m by 45 m	Area of land with a hard surface (ideally concrete) needed to carry out composting. Surface should be constructed appropriately to support the weight of delivery and materials handling vehicles Preferably impermeable surface with drainage to prevent leachate contamination of surrounding land
Covered area (fixed roof or tarpaulin)	To store finished compost and carry out composting during the rainy season
Small materials handling vehicle e.g., skid steer loader	To move and mix composting feedstocks and finished compost
Carbon-rich, low moisture bulking material/amendment	To balance moisture, C:N ratio and contribute towards structure of the piles
Long stem temperature probe	To monitor composting temperature to ensure it is adequate to kill pathogen and weed
Bins to store removed contaminants	To contain contaminants, especially plastic film, and prevent it from littering the surrounding area before disposal
Desirable	
Shredder or chipper to reduce the size of the incoming feedstocks	To improve handling and ensure appropriate structure of composting materials
Screen to remove contaminants and oversized materials from final compost	To maximise the quality of the compost

The composting process should take two to three months. Once screened, a truckful of compost could be taken back to the market for participating farmers and market vendors for use on their farms or yards. This could further motivate participation, improve collection of organic waste, and minimize contamination. It is also a perfect example of the food-waste-soil circular economy.

Table 5: Estimated Volume of Compost from Lafenwa Market

	Per market day	Per annum
Estimated mass	5 tons	370 tons
Estimated volume	13 m ³	920 m ³

NEXT STEPS

The following activities are recommended to assess the practicalities of implementing separate collection and composting of organic waste generated at Lafenwa market:

- **Conduct a waste compositional analysis** to better understand the types and quantities of organic wastes generated on the farmers' market day.
- **Investigate the seasonal effect** (between dry and rainy seasons) on the amount of organic waste generated.
- **Investigate possible business models** for the proposed composting scheme, e.g., whether it should be carried out solely by OGWAMA, solely by a private entity or microenterprise, or whether it should involve a public-private partnership.
- **Assess the options/availability of land** on which to compost. Ideally this should be as close to the market as possible to reduce transport costs and emissions and the land should be paved or have hard standing.
- **Assess the costs** of purchasing/acquiring an appropriate number of bins and equipment for collection and composting.
- **Investigate the availability of carbon-rich bulking material** to mix with the fruit and vegetable waste for composting.
- **Investigate the willingness of farmers and other market vendors** to participate in the composting scheme.

A composting strategy could be introduced in phases at the farmers' market, initially targeting a small number of vendors in order to:

- Familiarize the vendors with the concept of separate collection.
- Enable managers and key personnel to learn and troubleshoot the operational aspects of separate collections and the art of composting.
- Communicate the scheme, including motivational and practical information.

REFERENCES

1. Marco Ricci-Jürgensen et al., *Evaluation and Recommendation Report of the Pilot Composting Plant in the Lapa District of the City of Sao Paulo*, CCAC, 2016. <https://www.ccacoalition.org/resources/evaluation-and-recommendation-report-pilot-composting-plant-lapa-district-city-sao-paulo>.

ACKNOWLEDGMENT

The authors would like to thank the Global Methane Hub (GMH) for its generous funding support, which made this work possible.

All photos courtesy of the authors unless otherwise noted.