



Femmes en Action Rurales de Madagascar  
E-TAntsoroka ho an'ny Fampandrosoana ny maha Olona  
with Training and Research Support Centre  
In the Regional Network for Equity in Health in East and  
Southern Africa (EQUINET)



**Don't waste the waste! A case study of promising approaches in managing organic solid waste in Manandriana Municipality, Antananarivo Avaradrano, Madagascar January 2024**

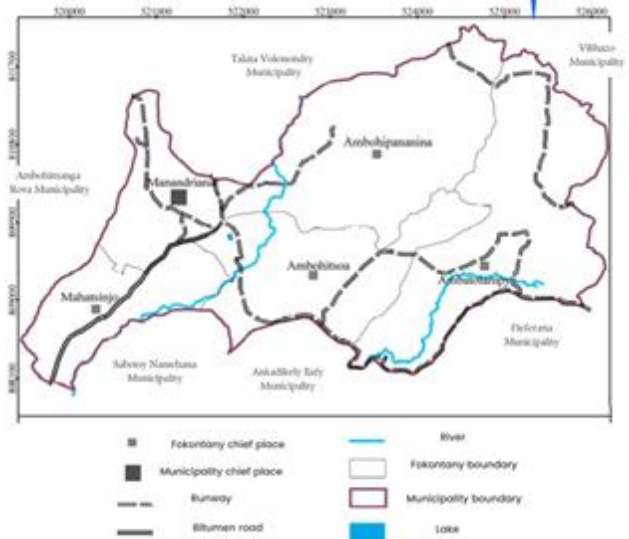
## Introduction

Understanding how waste management systems are linked to and interact with other sub-systems and the influence and moderation effects of contextual factors including climate change is important in informing actions and approaches that promote health and wellbeing. Waste management systems provide a potential entry point for fostering innovations, collaborations and system-wide changes for healthy communities and ecosystems, such as through strengthening their linkages with food systems and promotion of circular economies (EQUINET, 2023). This case study showcases experiences from the municipality of Manandriana in Antananarivo, Madagascar. It has been produced within a series on integrated urban health in EQUINET to foster learning on these promising approaches within east and southern Africa (ESA).

## Methods

This case study has been produced through an analysis of secondary evidence and primary data collected through observation, semi-structured focus group discussions and key informant interviews on waste management practices in the municipality of Manandriana between September and December 2023. The primary data collection was carried out in four purposively selected fokontany (small villages) of the Manandriana municipality. The villages were Ambatolampy, where the dumping site is located; Ambohibary and Ambohitsoa, where many farmers request to be supplied with municipal waste trucks directly on their personal land, and the fokontany of Manandriana, where the town hall is located and is the center of life/hub for the municipality. While far from the dumping site the latter was included to capture views of inhabitants with limited reach of the dumping site (see *Figure 1*).

Figure 1: Map of the municipality of Manandriana



**Cite as:** Femmes en Action Rurales de Madagascar, E-TAntsoroka ho an'ny Fampandrosoana ny maha Olona, TARSC, EQUINET (2024) Don't waste the waste! A case study of promising approaches in managing organic solid waste in Manandriana Municipality, Antananarivo Avaradrano, Madagascar, EQUINET, Harare

We included the neighboring municipality of Fieferana located just a few meters from this dumping site to explore the spillover effects of the dumping site activities. Participants in the focus group discussions were purposively selected in advance based on their occupation, gender, affiliation to an association and roles in waste management through collaborations with the respective community leaders (termed ‘fokontany chiefs’). Participants in both the focus group discussions and key informants voluntarily consented to participate in the data gathering process and have their views used in the case study after being informed about the work and its objectives. They were allowed to leave during any time during the discussions or interviews. No individual identifying information was kept in the notes or recordings/transcripts.

Focus group discussion participants included women, farmers, former farmers who were now waste sorters presidents of fokontany, “quartiers mobiles” or security staff of the fokontany, and members of local associations. Focus group discussions were conducted in fokontany offices and within the Fieferana town hall and lasted an average of 45 minutes. Key informants were identified based on FARM’s prior knowledge through our local work in the area. The people interviewed were drawn from the Manandriana municipality managers and workers in waste management, and from association members, waste sorters, farmers using compost made from the organic waste and those currently not using it, non-farming residents living near the dump site and those far away from the dump site. Each interview lasted between 10 and 50 minutes. We used focus group discussions and key informant guides with questions covering contextual factors surrounding the introduction of composting in the municipality, details about the composting process, current approaches and resources, risks and benefits, and lessons learnt.

Table 1 Distribution of focus groups by area and gender and key informant interviews by area.

<b>Table 1 : Distribution of FGD and KI interviews by area</b>					
<b>Municipality</b>	<b>Fokontany</b>	<b>Focus Group Discussions</b>			<b>Key Informant Interviews</b>
		<b>Female</b>	<b>Male</b>	<b>Total</b>	<b>Total</b>
Manandriana	Manandriana				8
	Ambohitsoa	7	8	15	9
	Ambohibary	2	4	6	7
	Ambatolampy	34	6	40	24
Fieferana		13	15	28	2
Sabotsy Namehana					1
<b>Total</b>		<b>56</b>	<b>33</b>	<b>89</b>	<b>51</b>

## Context

### Geographical, demographic and economic context

The municipality of Manandriana is located in the Antananarivo Avaradrano district, in the northwest of the Analamanga region and is bordered by the rural municipality of Talata Volonondry 11km on the west, the rural municipality of Ambohimanga Rova 8km to the east, the municipalities of Viliahazo 14km on the eastern side, municipality of Fiaferana 9km on the south-eastern side and the municipality of Sabotsy Namehana 5km on the southern side. It is divided into six fokontany (small villages) including Manandriana, Mahatsinjo, Ambohipianina, Ambohitsoa, Ambatolampy, and Ambohibary. *Figure 1* shows the map of the municipality, its divisions and its bordering regions.

The municipality of Manandriana is situated in the center of the highlands region with a granitic soil structure (Rakotorinina, 2007). The Commune of Manandriana is peri-urban. It has a population of approximately 11 050 inhabitants spread across an area of 21,6 square kilometers, resulting in a population density of 511 inhabitants per square kilometer (Niriniomy, 2022). The population has been steadily increasing from 6 026 in 2015 to the current 11 050 in 2021 (Niriniomy, 2022). Young people below 18 years constitute 50% and women 52% of the population (Niriniomy, 2022).

The economy of the Antananarivo Avaradrano district is mainly agriculture based. Over three quarters of residents (80%) derive their livelihoods and income from growing crops, albeit through intensive use of chemical fertilisers, such as rice, peas, onions, chives and keeping livestock and poultry for their consumption and sale outside their area (Judickaëlle, 2007; Rasolofoniaina, 2016; Focus group discussions and KII). Despite the area being suitable for crops and thus being part of the food producing district of the Analamanga region, three quarters of the Malagasy inhabitants have low incomes and live in poverty due to the archaic production methods they use (Niriniomy, 2022; World Bank, 2023). This results in challenges such as access to health care, further worsened by the population increase noted earlier.

### **Waste management context**

Waste management in Madagascar is closely tied to human health and the environment given the direct consequences of poor waste management practices on people's health and ecosystems (Ecology Madagascar, 2017). Municipalities, as provided by Law No 98-028 and Article 16 of the Water Code, have the responsibility to manage waste within their jurisdictions. However, there are as yet no comprehensive and explicit regulations on urban waste management (Rasolofoniaina, 2016). The municipality of Manandriana does not have a written municipal code on waste management hygiene (Salama, undated). Until 2020, no municipality had its own fully owned sorting centre or recycling centre. Some public-private partnerships have emerged, but this remains insufficient to manage the huge amount of waste generated daily in the country (Salama, undated). The island produces mainly organic waste (over 80% of the total) but it remains largely under-utilised (ISSUU, 2021). A number of associations including the Femmes Rurales en Action de Madagascar (FARM) and Fikambanana Fampivoarana ny Tantsaha (FIFATA) have trained and raised awareness in compost production to replace chemical fertilisers among the inhabitants of the municipality of Manandriana (Key informants).

### **Promoting waste and food system linkages**

The TAMBATRA project, meaning "together," involves various institutions such as the World Food Programme, Agronomes et Vétérinaires Sans Frontières, Gret (a French non state organisation), and Action Against Hunger. This project, initiated in 2019 and expected to last until March 2024, aims to eradicate and combat chronic malnutrition in the communes of Fieferana, Manandriana, and Vilihazo by promoting more sustainable and nutritionally beneficial food systems. Malnutrition is worsened by challenges in the delivery of health care related to long distances to facilities and poor services (TAMBATRA, undated). Nutritional status is also affected by environmental degradation owing to excessive use of chemical fertilisers, soil and air pollution in part due to poor waste management in the municipality of Manandriana, and diseases and other problems associated with the presence of the open-air dump in Ambatolampy (FARM, 2023).

These challenges motivated the introduction of the project, funded by the Principality of Monaco. The project, complemented by training and awareness programmes by local organisations promoted activities that included enhancing soil fertility through livestock farming, and the production of compost for use as organic fertiliser to replace expensive and environmentally degrading chemical fertilisers. Compost production at household level was below farmer needs, the process was long and required more inputs (dried leaves, expensive activators) (key informants and focus group discussions). This led Manandriana Municipality's former mayor to allow two neighboring municipalities of Ankadikely Ifaty and Sabotsy Namehana, located at about 5km to the south of Manandriana, to dump their waste at Manandriana's newly created dumpsite in 2018, in exchange for a monthly subsidy. The sections below provide more detail on the waste management practices in more general, and initiatives that are promoting the linkages between organic waste and production of the organic fertiliser (food systems), linkages with water, the benefits and risks including from climate change, impacts and learning for the future.

## The current waste management infrastructure and systems

In 2018, the guarded Manandriana communal open air dumping site measuring approx. 50m x 70m was allocated to serve two neighboring municipalities, Sabotsy Namahena (population of 63 660) and Ankadikely Ilafy (population of 85 610). Perched on top of a hill, visible throughout the municipality and located near a highly frequented road and residential areas in the southern part of the municipality, the dumpsite raises the risk of contaminating water, and affecting vehicular passengers and residents, explained later. It lacks any special facilities, has no visible lighting and piles of waste and ashes are haphazardly deposited without any specific order with no sorting or recycling. The neighbouring municipalities' trucks transport waste daily to the site for a fixed monthly fee determined by the area, waste tonnage and population of the municipality. Ankadikely Ilafy pays 1,2mn Ariary (260 US\$) while Sabotsy Namehana is taxed at 800 000 Ariary (174 US\$) (Focus groups and key informants). Sabotsy Namehana's 2 trucks and Ankadikely Ilafy's 3 trucks make 8-12 trips daily depending on the season, more during rainy days.



Sabotsy Namehana Municipality  
Waste truck, T Razafindrato, 2023

The waste types include household vegetable waste, packaging plastic and glass bottles. It also includes industrial waste from Somaou - a textile industry generating a significant amount of fabric debris, from Cementis, a cement factory that owns a cement depot in Manandriana and disposing of cement bags and cement itself, from JB, a biscuit factory producing mainly unused cardboard, and using a dedicated truck for waste disposal every week, and briquetery from Kianjavola, and textile waste from industries in Sabotsy Namehana such as Axelle and Festival. These factories also release chemical waste into the dumping site. The composition of this waste is unknown to both the municipality and the individuals working at the dump.

Waste sorters have, however, suffered skin infections and skin burns from this waste. There are other health hazards in the waste at the dumpsite. Municipal markets, retailers, restaurants generate food waste, plastic and bottles, and expired products. The six healthcare establishments in the two municipalities are reported to send medical and pharmaceutical waste to the site, including infectious waste such as used syringes, masks, used PPE and morgue bags, and expired pharmaceutical products, despite this being prohibited by law, sometimes delivered by the health institutions' own trucks at night (focus groups and key informants). Metal and electronic waste from mobile phones, radios and car batteries are also dumped.



Left: The dumping site at Ambatolampy Right: The location of the future waste treatment center.  
Photographs: T Razafindrato, 2023

The Ministry of Environment and Sustainable Development identified in 2020 a new site to relocate the dump site to a more secure place through a brick perimeter wall with appropriate equipment and infrastructure within government land. The project, expected to be completed in December 2022, has, however, been abandoned due to limited funds with only a fence having been built. Manandriana municipality's locally generated organic waste is mainly re-used directly by its urban farmer households placing waste in home pits 2-3 meters long and 1-2m deep for composting and incinerating non-organic waste.

### The reuse and recycling of waste

Waste sorting at the dump site is mainly carried out by former farmers who have transitioned into waste sorting. They do not use any protection or hygiene measures, using rudimentary tools such as forks, shovels, sieves, wearing sandals or working barefooted at the dump site. The sorters turn the organic waste into compost at the site, which they sell for 10,000 Ariary (2.17 US\$) per cartload or 1 000 Ariary (0.22 US\$) per rice bag. The income realised is used meet household expenses and is a major reason for transitioning from farming to waste sorting and production of organic fertiliser. Some types of sorted waste, such as wood, charcoal remnants, scrap metal and bottles, are reused directly by the sorters or transported by foot, cart and sold at the Sabotsy Namehana market. Others such as bones are recycled and transformed into "ranomena", a whitish liquid with therapeutic properties. The residual non-organic, non-reusable waste is incinerated and piled in a corner at the dump-site. However, when the on-site compost production fails to meet farmer demand, some sorters mix the ashes from the incinerated waste with the compost, contaminating the organic compost.



Top left: Biodegradable waste grouped in the dumping site  
 Top right: non-biodegradable waste incinerated, sieved, and added to a portion of the compost.  
 Bottom left: Waste sorters gathering the reusable waste into a basket  
 Photographs: T Razafindratsito, 2023

Organic fertiliser is thus produced in the municipality in two ways: at residents' homes using the waste they generate and by the former farmers who are now informal waste sorters at the dump site. Home production is mainly practiced by farmers who are members of associations and non-governmental organisations, who often gather in groups to produce their compost. For instance, the FIFATA group has 20 members who produce their compost as a group at a central area belonging to their association. Members bring their organic waste such as dry leaves and banana-tree trunks for composting. The compost is owned by the group and its members use it in their own fields. A seven-day composting process has been devised and is the most appreciated and chosen given its quick turn-over



Left: Group production of compost for 7 days by FIFATA members and the fields owned by the association nearby. Right: Production of compost at a private residence.

Photographs: T Razafindratsito, Razafindrakoto Ny Onja, 2023

The informal sorters' production at dump site is the most common method. It is implemented by sorters who are permanently present at the dump site, and some farmers also visit the dump site to produce their own compost when they cannot afford to buy it. The compost is mixed with animal manure and used in the farming of rice, peas, green beans, onions, potatoes, and lettuce. Some farmers who own private land informally contract municipal truck drivers to directly deliver the waste to their farms in the villages mainly in Ambatolampy and Ambohitsoa.

Table 2 summarises the steps in the production of compost at homes and at the dump site.

Table 2 Steps followed in producing compost at home and at the dump site.

Composting case	At HOME scenario 1	At HOME scenario 2	At the DUMP SITE
Waste sources	Waste produced in one's own home and from their own livestock	Waste brought by trucks in private farmers' land	Waste dumped at the municipal dumpsite. Waste in the dumpsite free for all the inhabitants of the municipality
Waste types	Biodegradable household waste. Banana leaves and trunks. Animal dung (cow, pig, chicken)	Biodegradable household waste Cardboard from factories	Biodegradable household waste Cardboard from factories
Composting methods	Dig a hole in the yard to layer the waste: Waste chopped and layered, watered regularly using water from natural sources near homes and turned (few days if 7-day composting; 2 weeks for traditional composting of 30-40 days). Biological activators used by some, but are expensive. Water scarce during dry season.	Waste sorting to remove non-degradable waste, bring biodegradable waste back to farmers' personal holes and let them macerate for a while by adding cow or pork dung, leave non-degradable waste in the land	Waste sorting to remove non-degradable waste, stack sorted waste in a corner of the dumping site, leave it for a while to decompose. Burn non-degradable waste, especially plastics, to be piled up in a corner of the dumping site or mixed with the compost.
Composting duration	Depending on the chosen composting type: 7 to 40 days	One to several weeks, depending on the type of waste	One to several weeks, depending on the type of waste arriving at the dumpsite.
Quantities of compost produced	One cartload per production per household, with the number of composting also determined by the fertiliser needs.	Depending on the waste brought by the trucks	One cartload per production per household, with the number of composting determined by the fertilizer needs. For one truckload of dumped waste, 10 bags of fertilizer obtained (in cases where the waste from the truck is already somewhat macerated upon arrival).

Composting case	At HOME scenario 1	At HOME scenario 2	At the DUMP SITE
Packaging of produced compost	No packaging		Recycled cement bags from the dumping site
Compost sales	Personal use		Personal use (if sorted by the farmer at the dumping site) 10,000 Ar (2.17 US\$) per cartload or 1 000Ar (0.22 US\$) per rice bag if produced by the dumping site sorters.
Learning from composting	Training provided by local associations, especially FARM, FIFATA and the Tambatra Project. FARM association eg has organised four training sessions since 2020. Sessions cover composting techniques, including the 7-day method, 15-day, and 30-day composting, as well as liquid fertilizer composting. Approximately 200 households benefited from those FARM's training sessions.		No specific training received

## Mechanisms for consultation and dialogue

The municipal dump site was established in 2018 in response to a request during a communal meeting from a portion of the residents. Prior to this, waste transport trucks used to dump garbage directly at private farmers' lands. Realising the ease and speed of producing organic fertilizer from waste and the growing demand for compost, the residents made this request to the local authorities. The municipality employs two individuals who are responsible for tracking and recording the trucks that dump waste at the site and distributing freely the dumped waste to sorters, who are listed in a book. These individuals also report any anomalies to the local authority.

The municipality retains decision making power on the type of waste that is acceptable for the dumping site, with a water, sanitation and hygiene management committee set up at the municipality to do this. The committee is composed of the Secretary-General and two other officials within the municipality, and a representative from the municipal police. Neighboring municipalities, factories and businesses that dispose of their waste at the dumping site pay monthly fees to the municipality, with the fee level based on their surface area and the number of inhabitants.

Truck drivers are not only in charge of transporting waste to the dumping site but are also closely associated with some residents who pay them 80 000 Ariary (18 US\$) per truck directly to have garbage on their personal land, despite this being prohibited by the local authority. As highlighted earlier, other government departments are involved, such as the Ministry of Environment and Sustainable development. At present, no international technical agencies or elected officials are materially involved in the waste management process.

## Impacts, challenges and learning

As a result of the composting training from the TAMBATRA project, FARM, and FIFATA, most of the municipal residents are using organic manure, as these are considered cheaper than the chemical fertilisers (key informants). Organic waste composting supports crop farming and nutrition in a circular economy, with spill-over effects on the environment through regeneration of soils and ecosystems. These intertwined economic and environmental benefits can be highlighted in seeking support for scale-up of the initiatives. Waste sorters realise daily incomes to meet part of their household needs. However, the lack of machinery and technology in the composting process, poor coordination at the municipal levels and limited regulations have constrained growth of the waste composting market. Hand-sorting of waste with rudimentary transport takes time. Without adequate protective clothing, farmers are exposed to injury and disease, including from chemicals, sharp metal objects and other hazardous waste. The skin allergies and respiratory problems they report can transform in long-term health challenges.

While waste sorters are promoting a circular economy, the poorly-controlled handling of the waste can also lead to environmental pollution: soil, water and air contamination. The case study suggests the urgent need to enhance the composting process- addressing the health risks posed to both sorters and the environment. The proposed new municipal dumpsite offers an opportunity to address this and to ensure that waste dumping meets standards for environmental protection. This requires financial resources. The fees being paid by the two neighbouring municipalities are only enough to cover the salaries of the two dump site employees, and not improvements to the existing physical dump site. How to better finance improvements is thus a priority.

The municipality removed restrictions on types of materials that could be deposited at the dump site from factories in 2019, but this has led to dumping of more harmful and hazardous waste at the site, posing health risks to sorters and the environment. This policy needs to be reviewed. Waste incineration, a common practice at the dumping site, generates risks for the sorters and air pollution, due to airborne particles with heavy metal released when burning metal waste.

### **System interactions, climate change impacts**

The composting process links waste and food systems. The compost produced from organic waste is used in growing food crops to support better nutrition. However, practices such as the mixing of compost with ash from incinerated non-organic waste may contaminate crops with residues from heavy metals, micro-plastics and other harmful materials. Inorganic waste can also be blown by winds or washed by water into crop fields, while plastics and bottles from chemicals used for spraying fields can pollute the land and water sources. Consumption of contaminated food from these impacts pose a risk to health (see a summary in *Box 1* below)

#### **Box 1: Challenges from existing waste management systems**

- Proliferation of vectors: rats, insects and flies that spread diseases, spreading of diseases from handling of PPE especially during Covid 19. Skin diseases observed in the Fokontany of Ambohitsoa were characterized by hair loss on the crown of the head (focus group discussions), persistent cough among waste sorters; diarrhea and food poisoning resulting from the consumption of expired products dumped in the dumping site. Sorters also experience injuries from sharp metal objects at the dump site.
- Injuries from glass shards and metallic objects found in the waste.
- Smoke from the incineration that pollutes the air and cause respiratory problems, foul odours.
- Surface and underground water pollution from run-off, seepage which cause health problems if contaminated water is consumed.
- Land pollution including farmland from waste especially dumped on private land.
- Compost from the dumpsite that has heavy metals causes soil infertility, soil becomes hard from the frequent use of such compost especially in rice fields.
- Truck drivers were said to be contributing to early 'marriages' of girls: the married young girls enjoy privileges in accessing the dump site. A local authority KII respondent bemoaned *Many young girls in our community either marry or just have children with truck drivers to benefit from high-quality waste.*
- Child labour was raised as a challenge, with some children no longer attending school and being engaged in sorting waste continuously, while also facing physical and moral insecurity.
- Numerous fights, sometimes deadly, break out at the dumping site due to disputes over the waste brought by the trucks. This has been exacerbated by the proliferation of bars near the dumping site.
- Sorters are now coming from other regions, and the informal sector in dumping site work is expanding.

Food and crop residue is used in compost or livestock feed. The composting process is linked to water systems in two ways. Water from the usual household water sources and springs is used for making home-made compost moist- a key requirement for the composting process to take place. The dump site composting process does not use water. Water availability and thus composting is affected by drought, and improper waste management from both landfill and residences contaminates the soil, ground and surface water sources such as springs, worse when there are heavy rains and winds. The water sources are also contaminated by foul-smelling sludge and non-biodegradable plastics and other materials.



The municipal dump site is open to any resident who wants to recover and recycle waste from it. This is a positive feature, but needs regulation and guidelines to manage risks to sorters and the environment. The sorters make cheaper and environmentally friendly organic manure available, supporting food security, nutrition and incomes through a circular economy approach, integrating them into the municipal economy and value chains, albeit in a less coordinated manner. Access to the dump site promotes waste recovery and re-use such as scrap metal, charcoal, and wood which the sorters recover and sell.

*Many people now depend on this waste. We sell low-cost fertilizer to farmers, and that ensures our survival too* Waste sorter during an FGD in Ambatolampy, 2023.

A centralised waste dumping area is welcome, but needs to include features that promote sorting, environmental and health protection and safeguards. Before the creation of the dump site in 2018, farmers used to pay truckers and have all the waste transported directly to their farmlands. The centralized public dumping site was created to make waste accessible to everyone who wants to produce cheaper organic fertilizer, thus implicitly promoting equity principles in waste and food systems. Some farmers are still source waste directly from truckers exacerbating pollution challenges within farming areas.

## Future priorities and plans

Improving the waste management system calls for regulations and municipal policy measures to promote waste separation at source, prohibiting disposal of unsorted waste, and on waste disposal, access and controls on disposal of hazardous waste. Stakeholders in the focus group discussions prioritised the implementation of laws and controls as essential for the dump site workers, surrounding residents and for the environment. Regulations should address restrictions on waste sorters accessing the dumpsite that leads to their access to only secondary-choice waste. There should be strong penalties for prohibited activities like illegal dumping and incentives for environmentally friendly practices, like sorting at source. The municipality needs to investment in improving its monitoring and enforcement capacities and encouragement of community compliance.

The municipality should accelerate the construction and adoption of the new dump site with improved siting, security to curtail illegal nocturnal dumping of waste, infrastructure and safeguards for human and environmental harms including those worsened by heavy rains, winds and cyclones. Sorters' risks will need to be managed through municipal support with PPE, promotion of environmentally friendly tools and machinery that further improve efficiency and productivity. Social dialogue and literacy could address the social-related risks and issues such as early marriages, fights and child labor.

Systems to monitor the quality of the compost to address risks from contamination from heavy metals and hazardous materials will need to be put in place. The monitoring log to track sorters and municipal employees tasked with managing this need to be strengthened. Prohibiting the incineration of plastic waste calls for a broader strategy to integrate a market for plastic waste. There is a concrete plan to do this. A private initiative to transform plastic bottles into interlocking paving stones was launched during the second half of 2023. A private company purchases bottles at 200 Ariary (US4c) per kilogram and processes them manually through heating the plastic together with sand, then pouring it into molds to take the shape of paving stones. The paving stones are sold at 40,000 Ariary per square meter.



Production of interlocking paving stones in Manandriana

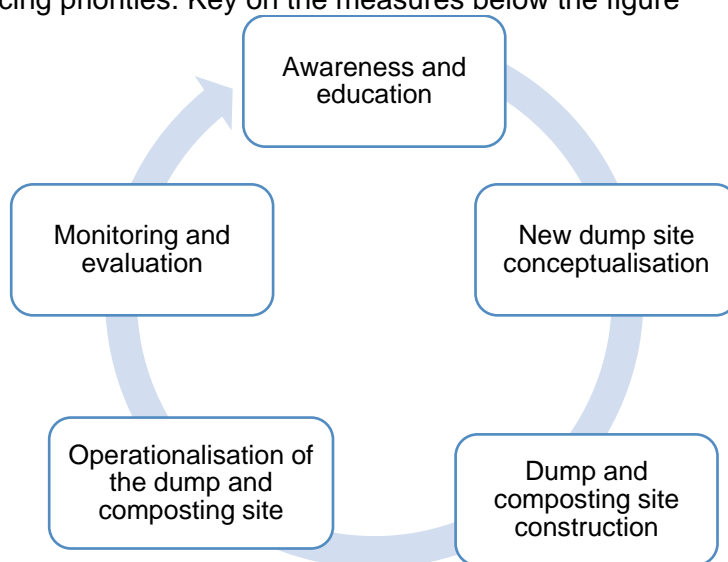
Photographs: T Razafindratsito, 2023

Measures need to be alive to the threats from climate change and the need for climate proofing infrastructure and processes. Cyclones in the region are increasing in occurrence and intensity with four cyclones experienced in one month February 2022 (UN News, 2022). In focus group discussions, people showed limited knowledge of the adverse effects or risks of the dumping site, and a strong positive perception of its economic benefit. Literacy and awareness programmes from the municipality in partnership with the existing associations could enhance awareness on waste management, environmental, climate and social risks and benefits, and knowledge on best practices in composting.

Municipal partnerships need to actively include the associations and the private sector in promoting environmentally friendly composting and opportunities for recycling non-organic waste materials. The municipality could enhance this through Public Private Partnerships with such companies. A system level monitoring and evaluation mechanism could be implemented with the existing associations, regularly reviewing and adjusting programmes in response to feedback from communities and stakeholders gathered through interviews, group discussions, and field observations.

A systems approach to address the challenges noted earlier and sequence implementation of these priorities is proposed in *Figure 2*.

Figure 2: Sequencing priorities. Key on the measures below the figure



KEY	Activities
Awareness and education, gap analysis	Municipality and existing partners (associations), build new partnerships and implement awareness, education, and training sessions with community on importance of sustainable waste management systems, their linkages with other systems, roles of stakeholders. Sensitize on impacts of poor waste disposal, proper waste management, composting techniques. Identify gaps in law .
Dumpsite conception, support infrastructure legal gaps addressed	A new dump site is being constructed, but may need to revisit in a collaborative manner the feasibility studies, review of existing site and plans, environmental and health impact assessment. Plan should include storage areas, drainage systems, safety equipment and appropriate composting areas. Funding options and partnerships e.g., grants from government, PPPs with recycling companies. New regulations, policies to support the infrastructure, governance framework. Other infrastructure needs e.g. trucks, personnel.
Construction of the dump site and other infrastructure, setting regulations	Construct the dump site per agreed plans, personnel, training and capacity needs addressed. Laws, policies and governance systems actualized.

KEY	Activities
Dump site operationalization	Implement and operate the site, guided by protocols and regulations including on waste sorting, waste treatment procedures (composting, recycling, reevaluating incineration). Multi-stakeholder M&E framework implemented to protect environment, health and continuous improvement of systems. Air, water and soil quality tracked, compliance with standards. Infrastructure maintenance systems put in place.
Continuous monitoring and evaluation	Joint and collaborative monitoring and evaluation implemented continuously, tracking implementation of plans, outcomes. Reports routinely produced, shared and used in refining programmes collaboratively. Awareness and education campaigns informed by monitoring, evaluation and review.

## Conclusion

The public dumpsite and waste management systems in the municipality of Manandriana present both opportunities and dangers to the local community's health, livelihoods and to the environment. This case study illustrates the potential of waste management systems as sites for innovation, providing practical links between waste, food, and water systems. Composted waste provides farmers with fertilizer and offers employment for compost producers and sellers, earning them income and facilitating their integration in the local economy. The compost enhances ecosystem regeneration, food security and nutrition.

However, the system also poses risks and challenges for residents and the environment. A systems approach to waste management and its links with the economy, food, water and other systems at municipal level is thus needed. This calls for construction of new infrastructure, such as the new dumping site, enactment and implementation of new policies and regulations, and strengthening of enforcement and implementation capacities. It involves strengthening and sustaining partnerships with diverse stakeholders to sustainably innovate and improve the system, in a manner that actively involves communities, and capacitates those involved through training and awareness programmes

## References

1. Ecology Madagascar .(2017). La gestion des déchets à Madagascar [Waste Management in Madagascar]. Online at <https://www.ong-madagascar.org/enjeux-ecologiques/gestion-des-dechets/>
2. EQUINET (2023) A conceptual framework for healthy urban systems for food and waste management in ESA countries, EQUINET, online, <https://equinetafrica.org/sites/default/files/uploads/documents/EQUINET%20conceptual%20framework%20for%20UH%20food%20and%20waste%20systems.pdf>
3. FARM (2023). Interview with some leaders of the Farm Association. Mimeo, FARM
4. ISSUU (2021). *La gestion des déchets* [Waste Management]. Online at [https://issuu.com/ldmdev/docs/madagascar\\_yearbook\\_2021/s/12999027](https://issuu.com/ldmdev/docs/madagascar_yearbook_2021/s/12999027)
5. Ndrenjasoa F T (2016). La Performance de la Gestion des Déchets dans la Ville D'antananarivo [The Performance Waste Management in the city of Antananarivo]. Antananarivo: University of Antananarivo. Online at [http://biblio.univ-antananarivo.mg/pdfs/ndrenjasoaFinaritraT\\_ECO\\_M1\\_16.pdf](http://biblio.univ-antananarivo.mg/pdfs/ndrenjasoaFinaritraT_ECO_M1_16.pdf)
6. Niriniomy T. (2022). Projet de fiabilisation des elements de base de p lan local d' o ccupation f onciere au niveau de la circonscription topographique D'avaradrano [Project for reliabilization of the basic elements of the local land occupation plan at the level of the topographic district of Avaradrano]. Antananarivo : University of Antananarivo. Online at [http://biblio.univ-antananarivo.mg/pdfs/niriniomyTahinjanahary\\_POLY\\_MAST2\\_22.pdf](http://biblio.univ-antananarivo.mg/pdfs/niriniomyTahinjanahary_POLY_MAST2_22.pdf)
7. Rakotorinina M J. (2007). Etude Par Prospection Electrique De La Potentialite En Eaux Souterraines De Deux Fokontany De La Commune Rurale De Manandriana Dans La Region Analamanga (Madagascar) [Study by Electrical Prospecting of the Groundwater Potential of Two Fokontany of the Rural Commune of Manandriana in the Analamanga Region (Madagascar)]. Antananarivo : University of Antananarivo. Online at [http://biblio.univ-antananarivo.mg/pdfs/rakotonirinamj\\_pc\\_m1\\_07.pdf](http://biblio.univ-antananarivo.mg/pdfs/rakotonirinamj_pc_m1_07.pdf)
8. Rasolofoniaina M . (2016). L'amenagement De L'espace Et Le Developpement Local Dans La Commune Rurale Manandriana, Region Analamanga [Space Arrangement and Local Development in the Rural Community of Manandriana, Analamanga Region]. Antananarivo, University of Antananarivo. Online at [http://biblio.univ-antananarivo.mg/pdfs/rasolofoniainaMalalaT\\_GEO\\_MAST2\\_2016.pdf](http://biblio.univ-antananarivo.mg/pdfs/rasolofoniainaMalalaT_GEO_MAST2_2016.pdf)
9. Salama J C .(undated). Dechet [Waste]. Online at <https://www.environnement.mg/wp-content/uploads/2019/04/14.-Chapitre-10-DECHET.pdf>
10. TAMBATRA. (Undated). GRET - TAMBATRA : Projet intégré de lutte contre la malnutrition dans les Communes de Fiaferana, Manandriana et Vilihazo - Phase transitoire. Gouvernement Princier Principauté de Monaco. Online at <https://cooperation.gouv.mc/Priorites/Cartographie-des-projets-en-cours/Afrique-Australe-de-l-Est/Madagascar/GRET-TAMBATRA-Projet-integre-de-lutte-contre-la-malnutrition-dans-les-Communes-de-Fiaferana-Manandriana-et-Vilihazo-Phase-transitoire>
11. UN News. (2022). 'Race against time' as Madagascar braces for 4th tropical cyclone in a month. Online at <https://news.un.org/en/story/2022/02/1112462>
12. World Bank. (2023). How Madagascar Can Break a Vicious Cycle of Poverty. World Bank. Online at <https://blogs.worldbank.org/african/how-madagascar-can-break-vicious-cycle-poverty>

### Acknowledgements:

Femmes Rurales en Action de Madagascar (FARM), established in 2018, primarily focuses on raising awareness among farmers about the use of biochar or green charcoal to halt tree felling. They promote agroecology by producing bio-compost to fertilize soils and discourage the use of chemical inputs. Fikambanana Fampivoarana ny Tantsaha (FIFATA) or the Association for Farmer Support, is a prominent Malagasy professional umbrella organization (OPF) founded in 1989. FIFATA advocates for a family-based, professional, and competitive agriculture sector while respecting the environment. It widely promotes sustainable agricultural techniques and agroecology across the 12 regions where it operates. The authors acknowledge guidance, peer review and edit from Artwell Kadungure and Rene Loewenson, TARSC and financial contribution for the case study from OSPC and EQUINET.