



Pesticide waste management in Tanzania under agricultural transformation: Policy, practice and systemic gaps

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Abstract

Tanzania is implementing the Agricultural Transformation Master Plan (ATMP 2024–2050) to accelerate agricultural productivity, commercialization, and income growth. Increased pesticide use is central to this transformation, yet it has simultaneously intensified the generation of pesticide waste, particularly empty containers and obsolete products, posing risks to environmental and human health. This study assesses pesticide waste management practices in Tanzania, focusing on the enabling policy and legal environment, institutional mandates, infrastructure and technical capacity, stakeholder responsibilities, core system functionality, and monitoring, reporting, and enforcement mechanisms. A qualitative research design was employed, drawing on key informant interviews with national regulators, environmental authorities, local government officials, private-sector actors, non-governmental organizations, and farmers across selected agricultural regions, complemented by a review of relevant laws, policies, and international instruments. The findings reveal that Tanzania has a robust legal and institutional framework aligned with international conventions; however, implementation remains fragmented and heavily project-dependent. The absence of a mandatory Extended Producer Responsibility framework, limited collection and disposal infrastructure, weak monitoring and reporting of pesticide waste flows, and reliance on corrective rather than deterrent enforcement undermine system sustainability. The study concludes that Tanzania's pesticide waste management system is in a transitional phase and recommends legal reforms to operationalize producer responsibility, investment in collection and disposal infrastructure, strengthened monitoring and transparency, and improved institutional coordination to support environmentally sound pesticide waste management alongside agricultural intensification.

Keywords: Pesticide waste management, empty pesticide containers, Extended Producer Responsibility (EPR), reverse logistics, hazardous waste governance, agricultural transformation, environmental policy and regulation, sustainable agriculture, Tanzania

Introduction

Tanzania is currently implementing the Agricultural Transformation Master Plan (2024-2050). The Agricultural Master Plan (ATMP 2024–2050) is a sectoral vehicle to implement Tanzania's long-term development agenda as set in: Tanzania Vision 2050, which is the national long-term development framework aimed at achieving upper-middle-income, industrialised, and inclusive economy status by 2050 through structural transformation, human capital development, and sustainable natural resource management, and Long-Term Perspective Plan (LTPP 2011–2025), which is a 15-year roadmap implemented through the Five-Year Development Plans (FYDP I–III), focusing on industrialisation, infrastructure, and inclusive growth. The ATMP (2024) serves as the agricultural pillar of Vision 2050, translating national aspirations into actionable sectoral programs, investments, and performance targets.

The primary objective of the Agricultural Transformation Master Plan (ATMP) (2024-2050) is to transform the agricultural sector towards higher productivity, commercialisation, and increased smallholder farmer income, thereby improving livelihoods and ensuring food and nutrition security (Omar, 2024). To realise this ambition, Tanzania has taken several initiatives, including increasing crop sector budgetary allocation from USD 122.5 million to over USD 500 million over 4 years from 2021/2022 to 2024/2025. Additionally, the Government

aimed to increase the area under block farming systems to a total of one million acres by 2030, from the current 41,000 acres; to increase the area under irrigation from the current 10% to 50%; and to grow the agricultural sector from 5% to 10% (ibid).

The ATMP (2024) targets a quintupling of agricultural GDP to USD 100 billion by 2050, driving 10% annual growth in the sector by 2030, and positioning agriculture as a springboard for industrialisation and trade. One of the main concerns in this expansion is the use of pesticides, which have become an integral part of the input ecosystem required to boost productivity and reduce post-harvest losses (ATMP, 2024).

However, pesticides are toxic chemicals intended to kill or repel target pests (Arias-Estevéz *et al.*, 2008)^[31]; their use has been accompanied by the generation of pesticide waste. According to Felsot *et al.* (2003)^[22], pesticide waste is referred to as packaging containing pesticide residues. If discarded at will, it will cause irreversible damage to soil, water, and human health. A failure to follow recommended practices in their handling could lead to undesired effects on the environment, humans, and other living organisms (Tilman *et al.*, 2011)^[33]. Worldwide, all developed and developing countries face the problems of pesticide waste, although the issue is different in developed industrial countries and poor developing countries (Mohafraash and Mossa, 2024)^[30]. The consideration of the industrialized

countries focuses on pesticide waste management, container disposal and recycling, wastewater treatment, and treatment of contaminated soil (ibid). On the other hand, in poor developing countries, little or no technical capacity exists for the handling and safe disposal of obsolete pesticides (FAO, 2001) [20]. Developing countries lack cost-effective local options for pesticide disposal that are environmentally sound (Mahugija, 2012) [29].”

Therefore, this study aims to assess the management practices and the potential environmental impact of pesticide waste in Tanzania.

Literature Review

Empty container management through (Extended Producer Responsibility and Reverse logistics): Experience from Brazil

Brazil is one of the world's largest consumers of pesticides, driven by the country's large agricultural production (Barroso *et al.*, 2025) [4]. Brazil used approximately 719,507 tonnes in 2021, averaging 10.9 kg/ha (ibid). To address the challenges associated with the increased use of pesticides, Brazil opted for a circular economy strategy, which fosters the end-of-useful-life management of products and their reinsertion in the supply chain (Agrawal and Singh, 2019) [1]. The process of reinserting products into the supply chain is done through reverse logistics (RL) to ensure operational efficiency and a sustainable chain (Oliveira and Camargo, 2014) [31].

In 2014, the National Environmental Council of Brazil (CONAMA) issued Resolution No. 465 of 5 December 2014, which establishes criteria and procedures for the disposal of empty pesticide containers and pesticide residues to protect the environment and public health (Brazil, 2014) [10]. The Resolution mandates a licensing-based, controlled system for the collection, storage, and final disposal of the empty pesticide containers as part of a “reverse logistics” scheme. The Resolution made the end-of-life for empty pesticide containers a mandatory and shared responsibility among several public and private agents, including: the final consumer, the manufacturer/importer, retailers and the public regulatory agency. This environmentally oriented legislation introduces the concept of Extended Producer Responsibility (EPR) and sheds light on a compulsory Reverse Logistics (RL) for products such as lamps, batteries, electronic products and lubricant oils, but also for empty pesticide containers. CONAMA 465/2014 complements earlier regulations such as Lei dos Agrotóxicos (Lei 7.802/1989), which is the main pesticide law in Brazil, by dealing specifically with post-use packaging waste (Karine, 2021) [27].

Does the same happen in Tanzania?

Pesticide Waste Management: The European Union Experience

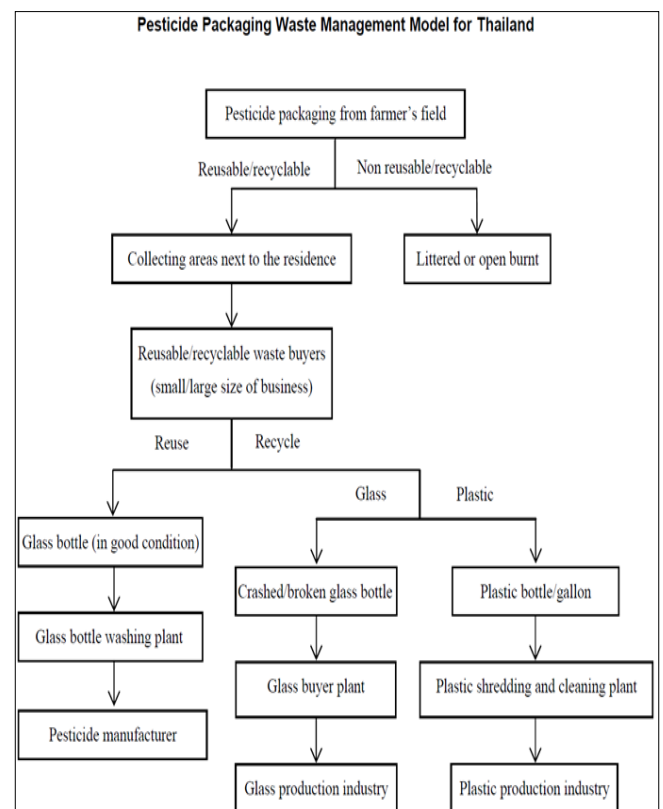
The Directive 2009/128/EC on the sustainable use of pesticides requires that Member States ensure “handling of packaging and remnants of pesticides” (including disposal) is done in accordance with Community legislation on waste (EPRS, 2018) [19]. The industry-level document CropLife Europe describes “Container Management Systems” (CMS)

that operate under national/transnational waste regulations (including in the EU), putting responsibility on producers/importers to ensure compliant end-of-life management of pesticide packaging (CropLife Europe, 2021) [14]. Germany, France and Belgium have long-established, nationwide container-management systems for empty pesticide packaging, supported by regulatory guidance and recurring national take-back programmes (CropLife Europe, 2023) [15].

Does the legislative framework in Tanzania put responsibility on producers/importers to ensure compliant end-of-life management of pesticide packaging?

Pesticide Waste Management: Thailand Experience

Thailand has 42% of its working population dependent on agriculture (Kaewboonchoo *et al.*, 2015) [26]. The country has been one of the world's food production hubs, delivering high quantities and high-quality foods to the global network for decades (Vanvimol *et al.*, 2013) [34]. For example, from 2001 to 2010, the importation of pesticide active ingredients increased twofold, from 37,039 tons in 2001 to 68,964 tons in 2010, with subsequent increase of pesticide packaging waste (Vanvimol *et al.*, 2013) [34]. However, in consideration of human and environmental health effects, current pesticide packaging waste management practices in Thailand pose a potential risk of exposure to harmful pesticides, as shown in Figure 1.0.



Source: Vanvimol *et al.*, 2013 [34]

Fig 1: Pesticide packaging waste chain in Thailand

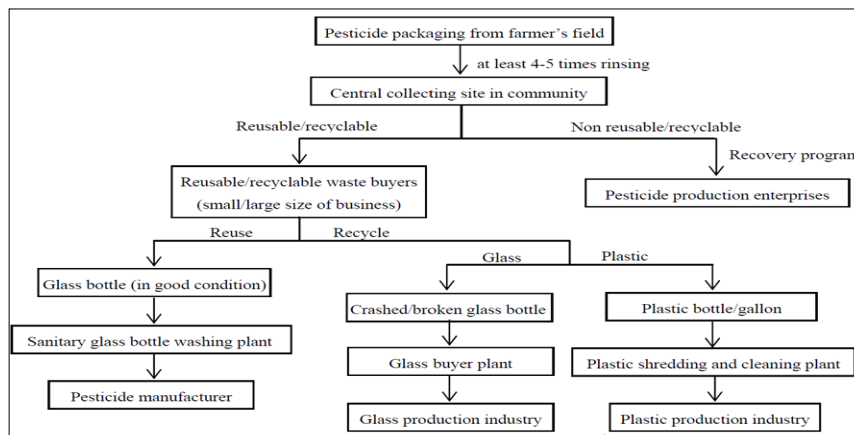
According to Vanvimol *et al.* (2013) [34], the pesticide waste management practice in Thailand increases the risk of exposure to harmful pesticides, as indicated in Table 1.0.

Table 1: Risk of exposure to harmful pesticides by pesticide packaging waste management value chain in Thailand

Activities	Possible risk		
	Pesticide contamination	Exposure to pesticide residue	Pesticide dispersion
Littered or burnt in open areas	Water, soil, and air (toxic gases)	-	-
Collecting of reusable/recyclable waste near the farmer's residence until selling to waste buyers, and mixed with general reusable/recyclable waste, such as drinking water and food seasoning bottles	Water and soil	Living organisms	General waste
Selling to reusable/recyclable waste buyers	-	Waste buyers/workers	-
Collecting areas of reusable/recyclable waste next to the residential area of waste buyers prior to transportation to next purchaser	Water and soil	Living organisms	General waste
Sorting of recyclable plastic wastes based on plastic types and colors	-	Workers	-
Shredding and washing of recyclable plastic wastes	Water and soil	Workers	-
Washing of reusable glass bottle	Water and soil	Workers	-

Source: Vanvimol *et al.*, 2013 [34]

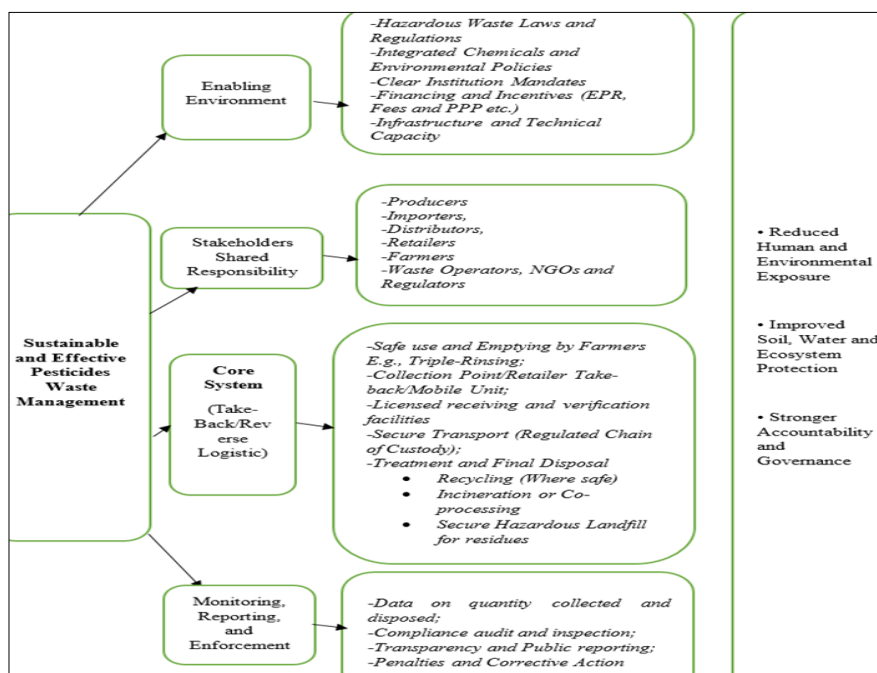
In addressing the challenges, Figure 2.0. developed as an appropriate management model of pesticide packaging waste for Thailand.



Source: Vanvimol *et al.*, 2013 [34]

Fig 2: Appropriate management model of pesticide packaging waste for Thailand

Conceptual Framework: Sustainable and Effective Pesticides Waste Management



Source: Own construct, 2025

Fig 3: Sustainable and Effective Pesticides Waste Management

Figure 3.0. illustrating how an enabling regulatory and policy environment, combined with shared stakeholder responsibility and a functioning take-back (reverse-logistics) system, leads to effective pesticide waste management. Continuous monitoring, reporting, and enforcement generate feedback that strengthens governance, compliance, and long-term environmental and public health.

Methodology

The study adopted a qualitative case-study design to examine pesticide waste management practices in Tanzania within the context of agricultural intensification under the ATMP (2024–2050). Primary data were collected through semi-structured key informant interviews with purposively selected stakeholders involved in pesticide regulation, environmental management, waste oversight, and pesticide use. Interviewees included officials from the Vice President's Office – Division of Environment, the National Environment Management Council, the Tropical Pesticides Research Institute / TPHPA, the Government Chemist Laboratory Authority, Local Government Authorities, pesticide importers and distributors, retailers, non-governmental organizations, and farmers from selected regions with intensive agricultural activity.

Secondary data were obtained through a systematic review of national legislation, regulations, policy documents, international conventions, project reports, and peer-reviewed literature relevant to pesticide waste management. Data collection focused on the full pesticide life cycle, including post-use waste handling, collection, transport, treatment, disposal, and enforcement mechanisms.

Qualitative data were analyzed using thematic content analysis. Interview responses and documentary evidence were coded and organized according to analytical themes derived from the study's conceptual framework: enabling environment, institutional roles, financing and incentives, infrastructure and technical capacity, stakeholder shared responsibilities, core system performance, and monitoring, reporting, and enforcement. Cross-validation of findings across stakeholder groups enhanced analytical rigor. Ethical considerations were observed through informed consent and anonymization of individual respondents.

Additionally, to enable comparison across crops and production systems of different scales, pesticide use was standardized as crop-normalized intensity, expressed as litres of formulated pesticide applied per hectare per year (L/ha/year). This metric captures application pressure at field level and provides a proxy for pesticide-container generation and residue load, which are central to waste-management outcomes.

Reported pesticide-use data were characterized by mixed units and variable reporting quality. To reflect this, confidence ranges were applied to all standardized estimates. These ranges represent plausible bounds rather than statistical confidence intervals and account for seasonal variability, formulation differences, packaging size variation, and assumptions required to harmonize reported data into a common metric. Systems with centralized procurement and consistent reporting were assigned narrower ranges, while systems with episodic or experimental use were assigned wider ranges.

To translate pesticide use into waste-management implications, a Pesticide-Waste Risk Score was developed on a semi-quantitative scale from 1 (very low) to 5 (very

high). The score integrates four criteria: (i) application intensity (L/ha/year), (ii) frequency and temporal concentration of use, (iii) chemical diversity and hazard profile, and (iv) likelihood of waste leakage outside formal hazardous-waste systems.

The analysis focuses on formulated products rather than active ingredients to reflect waste-relevant outcomes (containers and residues). Risk scoring is intended for comparative prioritization rather than precise waste inventories and supports interpretation of Findings in terms of environmental and institutional risk

Findings and Discussion

1. Enabling Environment

1.1 Hazardous Waste Laws and Regulations

While responding to the question which requires understanding of the international obligations to guide pesticide waste management in Mainland Tanzania, a respondent from the Vice-President's Office-Division of Environment, has indicated that,

“Tanzania is a Party to key international treaties that require environmentally sound management of pesticide wastes, including: Basel Convention (hazardous waste control and disposal), Bamako Convention (ban on import of hazardous waste into Africa), Rotterdam Convention (Prior Informed Consent for hazardous pesticides), Stockholm Convention (elimination/restriction of POPs pesticides), and Minamata Convention”.

He further stressed that,

“These treaties obligate Tanzania to control obsolete pesticides, residues, and contaminated packaging and prevent unsafe disposal”.

In an interview with an Officer from NEMC on the main national law governing pesticide waste management, she highlighted that,

“The Environmental Management Act (EMA), 2004, is the overarching law. It classifies pesticide waste as hazardous waste and mandates controls over its handling, transport, treatment, and disposal, implemented through the Hazardous Waste Control and Management Regulations.”

Further, while required to indicate specific regulations operationalize hazardous pesticide waste management, he highlighted that,

“The main Regulations are Environmental Management (Hazardous Waste Control and Management) Regulations, 2021 and Environmental Management (Solid Waste Management) Regulations, 2009.

1.2 Integrated chemicals and Environmental Policies

While required to shed light on the integrated chemical and Environmental policies in Tanzania, a Respondent from the Vice-President's Office in the Division of Environment, declared that,

The “Environmental Management (Hazardous Waste Control and Management) provide detailed procedures for classification, storage, transport, treatment, disposal, permitting, and reporting of hazardous waste, including pesticide residues and containers, while Environmental Management (Solid Waste Management) Regulations, 2009, apply where pesticide packaging interacts with municipal systems, though pesticide waste should remain under hazardous-waste controls”.

1.3 Institution Mandate

While responding to the role of TPHPA in pesticide waste management, a representative from TPHA mentioned that,

“Under the Plant Health Act, 2020 and Plant Health Regulations, 2023, TPHPA Registers and controls pesticides; Regulates import/export and distribution; and enforces compliance in use and handling.”

He further stressed that,

“Post-use waste management requires coordination with NEMC and LGAs, as TPHPA is not solely responsible for final disposal systems.

On the other hand, a representative from NEMC has indicated that,

“NEMC is responsible for Environmental oversight and enforcement under EMA, Licensing and supervision of hazardous-waste handling and disposal, supervising destruction of expired or obsolete pesticides, and Environmental inspections and compliance actions.

Further, a representative from GCLA, while responding to their role in pesticide waste management, indicated that,

“GCLA supports pesticide waste management by providing chemical analysis and verification, supporting identification of hazardous residues, and assisting enforcement agencies in compliance and prosecution cases.

While required to indicate the role of LGAs in pesticide Waste Management, an Environmental Officer from Dodoma City Council indicated that,

“LGAs are responsible for Local environmental protection and waste oversight, supporting safe storage, reporting, and handover of obsolete pesticides, enforcing EMA provisions at the community level, often in collaboration with NEMC, TPHPA, and sector boards.”

1.4 Financing and Incentives

While responding to the existence of financing or shared responsibility mechanisms, a representative from the Vice-President's Office in the division of the Environment indicated that,

“Yes, there is a mechanism, but they are limited. Some sectors, such as the cotton board, require suppliers to fund training as part of shared responsibility. However, Extended Producer Responsibility (EPR) for container take-back and disposal is not yet fully institutionalised in law.”

Further, while responding to the same question, a representative from TPHPA has indicated that,

“The TPHPA Act, 2020, is upstream-focused (market entry, use, compliance) rather than downstream-focused (post-use waste and container lifecycle).”

He further stressed that,

“The Act places strong obligations on registration, labelling, and safe use. However, it does not explicitly impose legal responsibility on producers or importers for the collection of empty or obsolete containers, financing take-back or disposal systems, or establishing or joining Extended Producer Responsibility schemes.”

“Under the TPHPA Act, once a pesticide is sold and used, producer responsibility effectively ends, which is inconsistent with EPR principles.” Added.

Additionally, while reviewing the TPHPA Act, 2020, there is no provision requiring Retailer take-back points, licensed receiving centres financed by producers, or Reverse-logistics arrangements for empty containers found in the ACT. The existing and promoted take-back initiatives that exist found to be voluntary, project-based, or donor-driven, not legally enforceable under TPHPA, Act.

Moreover, the analysis of the ACT revealed that the emphasis of the Act is on record-keeping related to sales, importation, and use, but does not require producers/importers to report quantities of containers placed on the market, or report on containers collected, recycled, or destroyed. In turn, this affect implementation of the EPR principle as the measurement of EPR performance or enforcement will be impossible.

1.5 Infrastructure and technical capacity

While responding to the existence of infrastructure and technical capacity to address sustainable and effective management of pesticide waste, a representative from TPHPA has indicated that,

“Our current mandate focuses on ensuring that pesticides entering the market meet safety and efficacy standards. Once the pesticide is used, the infrastructure for managing the resulting waste largely falls outside the pesticide control system and relies on environmental authorities and local arrangements.” However, through some projects, TPHPA is involved in providing demonstration infrastructure for effective management of pesticide waste.



Source: Field survey, 2025.



Fig 4: Pesticide container collection point in Simaniro, Arusha

He further added that,

“Technical guidance exists on safe handling and disposal practices, but the absence of standardised facilities such as regional hazardous-waste receiving centers limits the

effectiveness of these guidelines, particularly for smallholder farmers.”

During the study, it was found that TPHPA launched a special program to control and collect used pesticide

containers in Simanjiro District as a part of providing technical guidance to farmers. At the established centre, farmers were receiving

education on the proper handling procedures for obsolete pesticide containers.



Fig 5: TPHA train farmers on Environmentally Sound Management of Obsolete Pesticides Containers in Simanjiro, Arusha

Additionally, while responding to the training content, a representative from farmers indicated that,

“We have been instructed to carry out the triple Rinsing Process and then puncture the containers to prevent using them before taking them to the collection centres.

Moreover, a representative from NEMC, while responding to the existence of infrastructure and technical capacity to address sustainable and effective management of pesticide waste, has indicated that,

“Tanzania has a functional legal and institutional framework for pesticide control; however, the country has inadequate specialized infrastructure, such as certified hazardous-waste incinerators. There are very few (maybe one in Kisarawe district. The country also lacks a nationwide take-back system, which limits the full realization of sustainable pesticide management.”

On the other hand, a representative from VPO, while responding to the same question, indicated that,

“Environmental policies and regulations recognize pesticide waste as a potential environmental hazard; however, implementation is constrained by inadequate waste-handling infrastructure, particularly in rural and peri-urban agricultural areas where pesticide use is most intensive.”

Further to that, he stressed that,

“Local Government Authorities lack sufficient technical equipment, trained personnel, and financial resources to supervise environmentally sound management of pesticide residues and packaging at the community level.”

“The technical systems required for segregation, storage, transportation, and final disposal of hazardous agro-chemical waste are not yet fully developed.” Added.

Furthermore, while responding to the same question, farmers' representatives have indicated that,

“We receive guidance on how to apply pesticides, but there are no nearby facilities to return empty containers or expired products, so many farmers reuse, burn, or bury them out of necessity rather than choice. Extension services focus mainly on crop protection and yields; little practical training is provided on safe storage or disposal of pesticide containers, and protective equipment is often unavailable or unaffordable.”

“If collection points or take-back systems existed closer to our farms, farmers would be willing to comply, but currently there is no clear or practical option once pesticides are used.” Further added.

This implies that farmers operate within a compliance gap created not by unwillingness, but by structural deficiencies in infrastructure, training, and access to safe disposal mechanisms. Sustainable and effective pesticide management in Tanzania is constrained less by policy absence and more by infrastructural and technical limitations. This indicates a critical need for investment in hazardous-waste facilities, farmer-oriented technical support, and extended producer responsibility mechanisms to bridge the gap between regulation and practice.”

2. Stakeholders' Shared Responsibilities

While responding to the involvement of Stakeholders in sharing responsibility for sustainable and effective management of pesticide waste, a representative from VPO indicated that,

2.1 NGOs and Regulators

a. VPO

“There is currently no mandatory system requiring manufacturers to collect empty containers or obsolete pesticides once products are sold. The country has no Extended Producer Responsibility framework, which makes it difficult for Producers, Manufacturers and Importers to invest in take-back or disposal infrastructure.”

b. Non-Governmental Organisations (NGOs)

Representatives of NGOs, while answering the question on their involvement in effective management, indicated that, “Our engagement in pesticide waste management is mainly through awareness creation, training, and advocacy rather than direct involvement in waste collection or disposal.”

“NGOs operate in a limited number of project areas, and scaling up interventions is constrained by a lack of national infrastructure and sustainable financing.”

“We observe that pesticide waste management falls between institutions, and without strong producer or government leadership, NGO efforts remain fragmented and project-based.”

2.2 Importers and Manufacturers

A representative from the importers, while addressing the question of how they participate in ensuring effective management of pesticide waste, indicated that,

“We are willing to participate in container-management schemes, but such initiatives require clear government coordination, cost-sharing mechanisms, and legal certainty. However, currently there is no mandatory system requiring manufacturers to collect empty containers or obsolete pesticides once products are sold.”

“Our role remains in supporting safe pesticide use through labels and training materials.” Further added.

2.3 Distributors and Importers

For the case of distributors and wholesalers, while responding to their involvement in the management of pesticide waste, they have indicated that,

“Our role focuses on storage and distribution of registered pesticides, and we comply with licensing and inspection requirements, but we are not formally engaged in managing waste after products reach farmers.”

“There are no designated facilities or clear instructions for us to receive returned empty containers or expired products from retailers or farmers.”

“Without incentives or regulatory obligations, pesticide waste management is not integrated into distribution business models.”

2.4 Retailers

While responding to the question of how they are involved in sustainable and effective management of pesticide waste, a representative of retailers indicated that,

“We sell pesticides and provide basic advice on usage, but farmers rarely return empty containers because there is no system or space for us to store them safely.”

“Some farmers ask what to do with empty containers, but we have no official guidance or collection arrangements to offer.”

“If the government or manufacturers established a collection program, retailers could act as collection points, but currently this is not part of our licensing conditions.”

2.5 Farmers

Farmers in Iringa, Mbeya and Manyara, while responding to their participation in effective management of obsolete pesticide containers, have indicated that,

“Once the pesticide is used, no one comes to collect the container, and there is no nearby facility where we can take it safely.”

Further added that,

“We hear that pesticide containers are dangerous, but burning or burying them is often the only option available to us. If suppliers or manufacturers were involved in collecting the containers, farmers would cooperate, but at the moment, responsibility is left entirely to us.”

The analysis clearly shows that the sustainable and effective management of pesticide waste in Tanzania is constrained by limited stakeholder integration beyond the point of sale, weak enforcement of producer responsibility, and the absence of coordinated mechanisms linking manufacturers, distributors, retailers, farmers, and civil society organisations.

3. Core System

3.1 Safe use and emptying by farmers (including rinsing/decontamination)

Results indicate that safe use and emptying of pesticides is formally recognised but inconsistently practised at the farm level. National institutions emphasised that policy instruments and technical guidance exist to promote safe handling of pesticides. Officials from the Vice President’s Office – Division of Environment noted that

“At the policy level, safe use of chemicals is clearly articulated, and pesticide waste is acknowledged as an environmental risk within national environmental management frameworks. For example, Environmental Management (Hazardous Waste Control and Management) Regulations, 2021, indicate clearly that containers/packaging for hazardous waste must be labelled, punctured after use, and disposed of according to the Regulations.

However, translating policy into consistent farmer-level practices remains a challenge, particularly in rural areas where awareness, protective equipment, and monitoring are limited.” He added.

This policy practice gap was also acknowledged by the representative of TPHPA, who reported that,

“Guidance on safe use and emptying is incorporated into farmer trainings and dealer licensing. However, compliance remains uneven.”

“The challenge is not the absence of guidelines, but the level of adherence by farmers, especially smallholders who may not have received adequate training.” Further, explained.

Farmers’ accounts corroborated these concerns. A smallholder farmer from Arusha reported that

“We are told to rinse containers, but water is not always available, and after rinsing, there is no place to take the containers.”

Additionally, a representative from GCLA has indicated that,

“GCLA Industrial and Consumer Chemicals Regulations, 2020, strongly prohibit the domestic reuse of ‘empty’ chemical containers. Even beyond pesticides, Tanzania’s chemicals regulations provide that empty containers (or those with leftover hazardous chemicals) must be treated as chemical waste and must not be sold or used for domestic purposes.”

These findings suggest that safe use and emptying, while conceptually established, do not yet function as a consistent foundation for downstream pesticide waste management.

3.2 Collection Points, Retailer Take-Back, and Mobile Collection Systems

The study found that collection systems for pesticide waste are weakly institutionalised and largely project-driven. Officials from Local Government Authorities in Arusha consistently reported the absence of permanent, council-level collection points dedicated to pesticide containers. One LGA respondent stated that

“there is no specific infrastructure for pesticide container collection in our waste management plans; activities only happen when there is an external project.”

Similarly, a representative from NEMC confirmed that Tanzania has not yet implemented a mandatory retailer or importer take-back system. He further explained that,

“Collection initiatives exist, but they are mostly ad hoc and not embedded in a national take-back obligation for suppliers.”

However, farmers expressed willingness to participate in collection schemes if such systems were available. As one vegetable farmer in Arusha explained,

“If there were a shop or centre where we could return empty containers, farmers would use it.”

The absence of predictable collection mechanisms emerged as a critical bottleneck in the overall system.

3.3 Licensed Receiving and Verification Facilities

The findings show that licensed receiving and verification facilities are well-grounded in law but limited in operational reach. For example, in an interview with NEMC officials, it was clearly stipulated that the National Environment Management Council (NEMC) emphasised that pesticide waste is legally classified as hazardous and subject to licensing, environmental impact assessment, and monitoring requirements. Additionally, the regulatory framework clearly indicates that any facility handling hazardous waste must be licensed.”

However, one representative from GCLA indicated that, Across institutions, there is limited availability of Licensed Receiving and Verification Facilities. For example, the Government Chemist Laboratory Authority despite the

availability of a laboratory with capacity to analyze and verify hazardous pesticide waste, the number of formally designated receiving centers that regularly channel pesticide waste for verification and disposal is still very small.”

This limited physical infrastructure restricts compliance and undermines the effectiveness of subsequent transport and disposal stages.

3.4 Secure Transport (Chain of custody)

Findings indicate that secure transport and chain-of-custody systems are established in regulation but inconsistently applied in routine practice. Environmental regulators described a permitting and tracking system designed to ensure traceability of hazardous waste. An official from National Environment Management Council explained that “Movement of hazardous waste requires permits and tracking documents, and approved transporters are supposed to be used.”

However, a representative from LGAs reported that, “These mechanisms are primarily applied to large-scale operations. For small volumes of pesticide containers coming from villages, it is very difficult to apply the full chain-of-custody requirements. Consequently, routine pesticide waste streams remain largely informal and weakly monitored.”

3.5 Treatment and Final Disposal

The study found that final treatment and disposal options exist but are constrained by cost, scale, and financing. A representative from NEMC reported that, so far, reliance is largely on private incinerators, such as TINDWA or Cement Companies. The practice is controlled incineration, secure containment, or export for the disposal of high-risk or obsolete pesticide waste.

On the other hand, a representative from the Vice President’s Office – Division of Environment, declared that, “Technically sound disposal solutions are available, but they are expensive and not yet embedded as routine national systems.”

Additionally, Environmental regulators expressed caution regarding the recycling of pesticide containers. One NEMC official emphasized that

“Without proper decontamination and verification, recycling of pesticide containers can pose serious environmental and health risks.”

Farmers, on the other hand, reported limited awareness of what happens to containers after disposal, reinforcing the perception that final disposal is disconnected from farm-level practices.

Across stakeholder groups, results consistently indicate that Tanzania’s pesticide waste management system is not yet functioning as a fully integrated core system. While strong legal and institutional foundations are in place, operational elements—particularly collection, routine transport, and accessible treatment facilities, remain fragmented.

This implies that, the country has the rules, but the system is not yet complete from the farmer to the final disposal points. This underscores the transitional nature of Tanzania’s pesticide waste management system and highlights the need for institutionalized collection mechanisms, improved infrastructure, and sustainable financing to operationalize existing regulations.

4. Monitoring, Reporting and Enforcement

4.1 Monitoring and Reporting of Quantities Collected and Disposed

While responding to the question regarding reporting of the quantity collected and disposed, a representative from TPHPA indicated that,

“We have reliable data on pesticide registration, importation, and licensed dealers, but when it comes to quantities of empty containers collected or disposed, there is no routine national reporting system.”

On the other hand, a respondent from NEMC declared that, “Data on quantities of pesticide waste is usually available only during special exercises, such as obsolete pesticide stockpile projects. Outside those programs, container waste is largely invisible in the data.”

Additionally, a representative from LGA mentioned that, “At council level, we do not keep records of how many pesticide containers are generated or disposed. Farmers dispose of them individually, and the council does not receive reports.”

This implies that Quantitative monitoring of pesticide waste is episodic, project-based, and not institutionalized.

4.2 Compliance Audit and Inspection

In his response to the compliance audit and inspection of pesticide waste, a representative from NEMC indicated that, “We conduct inspections for licensed hazardous waste facilities and registered companies, but it is not practical to inspect pesticide container handling at farm level on a routine basis.”

While responding to the same, an officer from TPHPA mentioned that,

“Our inspections focus mainly on dealers, importers, and the quality of pesticides in the market. Waste management aspects are checked, but they are not always the main focus. This is attributed to the fact that it is beyond our core mandate”

Additionally, a representative from LGA, while reacting to the Compliance audit and inspection question, reported that, “We inspect farms for good agricultural practices, but container disposal is rarely audited unless there is a complaint or visible environmental problem. The concern of the LGA, as indicated in the Environmental Management Act, is largely on municipal waste”

The findings clearly show the existence of Compliance audits is upstream-focused and weakly applied to post-use waste management.

4.3 Transparency and Audit Reporting

While responding to the transparency and audit reporting for effective and sustainable pesticide waste management, a representative from VPO indicated that,

“Most reporting on hazardous waste is internal, between institutions. We do not regularly publish national reports showing how much pesticide waste has been collected or how it was disposed of.”

Responding to the same question, a representative from NEMC declared that,

“Inspection reports and disposal certificates are available within the regulatory system, but they are not usually shared with the public unless there is a specific reason.”

A representative from Farmers in Simanjiro on his side reported that,

“We never receive feedback on what happens to the containers. After all, in most cases we mix them with municipal waste. So, once they leave the farm, we don’t know where they go or how they are treated.”

The findings paint a clear picture that Transparency is administrative rather than public-facing. Consequently, this is observed to limit accountability and community awareness.

5. Penalties and Corrective Actions

In his response to the existence of penalties and corrective measures with regard to compliance on pesticides waste management requirements, a representative from NEMC indicated that,

“The law provides for penalties, including fines and suspension of licenses, but enforcement is usually applied to licensed operators rather than individual farmers.”

Additionally, a representative from TPHPA indicated that, “In many cases, we prioritize corrective measures such as warnings and training, especially where non-compliance is linked to a lack of awareness rather than deliberate violations.”

While responding to the same, a representative from LGA declared that,

“Penalizing farmers for improper disposal are difficult. This is attributed to the fact that most farming activities take place in rural areas, where there are adequate waste management services. However, we normally advise and educate them through extension and environmental officers instead of taking legal action.”

The findings portray a clear picture that enforcement relies more on corrective guidance than deterrent penalties, particularly at the farm level.

Conclusion

The study finds that Tanzania has established a comprehensive legal and institutional foundation for pesticide waste management, with pesticide waste clearly classified as hazardous and regulatory mandates defined across multiple institutions. However, the operationalization of this framework remains limited. Core system elements—particularly collection mechanisms, licensed receiving facilities, secure transport, and routine disposal pathways—are inadequately developed and unevenly accessible, especially for smallholder farmers.

The absence of a legally mandated Extended Producer Responsibility framework represents a critical gap, effectively shifting post-use waste responsibility to farmers and local authorities without corresponding infrastructure or financing. Monitoring and reporting systems focus primarily on pesticide registration and market compliance, while post-use waste flows remain largely unquantified. Enforcement mechanisms rely predominantly on corrective guidance rather than consistent deterrent penalties, weakening compliance incentives.

Overall, Tanzania’s pesticide waste management system is best characterized as transitional: strong on regulatory intent but weak in operational integration. Without targeted reforms, the expansion of pesticide uses under agricultural transformation risks exacerbating environmental and public health impacts.

Recommendations

To strengthen the sustainability and effectiveness of pesticide waste management in Tanzania, the study recommends:

1. Legal reform to introduce mandatory Extended Producer Responsibility provisions requiring producers and importers to finance and organize post-use container collection, transport, and disposal.
2. Infrastructure investment in regional hazardous-waste receiving facilities, certified incineration or secure landfill options, and decentralized collection points in high-pesticide-use areas.
3. Institutional coordination through a formal mechanism linking TPHPA, NEMC, GCLA, LGAs, and sector boards to manage pesticide waste across the full life cycle.
4. Monitoring and reporting enhancement by establishing a national system to track quantities of pesticide containers placed on the market, collected, treated, and disposed of.
5. Transparency and accountability through periodic public reporting on pesticide waste management outcomes.
6. Farmer-centered capacity building, integrating practical container management training into extension services and improving access to affordable protective equipment.

Implementing these measures would align Tanzania’s agricultural transformation agenda with environmental sustainability and public health protection.

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