



UNITED REPUBLIC OF TANZANIA

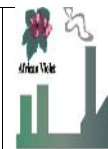
THE NATIONAL SOLID WASTE MANAGEMENT STRATEGY



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AGENDA
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FOREWORD

Urban solid waste in Tanzania is a serious environmental problem. Concurrent with recent socioeconomic development, coupled with liberalization of the economy and rapid population growth, the quantum of solid waste generated is at a rapid rate. The manner in which urban solid waste is managed in urban centres directly affects the metropolitan environment, the appearance of the cities and municipalities and the citizens day-to-day life. Furthermore, improper waste management apart from having severe health problem as waste lead to proliferation of diseases, environmental degradation and ultimate impact on livelihoods, improper management of waste also poses a threat to Climate Change and eventually in the achievement of sustainable development. Waste being one of the contributors of greenhouse gases, affects climate change and it is for this reason that as a country, we should develop sustainable waste management technologies and initiatives to curb this growing global challenge.

Through our commitment to sustainable development, Tanzania aims to balance the broader economic and social challenges of development and environmental protection. For this reason, the country subscribes to the vision of a prosperous and equitable society living in harmony with our natural resources. This is also reinforced in the Constitution under the fundamental right to a clean and healthy environment. Sound environmental management entails use of waste reduction technologies in production, sustainable product design, resource efficiency, re-using products where possible and recovering value from products. Although, elimination of waste entirely may not be feasible, systematic application of modern waste management systems should be explored and implemented.

In order to achieve a workable and sustainable waste management strategy, collaborative efforts from different stakeholders is very important. This National Solid Waste Management Strategy (NSWMS) seeks to establish a common platform for action between stakeholders to systematically improve waste management in Tanzania. It is for this reason that the Vice President's Office with other stakeholders undertook an assessment of waste management practices mainly in Dar es Salaam to form a basis on which this Strategy was developed. The Strategy lays the framework for improved waste management in the country.

January Makamba (MP)

PREFACE

The Constitution of the United Republic of Tanzania (1977) makes it mandatory to protect human health of each citizen in Tanzania. Article 14 states that “every person has the right to live and to the protection of his life by the society in accordance with the law,” which may be interpreted to mean that Tanzanians are entitled to a healthy environment. The Environmental Management Act No 20 of 2004 was enacted to ensure this important requirement of the Constitution is realised. It includes principles of public participation in the development of policies, plans and processes for the management of the environment, the principle of inter-generational and intra-generational equity, the polluter-pays principle and the precautionary principle.

It is in this context that efficient and sustainable waste management systems are required as the country develops into a newly industrialized state by 2025. This strategy is being developed in order to have fully functional and compliant waste management systems in our urban centres with a major goal of protecting human health through enhancing a clean and healthy environment for all.

Although only Dar es Salaam was used in developing this Strategy, it was observed that waste challenges were similar in all other Municipalities thus these systems can be replicated in other councils countrywide.

It is with this spirit that this strategy is based on the concepts of reduction, reuse, recycle, treatment and final disposal.

All the efforts were driven towards compliance with the Environmental Management Act No.20 of 2004, and the Environmental Management (Solid Waste Management) Regulations, 2009 in order to ensure a clean and healthy environment for all, keeping in line with Article 14, of the Constitution of Tanzania 1977.

Permanent Secretary

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SYMBOLS AND ACRONYMS

CBO	- Community Based Organization
CSO	- Civil Society Organization
CSR	- Corporate Social Responsibility
DCC	- Dar Es Salaam City Council
EIA	- Environmental Impact Assessment
EIS	- Environmental Impact Statement
EMA	- Environmental Management Act
GDP	- Gross Domestic Products
ICT	- Information and Communication Technology
IMC	- Ilala Municipal Council
ISO	- International Organization for Standardization
KMC	- Kigamboni Municipal Council
LGA	- Local Government Authorities
MIG	- Municipal Infrastructure Grant
MITI	- Ministry of Industry, Trade, and Investment
MoA	- Ministry of Agriculture
MoHCDGEC	- Ministry of Health, Community Development, Gender, Elderly and Children
MP	- Member of Parliament
NEAC	- National Environmental Advisory Committee
NEAP	- National Environmental Action Plan
NEMC	- National Environment Management Council
NGO	- Non-Governmental Organization
NSGRP	- National Strategy for Growth and Reduction of Poverty
NSWMS	- National Solid Waste Management Strategy
PCB	- Polychlorinated Biphenyls
PPP	- Public-Private-Partnerships
REME	- Regional Environmental Management Expert
SME	- Small and Medium Enterprises
SWOT	- Strength Weakness Opportunities Threat
SWM	- Solid Waste Management
TMC	- Temeke Municipal Council
TZS	- Tanzania Shillings
VPO	- Vice President's Office

1. INTRODUCTION TO THE STRATEGY

1.1. Background

The management of various types of waste has over the years been a very difficult and challenging issue. This difficulty has manifested itself in the perennial outbreak of diseases such as cholera, dysentery and pollution of water resources, air, soil or land contamination, proliferation of pests and vermin and the loss of aesthetic beauty. Improvements are desired in waste management covering aspects of minimisation of waste generation, collection, re-use, recycling, treatment and disposal.

In this regard, the Government of the Republic of Tanzania enacted legislations to manage environment. The Environmental Management Act No. 20 of 2004, which establishes legal and institutional framework for sustainable management of environment including waste management. The Act sets up the institutional framework for environmental management in the country. The Act establishes National Environmental Advisory Committee (NEAC) with the role of advising the Minister responsible for Environment, on matters relating to protection and management of environment. It confers the role of enforcement to the National Environment Management Council (NEMC). The Act directs establishment of Sector Environmental Sections with the role of overseeing environmental management relevant to such respective sectors. It also gives power to the Regional Secretariats to designate Regional Environmental Management Expert (REME) charged with responsibility to advise and oversee implementation and enforcement of EMA. Furthermore, it empowers Local Government Authorities (LGAs: City, Municipal, District, Township) to designate or appoint Environmental Management Officers to oversee implementation of EMA at respective levels. In addition, the Act establishes Environmental Committees at LGAs levels to advise and oversee the implementation of EMA within their jurisdiction. The Act establishes the National Environmental Management Council as an institution responsible for enforcement of laws related to environmental management. Part IX of the Act is dedicated to waste management. Although the section does not specifically mention waste management strategy, it covers solid waste management along its life cycle.

On one hand, under the EMA the solid waste is defined as non-liquid materials arising from domestic, street, commercial, industrial and agricultural activities; and include garbage, non-liquid materials arising from construction and demolition activities, garden trimmings and mining operations, dead animals and abandoned car scraps. On the other hand, solid waste management is defined as an essential service that is provided to protect the environment and public health, promote hygiene, remove materials, avoid waste, reduce waste quantities, decrease emissions and residues and prevent spread of diseases.

Before enacting the EMA Tanzania developed a National Environmental Action Plan (NEAP; 1994). Since preparation of NEAP (1994), the Government has undertaken various initiatives to improve environmental management in the country. These include: formulation and implementation of the National Environmental Policy (1997); enactment of the Environmental Management Act, 2004; mainstreaming of environment into National Strategy for Growth and Reduction of Poverty (NSGRP) I (2005-2010) and II (2010-2015), sectoral policies, strategies, plans, and programmes. Currently Tanzania

is implementing the National Environmental Action Plan (NEAP) 2013 – 2018. This plan acknowledges that increasing urbanization; rising standards of living and rapid development associated with population growth have resulted in increased solid and liquid waste generation mainly by industrial and domestic activities. It estimates that more than 10,000 tonnes of municipal solid waste are generated per day countrywide. The indicative generation rate ranges from 0.1 – 1.0 kg/cap/day. It further acknowledges that the increase in waste generation is not equivalent to increase in the capacity of the relevant urban authorities to deal with this problem. As much as 80-90% of solid waste generated in urban areas is not collected and most of the domestic waste, which accounts for about 60 % of the total solid waste generated daily, is disposed of by burning or burying. Among the actions advocated to manage degradation of environment as a result of poor waste management the plan advocates for strengthening integrated solid waste management system. However, the plan does not provide detailed strategy on how to achieve this.

1.2. Government Initiatives

- a) The government has engaged the private sector, Non-Governmental Organizations and community Based Organizations to be involved in solid waste management (SWM) services.
- b) The government is encouraging private sector to establish solid waste recycling systems in order to minimize the amount of the non-degradable waste materials such as metal, glass, plastic bottles and used tires.
- c) The government has issued a Public Notice (2015) to ban the manufacturing, importation, selling, buying, and use of plastic bags under 30 microns (or 0.03 mm) thickness and those with 65 microns (or 0.065 mm) thickness used for water and juice packaging. Also, it surtaxes other types of plastic bags with 30 microns (or 0.03 mm) thickness and above, by more than 100%. Industry owners and investors are encouraged to promote the production of alternative bags in place of plastic bags, such as paper manufactured bags.
- d) The government is encouraging various stakeholders to exploit the potential of decomposing solid waste for Climate Change Mitigation through biogas flaring and generation of electricity.
- e) Some industries have started to make use of the waste generated for economic purposes including Biogas plants for energy needs. A typical example is the sisal waste to electricity which has been developed by Katani Industries in Tanga, and bagasse which is used by some sugar factories as fuel for producing steam and electricity.
- f) The government has developed Regulations on Solid and Hazardous Waste Management.

However, despite all these efforts waste management in urban centres is still a major challenge. Major challenges of concerns include:

- Littering, uncollected garbage, and indiscriminate dumping of waste;
- Improper handling of hazardous wastes;
- Health hazards due to indiscriminate disposal of waste
- Low standards of operational disposal sites; and
- Potential for contamination of soils and underground/ surface water from operations of disposal sites and the indiscriminate disposal of wastes.

1.3. The Operational Legal and Regulatory framework of the strategy

Tanzania has recognised the need for a strengthened legal framework to the management of waste. In this regard the EMA, forms the basis of the framework. Within this framework, all the stakeholders will have a role to play, with local authorities playing a key role in the formulation of by-laws and regulations in their areas of jurisdiction. The polluter-pays-principle', precautionary principle, principle of ecosystem integrity, principle of public participation, principle of access to justice, principle of inter-generational and intra-generational equity and similar such principles shall guide this process.

This framework reflects the NEAP's fundamental principles of:

- a) The right of the citizens to a clean environment;
- b) The participation of Local communities and the private sector in natural resources management; and
- c) Obligatory Environmental Impact Assessment (EIA) of major development projects in all sectors.

The Environmental Management Act No. 20 of 2004 is the principal law on environment. This provides duties for Local Government in solid waste management, disposal of solid waste from market business areas, and institutions, storage of solid waste from industries, solid waste collection waste transfer stations, and final disposal of waste. Other supporting pieces of legislation with regard to waste management are listed in Table 1.1.

Table 1.1: Summary of requirements of various Legislation with regards to waste management

Legislation	Summary of Requirements
Constitution of the United Republic of Tanzania, 1977	Articles relevant to the project are: <ul style="list-style-type: none"> ➤ Article 14 states that "every person has the right to live and to the protection of his life by the society in accordance with the law," which may be interpreted to mean that Tanzanians are entitled to a healthy environment. ➤ Article 27 (1) specifically states that "every person has the duty to protect the natural resources of the United Republic" where natural resources may be interpreted as environment.

Legislation	Summary of Requirements
<p>Environmental Management Act (EMA), 2004</p>	<p>The EMA is the prevailing law regarding environmental management in Tanzania. It sets out a range of measures for sustainable management of the environment, prevention and control of pollution, waste management, regulation of compliance, impact and risk assessment and EIA requirements.</p> <p>The Act:</p> <ul style="list-style-type: none"> • requires each ministry to establish an environmental section, which has functions and duties assigned to them under the Act and to appoint environmental coordinators (Section 30) • gives the National Environment Management Council (NEMC) a mandate to undertake environmental compliance monitoring and enforcement, to review EIAs and facilitate public participation in environmental decision making, and to exercise general supervision and coordination of all matters relating to the environment • sets out the legal basis for the EIA process and requires the NEMC to determine whether a developer must prepare an EIA before a proposed project, establish whether a project is likely to have a significant impact on the environment, and recommend projects to the Minister for approval and issuance of an EIA certificate • Defines environmentally sensitive areas, makes provision for these areas to be designated or notified and for prescribing environmental restrictions or conditions to protect these areas. • Make regulations prescribing on (k) safe transportation of toxic waste or dangerous chemicals, obsolete stocks or related chemicals as a way of protecting the environment and human health; and (q) compensations, clean-ups and emergency response to hazardous substances released into the environment and clean-up of inactive hazardous waste disposal sites (Section 77) • Section 114: <ul style="list-style-type: none"> (1) For the purposes of ensuring minimization of the solid waste in their respective areas of jurisdiction, local government authorities shall prescribe: (a) for different types or kinds of waste or refuse or garbage to be separated at the source; (b) for standards to guide the type, size, shape, colour and other specifications for refuse containers used; and (c) for mechanisms to be put in place to involve the private sector and Non-Governmental Organisations on planning, raising awareness among producers, vendors, transporters, manufacturers and others on the need to have appropriate containers and enhance separation of waste at source. (2) The local government authorities shall, with respect to their areas of respective jurisdiction: (a) cause to be conducted appropriate Environmental Impact Assessment for all new major activities leading to proper management of solid waste; (b) manage solid waste generated in accordance with sustainable plans produced by respective local government authority; and (c) ensure the appropriate sorting of waste is made right at the source and in accordance with standards or specifications prescribed by the local government authority concerned. • Section 119 - <p>The local government authorities shall in choosing the best method of solid waste disposal for their areas of jurisdiction consider the following matters: (a) climatic conditions; (b) economic ability; (c) interest of the community; (d) environmental, hygienic and social benefits; and (e) availability of tipping sites.</p> • Section 134. <ul style="list-style-type: none"> (1) Each local government authority shall, with respect to its area of jurisdiction, ensure that: (a) standards prescribed for the hazardous waste management are in place and operational at all the time; (b) premises producing hazardous wastes are adequately ventilated and are in compliance with prescribed standards; (c) waste effluents are treated or are so modified as to comply with prescribed standards before final disposal; and (d) hazardous liquid wastes are treated to conform with prescribed environmental standards at factory or on site before their discharge into public sewers or municipal oxidation ponds or in an open land or into receiving water bodies.
<p>Industrial and Consumer Chemicals (Management and Control) Act, No. 3, 2003</p>	<p>The Act provides for the:</p> <ul style="list-style-type: none"> • control of production, importation, exportation, transportation, storage of and dealing in chemicals (Part III) • management of industrial and consumer chemicals including associated wastes.

Legislation	Summary of Requirements
Land Acquisition Act, 1967	<p>The Act provides for:</p> <ul style="list-style-type: none"> • the president to acquire any land for any public purpose and defines the circumstances in which public interest could be invoked • the acquisition of the land for landfill • requirements before land acquisition such as investigations, issuing notice of intention to take land and the requirements for, and restrictions on compensation.
Land Act No. 4, 1999	<p>The Ministry of Lands, Housing and Human Settlement Development is responsible for implementing the Act.</p> <p>The Land Act provides for:</p> <ul style="list-style-type: none"> • particular areas to be designated as “hazardous land”, the development of which is likely to pose a danger to life or lead to the degradation or destruction of the environment on a site or on land adjacent to the site. Hazardous land includes: <ul style="list-style-type: none"> ○ mangrove swamps ○ coral reefs ○ wetlands ○ offshore islands ○ land designated or used for dumping of hazardous wastes ○ land within 60 m of a riverbank, shoreline of an inland lake, beach or coast ○ land on slopes with a gradient exceeding acceptable angle ○ land specified by appropriate authority as fragile nature or of environmental significance • the protection of hazardous land <p>Landfill facility may not be constructed in sensitive sites</p>
The Village Land Act No. 5, 1999	<p>The Ministry of Lands, Housing and Human Settlement Development is responsible for implementing the Act.</p> <p>Section 6.-(1) The Minister may declare any area of a village land to be hazard land subject to the provisions subsection of subsection (3). (3) For purposes of this Section, hazard land is land the development of which is likely to pose a danger to life or to lead to the degradation of or environmental destruction on that or contiguous land and includes but is not limited to- (c) land designated or used or the dumping of hazardous waste;</p>
Land Use Planning Act No. 6, 2007	<p>This Act provides for:</p> <ul style="list-style-type: none"> • procedures for the preparation, administration and enforcement of land use plans; to facilitate an orderly management of land use, empower land occupiers and users to make better and more productive use of land, to enhance security and equity in accessing land and its resources • a legal framework for planning authorities with the mandate to prepare and implement land use plans following the laid out procedures • the requirement for projects to be integrated in land use plans of region(s) and district(s) is of relevance to the project. <p>This Act requires waste disposal sites to be included in land use plans.</p>

Legislation	Summary of Requirements
Occupational Health and Safety Act, 2003	<p>This Act provides for:</p> <ul style="list-style-type: none"> • the safety, health and welfare of persons working in factories and all other places of work • the protection of persons, other than persons at work, against hazards to health and safety arising out of, or in connection with, activities of persons at work • safe means of access, safe working conditions, fire prevention, health and welfare provisions, the provision of personal protective equipment, first aid and fire fighting training. <p>The Ministry of Labour and Employment is responsible for implementing the Act.</p>
Public Health Act, 2009	<p>The Act:</p> <ul style="list-style-type: none"> • prohibits the discharge of oil, grease, ballast, waste, sewage or any other polluting substance into waters of the seaport, lake, port or river port (Section 37(1)) • prohibits dumping or discharge of waste into the land within the defined port area (Section 38(1)) • provides for addressing nuisances, such as noise, waste, workplaces in poor condition (Part IV(a)) • stipulates that construction and industries producing dust and gaseous wastes should be situated far from residential areas (Section 84 (1)) • provides for hazardous and health care wastes management (Section 87). • provides for welfare and health of workers (Sections 168–169).
Tanzania Investment Act, No. 26, 1997	<p>This Act:</p> <ul style="list-style-type: none"> • established the Tanzania Investment Centre (TIC) to promote, coordinate and facilitate investment into Tanzania, and governs investment activities. <p>This Act is relevant for Private Investors intending in waste management</p>
Urban Planning Act No. 8, 2007	<p>The Act provides for:</p> <ul style="list-style-type: none"> • the orderly and sustainable development of land in urban areas to preserve and improve amenities • consent to develop land, and controlling the use of land in urban areas.
Worker's Compensation Act, No 20, 2008	<p>The Act provides for the:</p> <ul style="list-style-type: none"> • right to compensation and protection (Part IV) • claims for compensation (Part V) • determination of compensation (Part VI) • obligations of employers (Part VIII).

Legislation	Summary of Requirements
Public Private Partnership Act, 2010	The Act give effect to the public-private partnership policy; to provide for institutional frameworks for the implementation of public-private agreements between public sector and private sector entities; to set rules, guidelines and procedures governing public-private procurement, development and implementation of public private partnership and to provide for other related matters. Public Private Partnership Co-ordination Unit shall deal with promotion and co-ordination of all matters relating to public-private partnership projects undertaken within the Mainland Tanzania. (g) Environment and Waste Management (section 6 (3));
Atomic Energy Act, 2003	The Act provides for establishment of the Tanzania Atomic Energy Commission and to provide for its functions in relation to the control of the use of ionizing and non-ionizing sources, the promotion of safety use and peaceful uses of atomic energy and nuclear technology, and to repeal the Protection from Radiation Act, 1983. Section 34, no person shall, except in accordance with an authorisation granted in that behalf under section 35 of the Act, dispose of any radioactive waste on or from any premises which were used for the purposes of an undertaking carried on by him, or cause or permit any radioactive waste to be so disposed of, if he knows or has reasonable grounds for believing it to be radioactive waste.

Table 1.2: Shows a summary of relevant regulations

Regulations and Guidelines	Summary of Requirements
Regulations	
Environmental Impact Assessment and Audit Regulations, 2005 and 2018 amendments	<p>The Regulations:</p> <ul style="list-style-type: none"> • make it an offence to begin, finance, permit or licence any projects listed in the regulations without the developer submitting to the licensing or permitting authority an application for an EIA certificate in the format of a project brief • cover appeals to the environmental appeals tribunal on approval or disapproval of an EIS by the Minister and public access to information on EIAs. The EIA process, including registration, screening, assessment, review and approval, is described in Section 44. contain requirements for environmental audits and monitoring. • First schedule on the projects category type A that are mandatory to undertake Environmental Impact Assessment (20). WASTE TREATMENT AND DISPOSAL: (a) Toxic and Hazardous waste: (i) Construction of Incineration plants; (ii) Construction of recovery plant; (iii) Construction of waste water treatment plant; (iv) Construction of secure landfills facility; and (v) Construction of storage (temporary) facility. (b) municipal solid waste: (i) construction of Municipal Solid Waste landfill facility (c) municipal sewage: (i) construction of sewage sewer system

Regulations and Guidelines	Summary of Requirements
Environmental Management (Air Quality Standards) Regulations, 2007	<p>The Regulations:</p> <ul style="list-style-type: none"> • prohibit emissions and releases of hazardous substances into the environment • prescribe permissible emission limits and quantities of emissions of sulphur oxide, carbon monoxide, black smoke and suspended particulate matters, nitrogen oxide, ozone, hydrocarbons, dust and lead • empower NEMC to issue air pollutant emission permits, enforce compliance, undertake emergency prevention and issue stop orders.
Environmental Management (Hazardous Waste Control and Management) Regulations, 2009	<p>The Regulations:</p> <ul style="list-style-type: none"> • detail the requirements and responsibilities for controlling and managing hazardous waste in Tanzania. This includes implementing the same guiding principles for solid waste disposal and management. • detail permitting requirements, notably the requirement for a permit to export hazardous wastes, and procedures for applying to the Director of Environment for a licence for transporting or storing hazardous waste. Article 14 describes the conditions with regards to facilities, procedures, personnel and equipment required to obtain this type of licence. • Part IV (Trans-boundary movement of hazardous waste) addresses the export and import of these types of waste.
Environmental Management (Soil Quality Standards) Regulations, 2007	<p>The Regulations:</p> <ul style="list-style-type: none"> • comprise hazardous waste management; registration and discharge permits for polluting activities •
Environmental Management (Solid Waste) Regulations, 2009	<p>The Regulations:</p> <ul style="list-style-type: none"> • detail the requirements and responsibilities for managing solid waste in Tanzania • highlight waste minimisation and cleaner production principles alongside the duty to safeguard the public health and the environment from adverse effects of solid waste • detail permitting requirements (Part III), notably that any person dealing with solid waste as collector, transporter, waste depositor or manager of a transfer station will apply to the LGA for a permit. The local authority will also issue licences to individuals or companies qualified to operate solid waste disposal sites, i.e., a permit is required to operate a LGA waste disposal site.
Land (Assessment of Value for Compensation) Regulations, 2001	<p>The Regulations:</p> <ul style="list-style-type: none"> • apply to any application or claims for compensation by any person occupying land.

Regulations and Guidelines	Summary of Requirements
Land (Compensation Claims) Regulations, 2001	<p>The Regulations:</p> <ul style="list-style-type: none"> • provide the basis for eligibility for compensation • state that compensation can take the form of monetary compensation, or could, at the option of the government, take the form of all or a combination of the following: <ul style="list-style-type: none"> ○ a plot of land of comparable quality, extent and productive potential the land loss ○ a building or buildings of comparable quality extent and use comparable to the building or buildings lost ○ plant and seedlings ○ regular supplies of grain and other basic foodstuffs for a specified period.

1.4. MEAs and Regional agreements (should include all agreements which Tanzania has ratified related to SWM)

1.4.1 . Basel convention on Trans-boundary movement of hazardous waste and other waste

The Basel Convention was originally established to address the global problem of uncontrolled movement and dumping of hazardous wastes, including incidents of illegal dumping in developing countries by companies from developed countries. This was of great concern as indiscriminately disposed, accidental spillage or improper management of hazardous waste can pose severe health problems, even death and can poison water and land for decades. The Basel Convention is therefore a global agreement, ratified by many member countries including The United Republic of Tanzania, for addressing the problems and challenges posed by hazardous waste.

The Bamako Convention is the convention on the ban of the importing to Africa and Control of Trans-boundary Movements and Management of Hazardous wastes within Africa, which was adopted by the members of the African Union in 1991 and came into force in 1998.

2. CURRENT WASTE MANAGEMENT SYSTEMS

2.1. An overview of the current status of waste management

Tanzania is home to a population of over 50 million people in 2017 (Population and Housing Census, 2012). Since gaining its independence in 1961, the country has been continuously developing in terms of its economy and modern industry. Currently the country's economy is estimated to grow with a GDP of 7% (MetaSus, 2016). Large population is now living in urban areas where most of this growth is taking place. The country has a number of towns/cities, four are being considered to be metropolitan cities: Dar es Salaam, Mwanza, Arusha and Mbeya. Due to growth in urbanization, industrialization and population, the generation rate of solid waste in Tanzania cities and towns is also increased. MetaSus, 2016 predicted the annual waste growth of approximately 10% in Dar es Salaam city. The historical and expected growth waste production as a result of population and wealth growth is indicated in Figure 2.1 for Dar es Salaam.

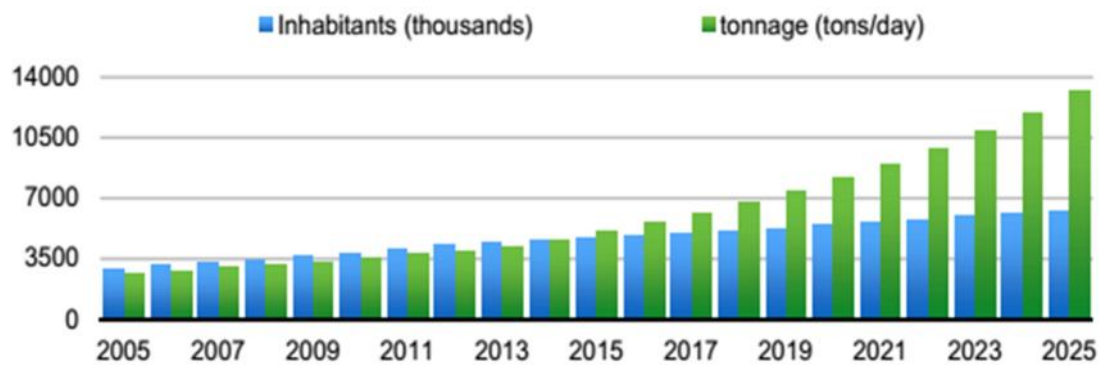


Figure 2.1: Expected growth in waste production of Dar es Salaam until 2025 (MetaSus, 2016)

In most cases like in other countries around the world, the management practice of solid waste in Tanzania is the responsibility of municipalities. National Bureau of Statistics, 2015 report states that, there is a limited waste management data available for the country. This becomes a difficult issue to quantify the amount of waste and management practices in municipalities within the country. Mismanagement of solid waste can cause adverse environmental impacts, public health risk and other socio-economic problem. Only Dar es Salaam municipality council has an improved data for waste management.

Taking the Dar es Salaam city as a point of reference, the population is estimated to be 4.2 million people in 2015 and also expected to be 6.2 million people in 2025 (MetaSus, 2016). Dar es Salaam is considered to be the 3rd fastest growing city in Africa and 10th in the world with a population density of approximately 2,700 people per km² (Breeze, 2012). The city currently generates approximately 4,600 tons of waste per day on average from the previous generation of 4,200 tonnes per day of solid waste in 2011 (Table 2.1). The current solid waste generation rate is estimated to be about 1 kg/day per

household, which is higher than typical values for developing countries, which range from 0.4 to 0.6 kg/day per household.

Table 2.1: Solid Waste Generated and Collected (tonnes/day)

Municipality	Wastes Generated Per Day [Ton]	Wastes Transferred Per Day [Ton]	%
Ilala	1,088	600	55
Kinondoni	1,223	795	65
Temeke	1,300	585	45
Ubungo	828	423	51
Kigamboni	210	70	33
Total:	4,252	2473	58

Source: Kishere, 2017

It is also estimated that less than 40% of the total wastes generated in the Dar es Salaam city are appropriately collected and disposed of in designated dump sites or otherwise recovered. The final disposal activities are carried out at Pugu Kinyamwezi dump site located 30 km from the city centre. The collected wastes are normally unsorted except biodegradable wastes collected at the city markets. Very little recycling and processing of biodegradable waste (composting) is performed; however, if sorting of recyclable and biodegradable waste is done, it is considered to reduce the waste load by 50%. The waste collection is carried out daily/weekly; the waste management is carried out by Municipal councils assisted with private companies and informal sectors. Dar es Salaam City Council (DCC) is divided into five municipal councils which are also local districts: Ilala, Temeke, Kigamboni, Ubungo and Kinondoni. Table 2.2 shows the roles and responsibilities of key stakeholders in solid waste management.

Table 2.2: Roles and Responsibilities of Key Stakeholders in Solid Waste Management

Stakeholder	Roles/Responsibilities
Central Government	<ul style="list-style-type: none"> Guidance to municipal council Provision of resources (finance, equipment, etc.)
City Council	<ul style="list-style-type: none"> Coordination of solid waste management Management of solid waste final disposal Awareness creation of solid waste management
Municipal Councils	<ul style="list-style-type: none"> Primary responsibility for waste management Refuse collection and night soil removal from households Law enforcement
Private Sectors/ Contractors	<ul style="list-style-type: none"> Collect waste from their respective service areas as directed by the Municipal Council (as per contract)
Residents/Public	<ul style="list-style-type: none"> Cooperate in the waste management programs and pay their refuse collection charges Segregation of waste and keeping surroundings clean

Informal sector	<ul style="list-style-type: none">• Collect and dispose wastes to the designated solid waste collection point• Sort recyclable materials and sell to recyclers
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Source: Membe, 2015.

The waste disposal is conducted at an open dump in absence of engineered safety features such as base liner, leachate and gas collection, soil cover, embankments and fence. Figures 2.2 and 2.3 show the current disposal practices.





Figure 2.2: Current disposal Practice at Pugu Kinyamwezi dump site



Figure 2.3: Recyclables at collection point

The remaining 60% of the wastes are either burnt at the households or dumped by the road side or into drainage canals, sewers and shores or buried or thrown in open fields or anywhere in the compound contributing to methane generation, health problems for local residents and annual flooding events. Approximately 3,000 tonnes of waste per day is mismanaged somewhere in Dar es Salaam. Figure 2.4 shows the typical mismanagement of solid waste in the city whereas Table 2.3 shows the degree of waste management practices at household level.



Figure 2.4: Disposal practice of uncollected waste

Table 2.3: Measure of waste management practices at household level

Practises	%
Bury	26.4
Open burning	3.2
Throw in open fields	4.0
Collection by municipal council	50.4
Throw anywhere in the compound	11.2
Other	4.8
Total	100.0

Source: Membe, 2015

Incomplete collection of the waste has been linked to among others, rapid growth of the city population and urbanization, informal human settlements, low education level and public awareness, low waste collection coverage, poor law enforcement and coordination of waste management stakeholders and insufficient financial support. Approximately over 70% of the population live in unplanned and under-served areas of the city (Breeze, 2012).

The incomplete collection is also attributed by the fact that some places are inaccessible. The Municipalities show a good primary road system reaching all individual wards. However, internal structure of some formal wards, the many informal wards and the outskirts of the Municipalities is complex. The roads tend to get narrower and many of them are not paved; hence, necessitates a mixed system of both (i) door-to-door collection by compaction trucks; and (ii) a combination of collection by handcarts, collection points and (container)trucks clearing these points. Figures 2.5 and 2.6 show the current collection practices.



Figure 2.5: Mini waste collection point (MetaSus, 2016).





Figure 2.6: Waste collection trucks in Dar es Salaam.

The capacity of solid waste collection in Dar es Salaam in 2012 reached around 1,533 tonnes of solid waste per day which is only 37% of total solid waste generated in the City. In order for the Dar es Salaam to increase the solid waste collection capacity from 1,533 tonnes per day to 3,000 tonnes per day the following equipment, tools and machines are required as shown in Table 2.4, 2.5 & 2.6.

Pugu Kinyamwezi dumpsite receives 2000 - 2500 tonnes per day of solid waste and its main operation is Open dumpsite but controlled. Private companies had been contracted by the city council as well as respective municipalities to collect and transport waste to the dumpsite. The city dumpsite has 2 bulldozers, 2 excavators and 1 compactor (broken) (Bubegwa, 2012).

Table 2.4: SWM Equipment Owned by municipal councils

Municipal Council (Old)	Number of working facilities available					
	Tipper trucks	Compactor trucks	Skip loaders	Skip containers	Tractors	Trailers
Ilala	6	-	3	30	1	8
Kinondoni	10	-	-	-	2	38
Temeke	6	-	2	18	2	14
Total	22	-	5	18	5	60

Source: Bubegwa, 2012

Table 2.5: Number of SWM Equipment Owned by contractors

Municipal	Number of working facilities available
-----------	--

Council (old)	Tipper trucks	Compactor trucks	Skip loader	Skip containers	Tractors
Ilala	6	5	-	-	2
Kinondoni	12	4	-	-	2
Temeke	7	-	-	-	2
Total	34	6	-	-	6

Source: Bubegwa, 2012

Table 2.6: Required equipment/tools to increase collection

Description	Equipment requirements			
	DCC	IMC	KMC	TMC
Wheel Loader	1	1	1	1
Open Truck	5	10	10	10
Semi-trailers	-	4	4	4
Skip Loaders	-	20	25	20
Skip Containers	-	230	250	220
Compactor Trucks	2	10	10	10
Street Sweepers	-	4	4	4
Cesspit Emptier	-	4	4	4
Gully emptying trucks	-	2	2	2
Water Boozers	1	2	2	2
Computer and accessories sets	-	3	3	3
Supervision car	1	3	3	3
Tractors	-	4	4	4
Excavator	1	-	-	-
Dump-Bulldozer	1	-	-	-

Source: Bubegwa, 2012

Solid waste composition should clearly be understood in order to separate them for management purpose. For Dar es Salaam in particular, Table 2.7 summarizes the composition of solid wastes generated for 2012-2014. The composition of solid waste in Dar es Salaam to a great extent is food waste, garden waste, grass and wood. Organic is the main composition, others are plastics, paper and nylon. Due to the lack of segregation at the source, usually these wastes are mixed.

The main sources of Municipal Solid waste are Households, Institutions, Markets, Street sweeping and Other sources (see Table 2.8). In addition, the statistics of the sectoral waste generation for 2012, 2013 and 2014 with respective total tonnages of solid waste are presented in Figure 2.7 (data extracted in National Bureau of Statistics, 2015). The main areas covered are agriculture, forestry and fishing, mining and quarrying, manufacturing, energy supplies, construction, households and other economic activities. It can be observed that manufacturing and households forms the major components of solid waste generation for the three years while the construction and quarrying show the least of all year by year.

Table 2.7: Percentage Composition of Municipal Wastes, Dar es Salaam City 2012-2014

Category	2012	2013	2014
Paper, paperboard	20.6	15.0	12.0
Textiles	1.0	3.0	5.0
Plastics	16.0	21.0	22.0
Glass	15.0	8.0	9.0
Metals	6.5	4.0	0.5
Organic material	26.0	28.0	31.5
of which: food and garden waste	7.9	11.0	13.0
Other inorganic material	7.0	10.0	7.0
Total	100.0	100.0	100.0

Data source: National Bureau of Statistics, 2015

Table 2.8: MSW Sources in Dar es Salaam

Waste Source	Percentage (%)
Households	75%
Institutions	0.5%
Markets	3.5 %
Street sweeping	0.5%
Other sources	0.5%
industry and commerce	20%

Source: BreAd B. V, 2016

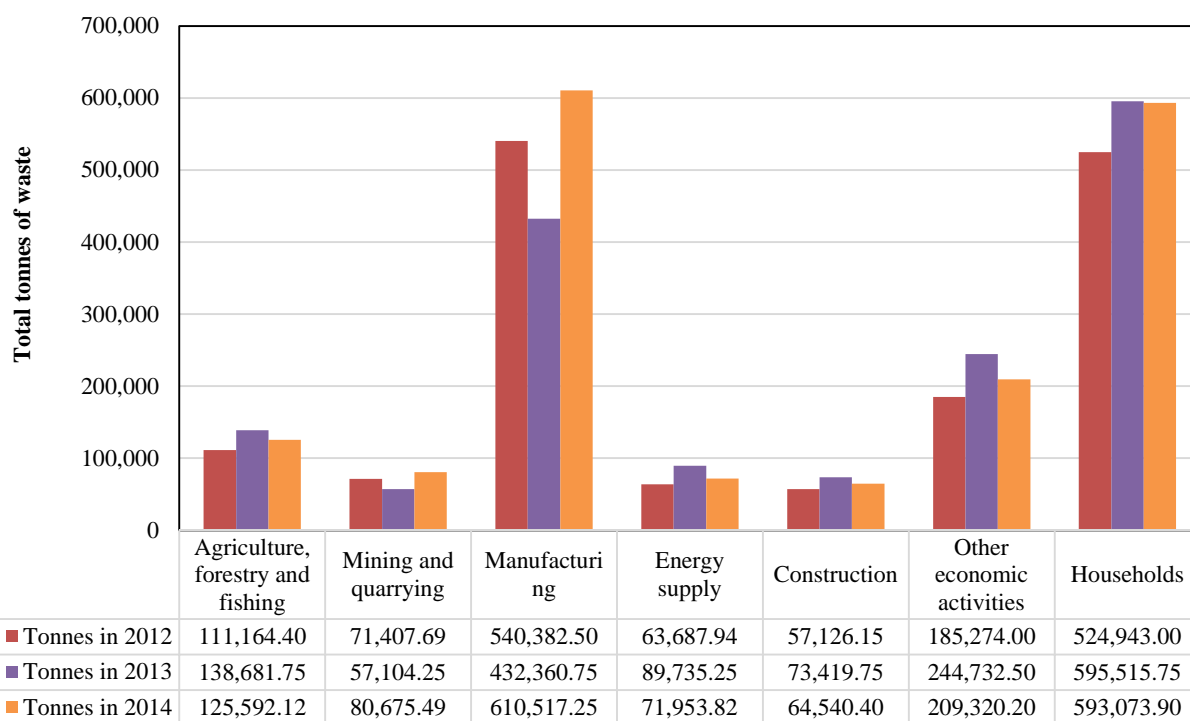


Figure 2.7: Generation of Waste by Source in the City of Dar es Salaam in 2012-2014 (Data source: National Bureau of Statistics, 2015)

2.1.1 Domestic waste

This category of waste is also known as refuse; mainly composed of garbage and rubbish generated from households. Garbage is mostly highly biodegradable materials such as food waste whereas rubbish is mostly dry materials such as paper, glass bottle, plastics, cloth, wood off cuts, and metals. Trash which is also rubbish belongs to this category, includes bulky items such as old refrigerators, couches, or large tree stumps. Table 2.8 shows that approximately 75% of the waste generated in Dar es Salaam is domestic waste. Currently, there is no any sorting/segregation of the waste in this category, which makes recycling challenging.

2.1.2 Commercial Waste

Waste generated from commercial and business houses belongs to this category; it mostly includes materials such as discarded papers, cardboard, plastic and general packaging materials wastes.

2.1.3 Industrial waste

This is the waste generated by industrial activities during manufacturing or production process of goods; they can be either hazardous or non-hazardous. This category includes industrial by-products, metals, papers, manufacturing facilities, refineries, food processing wastes, water treatment filter cake sludge, industrial sludge from factories, ash from industrial combustion processes, wastes from mineral processing activities and radio-active waste. It is estimated that this waste stream together with commercial waste accounts for 20% of the total waste generated in Dar es Salaam (see Table 2.8).

2.1.4 Mine Waste

This category of waste is generated from mining activities such as tires of huge machines, quarrying and others includes are overburden, waste rock, tailings and slag. Overburden refers to the near surface soil and rocks after stripping work to be done in order to access the mineral of interest. Waste rocks results from the development of underground mines in order to get access of the mineral ore body existing deep in the ground using shafts. Tailings refers to the solid particles of ground rocks from mining and water mixture after extracting valuable minerals, these consist of chemical such as cyanide that is harmful when realized to the environment.

2.1.5 Hazardous Waste

Hazardous wastes are characterized as toxic, corrosive, flammable, irritable and ignitable materials. This category includes health care facilities from hospitals and health centres, clinical waste and waste oils. It also includes industrial hazardous waste products such as wastes containing heavy metals such as lead and chromium, polychlorinated biphenyls (PCBs), asbestos, tyres and ink sludges. Currently, Hazardous wastes (medical) are collected and disposed of by contracted companies; however, many health facilities dispose some of their hazardous waste in incinerators existing in some main hospitals.

The city dumpsite does not receive Hazardous waste (like healthcare waste) and other types of wastes such as tyres and chemicals that require specialized treatment system.

2.1.5.1 Health Care waste

These wastes are generated from activities carried out using health care facilities in hospitals and health centres such as dispensaries or clinics during healthy services such as treatments and in research centres for human being and animals. These wastes can be categorized into the Infectious and pathogenic wastes. They are also characterized as sharps, swabs, and pathological and cytotoxic wastes. The requirement should be treatment before being disposed of to the environment.

2.1.5.2 Agricultural waste

Agricultural wastes are discarded materials from agricultural activities; most of them are organic materials. This includes stem and vegetables remains from harvest as well as rotten fruits and vegetables, and pesticides containing wastes. The pesticides containing wastes are classified as hazardous waste.

2.1.5.3 Other Hazardous Waste Streams

Other waste streams that are considered to be hazardous include sewer sludge, radioactive materials, agrochemicals and other chemical waste.

2.1.6 Construction and Demolition wastes

This waste stream is mostly generated during construction works for new building, roads and other infrastructures. It includes steel, timber, iron sheets, tiles, ceramics and others hazardous waste such as asbestos which are harmful to the environment. When incorrectly handled and disposed can cause healthy risk.

2.1.7 E-waste

This is a group of emerging wastes as a result of the use of electronic and electrical equipment. These wastes are generated when these equipment come to the end of their lives, they become obsolete and get disposed. Examples of the solid waste in this category include computers, televisions, telephones and printers. The increasing generation of these wastes is mainly due to the adaptation of ICT in most activities of the economy. They consist of metals and plastics that are non-biodegradable that affect the environment when are carelessly disposed.

2.2.SWOT Analysis of the Existing waste Management System

Table 2.9: SWOT analysis of stakeholders in waste management system.

Stakeholder	Strength	Weaknesses	Opportunities	Threats
Central Government	<ul style="list-style-type: none"> • Qualified expertise • Waste legislation is available • Increasingly investing in waste management systems and equipment 	<ul style="list-style-type: none"> • Low budgetary allocations due to low priority to waste management • Political competition between LGAs, and government • Low legislation 	<ul style="list-style-type: none"> • Donor support from development partners • Financial and technology resources from external investors • Political support 	<ul style="list-style-type: none"> • Political interference and patronage • Lack of co-ordination and consultation • Lack of political will • Inadequate re-investment and capitalization

Stakeholder	Strength	Weaknesses	Opportunities	Threats
		<p>enforcement</p> <ul style="list-style-type: none"> Poor infrastructure to access unplanned and under- serviced areas 		
City Council	<ul style="list-style-type: none"> Creates waste disposal sites Qualified expertise and experience Growing interest in setting up proper solid waste management system Increasingly interest in creating awareness of solid waste management Lobbying capacity 	<ul style="list-style-type: none"> Lack of strong organizational structure Inadequate plans and coordination for the municipals. Inadequate awareness creation of solid waste by-laws to communities. Long distance allocated dumpsite Poor management plans of organic waste at the dumpsite Inadequate political good-will at all administrative levels 	<ul style="list-style-type: none"> Able to encourage community involvement Able to create awareness of solid waste management 	<ul style="list-style-type: none"> High accumulation of waste than the designed amount for the dumpsite due to low recycling activities and un-degradable waste Traffic jam prolong time to reach the dumpsite Trucks are stuck at the dump site during rainy season Organic waste produces smoke, smell, decomposes and produces leachate and fleas at the dumpsite
Municipal /Town Councils	<ul style="list-style-type: none"> Aware of their obligation on waste management. Increasingly interest in collecting refuse and removing night soil from households 	<ul style="list-style-type: none"> Low law enforcement capacity Low revenues (feeble system of fee collection) Low waste collection coverage Inadequate human resources Unfaithful and poorly motivated workers Inadequate solid waste collection trucks, equipment and tools Poor condition of Solid Waste Collection Vehicles Poor/inadequate maintenance of machinery and equipment Lack of specialized equipment and tools Improper planning of collection routes and frequencies Lack of supervision 	<ul style="list-style-type: none"> Extension of the waste collection coverage Improvement of the current waste collection practices and services Adoption of emerging technologies in waste management Employment opportunities in waste management through diverse waste based enterprises (waste as a resource by recovery) Improvement of revenue from resource collection charges 	<ul style="list-style-type: none"> Inaccessibility to some of the localities Population growth Informal settlement High ground table can hinder improvement of current landfill practices and availability of land for final disposal

Stakeholder	Strength	Weaknesses	Opportunities	Threats
		<ul style="list-style-type: none"> Inadequate waste management plans Inadequate political good-will at all administrative levels 		
Private Sectors/ Contractors	<ul style="list-style-type: none"> Growing interest in collecting waste Have resources, experiences and expertise 	<ul style="list-style-type: none"> Inadequate support Inadequate management commitment Inadequate environmental management plans Lack of coordination among themselves 	<ul style="list-style-type: none"> Investment opportunities in recycling, energy recovery, composting, incineration. Formation of industrial association of waste management 	<ul style="list-style-type: none"> Inaccessibility to some of the localities Inadequate investment Inhibiting bank rates Inadequate consultation among themselves
Residents/Public	<ul style="list-style-type: none"> Easily mobilized and motivated 	<ul style="list-style-type: none"> Lack of segregation of wastes leads to limited recycling activities Poor attitude Low education capacity and awareness of solid waste by-laws 	<ul style="list-style-type: none"> Able to pay their refuse collection charges Able to cooperate/participate in waste management programs 	<ul style="list-style-type: none"> Unwillingness of communities to pay for waste collection costs Political interference on payment of waste collection fees Easily taken advantage of due to high poverty and low education capacity Unwillingness of communities to clean their environment Tolerance to living in a dirty environment

3. THE NATIONAL SOLID WASTE MANAGEMENT STRATEGY

Solid waste management system can be defined as the process of handling solid waste through different methods of minimizing generation, collecting, treating and disposing the wastes in such a way that they cannot affect the environment.

The strategy for Solid Waste Management (SWM) is aiming at attaining sustainable management of solid waste that contributes to achieving economic and social benefits to Tanzanian people. This strategy has been developed to enable the country meet the goals for solid waste management as summarized in Chapter 4 Table 4.1.

3.1. The Need for the Strategy

The strategy for solid waste management sets standards that a society and all stakeholders are required to attain and implement in order to conserve the environment by reducing pollution, hazards and adverse consequences to the lives of living organisms and the environment. The strategy therefore promotes social economic development of the nation. Besides, the strategy enhances the nation to comply with the international treaties of which it is a member. The strategy provides environmentally sound waste management technologies and best practices.

3.2. Vision of the Strategy

A vision for the strategy is an articulation of a desirable future condition or situation which a nation envisages to attain and the plausible course of action to be taken to have sound solid waste management. These manifestations are inconsistent with the national development aspirations articulated in the Tanzania Development Vision 2025 of transforming the economy into a middle income and semi-industrialized state by 2025; National Five Year Development Plan 2016/17 - 2020/21 of nurturing industrialization for economic transformation and human development; and National Strategy for Growth and Reduction of Poverty. The vision for the strategy seeks to actively mobilize the people and other resources to achieve: sustainable clean; safe and healthy environment to the people of Tanzania; efficient use of resources; and protection of environment to the social-economic development with minimum solid waste generation and efficient handling technologies by 2025. It is envisaged that the framework provided by the strategy will improve significantly the waste management systems.

3.3. Aims of the National Solid Waste Management Strategy

The main aims of the national strategy are:

- To minimise generation of waste in industry, commerce and private households;

- To ensure proper handling of waste after being generated prior to the reuse/recycling and disposal; to maximise waste collection efficiency.
- To reduce the volume of waste requiring disposal and maximise the economic value of waste.
- To establish proper disposal facilities across the country and promote proper disposal practice;
- To develop and adopt environmentally sound treatment and disposal facilities/practices; and
- To ensure key stakeholders of waste management systems play their roles and responsibilities effectively

3.4. Scope of the Strategy

The scope for the strategy involves every sector of the economy that lead to the generation of solid waste countrywide. It mainly involves all stakeholders including government, industry and business, private sector, non-governmental organisations, learning and research institutions, and the community.

3.5. Components of the Strategy

3.5.1. Waste Management Systems

Most of social-economic activities lead to the generation of waste. However, it is possible to carry out these activities and generate less waste which can be managed efficiently to the extent that there are no negative impacts to the environment when they are disposed. This can only be achieved by having sound waste management systems.

Therefore, the national solid waste management strategy should be composed of the following components; minimisation/reduction, re-use and recycling, pre-treatment/treatment and disposal of waste. This process can be described using the waste management Hierarchy indicated in Figure 3.1 (Tanzania Waste Management Strategy 1998). The hierarchy was proposed for long term waste management in Tanzania.

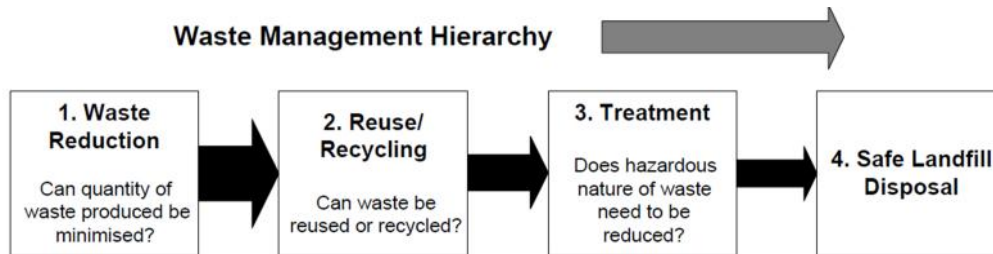


Figure 3.1: Ideal waste management system (Source: Tanzania Waste Management Strategy 1998)

3.5.2. General Actions and Measures

In order to have sound environment, there are actions and measures need to be implemented by stakeholders involved in solid waste management systems. Those include Waste minimization, Waste generation, storage, collection and transportation, recycling, waste pre-treatment and treatment waste disposal, and Institutional Strategies.

3.5.2.1. Waste Minimization

Minimizing waste generation is an important component to achieve a sound waste management system. Minimization is attained through the use of cleaner production techniques to reduce waste generation at the source including use of cost effective process/product design that minimizes the waste generation; management of material in the factories; good housekeeping; minimize volume of items/material usage; use of goods with longer useful life and minimum toxicity and selective buying and use of material at households. The application of proper procedures and use of the required amount of material assures less generation of waste in a given production system.

Different approaches can be applied in minimization of solid wastes that include but not limited to:

- Commitment of management from senior position to achieve the goal set,
- Strategically plan programmes focusing on waste minimization and green procurement leading to more sustainable consumption patterns along with economic development
- Supporting programmes that enhance cleaner production; including capacity building in cleaner production programmes
- Strengthening or scaling up existing cleaner production centre in the country to promote cleaner production in all sectors national wide.

3.5.2.2. Waste Generation

Generation of waste is primarily linked to economic growth and urbanization; and types of waste produced change according to the standard of living in the city. The wastes generated in high-income cities like Dar es Salaam are more diversified with relatively large shares from manufacturing and

households' sectors. Furthermore, some of these wastes are hazardous; therefore, need special treatment. Although the aim is at reducing the quantity of waste generated but aspect of handling after the waste being generated is also significant. To deal with waste generation patterns the following approaches can be applied:

- Enforcement of policies that encourage minimization of waste generation in all sectors
- Development of ant-litter programmes
- Enactment of specific regulations to address producer responsibility
- Encouraging industries to adopt non-regulatory tools such as ISO 14001
- Development of mechanisms to treat all hazardous waste generated such as incinerators.
- Promotion of waste separation at source such as campaigns on waste separation, having pilot waste separation, provision of equipment for waste separation, and provision of separated waste transport systems.
- Inculcating responsible public behaviour on waste management such as creating awareness on sustainable waste management options, sensitizing the public on responsible waste management and developing sensitization materials, educate the public on integrated waste management options, and undertaking monthly clean-ups.

3.5.2.3. Storage

Storage is a system for keeping materials after they have been discarded and prior to collection and final disposal. In case of on-site disposal such as direct discarding of items into family pits, storage may not be necessary. The storage of solid wastes after being generated prior to the disposal is categories into: (1) small container: household containers and trash bins, etc.; (2) large containers: communal bins, oil drums, etc.; (3) shallow pits; (4) communal depots: walled or fenced-in areas. Proper storage of waste provides a better planning of the frequency of collection, and an opportunity to sort the waste and recover any useful materials for recycling. The following approaches can be applied to achieve proper storage:

- Waste should be stored according to the set conditions as provided for in the regulations governing the management of both hazardous and non-hazardous waste
- Mobilization of financial resources to procure storage containers for unfortunate areas
- Encourage storage of wastes of different nature and composition separately; to enhance recovery of useful materials and prevent cross contamination
- All solid waste must be stored in fly tight, watertight, rodent-proof containers or in other suitable containers with secured lids. The containers must be located not more than 300 feet from any trailer space or campsite. Containers must be provided in sufficient number and capacity to properly store all solid waste between collections.
- All solid waste containing organic material capable of spoilage must be collected at least weekly. If suitable collection service is not available from municipal or private agencies, the owner or operator of the campground or trailer court shall transport the solid waste off-site.
- Introduction of transfer stations as part of the storage system.

- Development of appropriate management systems for transfer stations which will not contribute to the generation of nuisances.

3.5.2.4. *Collection and Transportation*

Solid waste collection in Dar es Salaam is carried out by Municipalities, private companies, community based organizations, and the informal sector. Trucks are used to collect and transport to the dumpsites. Other means include mini waste collections in bags and boxes. Municipalities are responsible for cleaning, collecting and transporting the waste as well as fee collection at the households and the markets. Private collectors collect waste from their respective service areas as directed by the Municipal Council (as per contract). Collection is carried out daily/weekly. However, there are number of challenges that limit efficiency of the current collection and transportation system; some of them have been listed in SWOT analysis of the Existing waste Management System (see Chapter 2). To mitigate those challenges and improve the system the following approaches can be applied:

- All solid waste must be collected and transported in a covered vehicle or covered containers to a solid waste disposal facility.
- Provision of adequate and appropriate collection facilities and services
- Improvement of the existing collection facilities and services
- Provision of adequate and appropriate transport systems for segregated waste
- Development of favourable regulations for private sector-local authority contracts
- Enforcement of by-laws that will obligate householders to pay for collection services
- Mobilization and coordination of financial resources for extension of waste collection coverage
- Provision of adequate waste management plans
- Proper planning of collection routes and frequencies
- Provision of adequate human resources; including creating employment opportunities in waste management through diverse waste based enterprises (waste as a resource by recovery)
- Empower workers to be self-motivated
- Commitment of management from senior position to achieve the goal set
- Formation of industrial association of waste management
- Provision of adequate support to Private Sectors/ Contractors

3.5.2.5. *Reuse/Recycling*

Recycling is a process of converting waste materials into new products of either the same grade or lower. This is more possible if materials can be separated at the source into respective categories, collected, reprocessed or reused again. Recycling is beneficial for the environment as it reduces the amount of raw materials and energy required in the manufacture of new products. Recycling also prevents waste from being disposed of and so contributes to reduced resource and energy impacts. For example, the lead acid battery can be recycled to produce new batteries and on the other hand the casings can be further processed to produce plastic containers that are used for storage of water or conduits for electrical cables in houses construction. The household wastes are difficult to recycle as compared to the industrial waste; due to their complex composition. However, recycling of these wastes is easy if dwellers are committed to waste separation. In Dar es Salaam the solid waste generated has

high content of organic waste and recyclables such as paper, plastics, glass, metals and e-waste; all account for 98% of the total waste generated. It is reported that, ideally recycling of all these waste could lead to 2% disposal (Senzigeet *al.*, 2014). So far very little recycling and processing of biodegradable waste (composting) is performed in Dar es Salaam and Tanzania in general; however, it is considered to reduce the waste load by 50%. To improve recycling/reuse, the following approaches can be applied:

- Promotion of waste separation at source such as awareness creation and campaigns on waste separation, having pilot waste separation, provision of equipment for waste separation, and provision of separated waste transport systems.
- Promotion of organic waste composting
- Enforcement of the policies, rules and regulations that obligate source separation as well as producer responsibility
- Reviewing policies **to encourage recycling industry and promote industrial symbiosis**
- Provision of conducive/enabling environment for individuals/companies/communities to invest in recycling, energy recovery, composting and incineration.
- Promotion of recycled and recovered materials utilization
- Development of promotion programs for use of recovered materials
- Promotion of modern technologies on recovery, recycling and composting.
- Development of the A-Z re-use and recycling directory which explains how and where to re-use and recycle a range of items and materials
- Municipalities/Townships should specify collection, processing and marketing requirements in their requests for services
- Enhancing collaboration with stakeholders on recycling

3.5.2.6. Waste Pre-treatment and Treatment

Waste is treated chemically, physically or biologically so that once the wastes are disposed of will have no negative effects to the environment. Treatment in particular requires expertise of specific application of the technologies for treatment of the wastes. For example, incineration technology can be applied to both hazardous and non-hazardous waste material but it requires a dedicated expert to carry on the activity in acceptable practices. For example, medical waste can be treated by incineration but care should be taken to minimize the effect of air pollution. Currently, Hazardous wastes such as medical waste are collected and disposed of by contracted companies; however, many health facilities dispose some of their hazardous waste in incinerators existing in some main hospitals. The following approaches can be applied to improve waste pre-treatment and treatment:

- Promotion of waste separation at source to reduce amount of waste to be handled;
- Improve status of currently running incinerators
- Provision of financial support to research institutions developing appropriate incinerators;
- Enforcement of relevant regulations for healthcare waste;

- Development of treatment techniques
- Development of technical guidelines for management of different hazardous waste streams for commercial facilities
- Development of technical guidelines for treatment methods
- Reduction of pollution from incinerators
- Provision of adequate support to Private Sectors/ Contractors

3.5.2.7. Waste Disposal

Waste disposal is the last waste management option which deals with handling of discarded materials. Land filling is one of the methods that can be applied in places where the land is less populated. It is mostly applied for the remains of the recycling and some direct generated wastes that are degradable. Land filling should be carried out safely such that it doesn't harm the environment. If landfills are not well protected, they might be accessed by animals and people who pick some components, hence affecting health and might cause outbreak diseases. The following approaches can be applied to improve waste disposal:

- Promotion of waste separation at source to reduce amount of waste to be disposed.
- Development of programmes aimed at preventing illegal disposal of both hazardous and non-hazardous waste
- Improvement of management plans of organic waste at the dumpsites
- Adoption of a mechanism of improving and upgrading dumpsites
- Disposal systems shall include material recovery facilities and transfer stations
- Regulations on waste picking at disposal sites
- Development of private/public partnerships strategy
- Provision of conducive/enabling environment for investment in waste management.

3.5.2.8. Institutional Framework

Institutional framework in solid waste management context refers to the organizational structure, roles and responsibilities of every stakeholder involved in solid waste management. The responsibilities include coordination, setting procedures and methods, implementation of laws, regulations and policies for the purpose of effective and sustainable management of the solid wastes (ADB, 2014). This is a joint effort in order to protect the environmental quality and public health.

In order to facilitate the implementation of the strategy, each of the institutions which are crucial stakeholders of the solid waste management system have to play their role effectively.

- **Central Government**
 - Prioritize solid waste management
 - Provide adequate fund to support:

- ✓ the local government authorities for acquisition of facilities and human resources to carry out efficient waste collection and disposal as well extending waste collection coverage
 - ✓ programmes that promote waste management
 - Review and enforce legislation that promote waste management
 - Build new and improve existing infrastructure to access unplanned and under- serviced areas
 -
 - Set up strong governance on environment for enforcing policy and laws and also draw action plan for implementation of solid waste management systems
- **City Council**
 - Create awareness to the:
 - ✓ leaders and policy makers about the environmental management strategy.
 - ✓ communities about solid waste by-laws
 - Develop a strong organizational structure to achieve a sound waste management system
 - Develop a proper plan for coordination of municipalities
 - Set new or improve existing management plans of organic waste at the dumpsite
 - Develop programmes that promote waste management as well as prevent illegal disposal of both hazardous and non-hazardous waste
 - Provide conducive/enabling environment for investment in waste management
 - Encourage communities to participate in waste management
 - Provide the necessary political good-will at all administrative levels as well as programmes that promote waste management
- **Municipal/Town Councils**
 - Coordinate and maintain the legal requirement in their capacity for reinforcing Acts related to the solid waste management.
 - Implement local by-laws for littering and illegal disposal.
 - Plan properly:
 - ✓ maintenance of public space, roads and drainages, collect levy local taxes on services provided to residents to cover the costs involved in providing services
 - ✓ acquisition and maintenance of collection vehicles
 - ✓ collection routes and frequencies
 - Empower and motivate workers as well as provide proper supervision
 - Provide adequate waste management plans
 - Provide adequate support to private sectors/contractors.
 - Provide the necessary political good-will at all administrative levels as well as programmes that promote waste management

- **Private Sectors/Contractors**
 - Have adequate investment capital
 - Have management commitment
 - Have proper environmental management plans
 - Have coordination among themselves

- **Civil Society and Nongovernment Organizations (NGOs)**
 - Raise fund for environmental management
 - Carry out informal and formal education to change attitude in the communities and promote best practice methods for environment management that are “3 Rs” (reduce, reuse, and recycle)

- **Residents/Public/Private Sectors:**
 - Have good attitude towards:
 - ✓ waste minimization, separation, reuse, recycling, and legal disposal of waste
 - ✓ good housekeeping practices
 - Adopt the process of recycling material that need to be recycled
 - Collaborate with the government or private sectors in keeping the environment clean.
 - Efficient use of raw materials to minimize the surplus of materials
 - Promote corporate social responsibilities on waste management
 - Promote environment management attitude to an organizational employees and surrounding community

4. TARGETS FOR THE STRATEGY

This National Solid Waste Management Strategy (NSWMS) has been formulated with an aim of achieving sustainable waste management in urban and rural centres in Tanzania.

The Strategy has been developed as a collaborative effort between the Vice President's Office (VPO) and other stakeholders to enable the Local Government Authorities to protect human health and the environment. The goals for solid waste management are as summarized below:

Table 4.1: Summary of Goals for Solid Waste Management

Overall Strategy Goals	<ul style="list-style-type: none"> a) Protection of human health b) Reduction of poverty c) Reduction of waste management costs d) Protection of the environment
Guiding principles	Promotion of circular economy (Waste is a resource that can be harnessed to create wealth, employment and reduce pollution of the environment)
Long-term goals	Achieve approximately 80% waste recovery (re-use, recycling, composting and energy recovery) and 20% landfilling in a Sanitary landfill (inert material) by 2030
Medium-term goals	Achieve 50% waste recovery (re-use, recycling, composting and energy recovery) and 50% semi-landfilling by 2025
Short-term goals	Achieve 30% waste recovery (re-use, recycling, composting) and 70% controlled dumping (tipping, compacting and covering) in key urban areas by 2020
Key priority areas	<ul style="list-style-type: none"> a) Preparation of LGAs' waste management action plans that is consistent with this NSWMS and other relevant policies. b) Capacity building at all levels of planning and decision making (national and the local government levels) to promote transformative leadership. c) Enactment of local government laws to regulate waste recovery and disposal to serve as a regulatory regime for the use of waste as a resource.

Table 4.2: Summary of Instruments for Solid Waste Management

Instruments	Specification/programs
Legal instruments	Solid waste recovery and disposal laws (emphasis for SWM should be on reuse and recycling), enactment/enforcement of regulatory and supervisory statutes.
Financial instruments	Levying taxes as disincentives for landfilling to encourage source reduction; provide incentives for waste recyclers, preferential use of recovered material over virgin materials.
Communication instruments	Advocacy for attitude, behavioural and practices change through media campaigns, communication and technology, dissemination of waste management information.
Institutional instruments	Decentralized SWM, public-private partnerships (e.g. voluntary agreements), strengthened entrepreneurial activities (e.g. for SMEs) training of SWM managers, demonstrations, promotion of research and development in SWM.

4.1. Objectives of the Strategy

The primary objective of the National Solid Waste Management Strategy is to provide guidance to

sustainable solid waste management in Tanzania to ensure a healthy, safe and secure environment. This strategy is to be implemented through seven (7) key objectives.

- a) To review policies, legislations and economic instruments to reduce waste quantities.
- b) To inculcate responsible public behaviour on waste management.
- c) To promote waste as an income generating venture.
- d) To promote waste segregation at source.
- e) To promote resource recovery for materials.
- f) To promote resource recovery through energy generation.
- g) To establish environmentally sound infrastructure and systems for waste management.

Table 4.3: Log frame on the NSWMS Objectives

Overall goal: Sustainable solid waste management by the year 2030				
SN	Objectives	Key Result Areas	Outcomes	Activities
1	To review policies, legislations and economic instruments on solid waste management	Policies and economic instruments on waste management	Sustainable management of solid waste	Review and harmonize Local Government legislations on waste management
		Uptake of efficient technologies		Review policies on economic instruments
		Compliance and enforcement of waste management legislations		Implement policies and economic instruments
2	To inculcate responsible public behaviour on waste management	Capacity building in waste management	Public behaviour changed on waste management	Benchmark on appropriate technologies
		Informed public on waste management		Enforcement of waste management standards and legislations
3	To promote waste as an income generating venture	Market for the recovered and recycled products	Enhanced income from waste management activities	Sensitize the public on responsible waste management
		More entrepreneurship in waste management activities		Create awareness on suitable waste management options
				Educate the public on integrated waste management
				Undertake monthly clean-ups
				Develop sensitization materials
				Explore market opportunities for the recovered and recycling materials
				Promote the use of recycled and recovered materials

Overall goal: Sustainable solid waste management by the year 2030				
SN	Objectives	Key Result Areas	Outcomes	Activities
		Increased uptake of modern technology		Promote modern technologies on recovery and recycling Promote Public Private Partnership in waste management
4	To promote waste segregation at source	Improvement in Knowledge, Attitude and Practice towards SWM	Segregated waste services	Intensified waste segregation campaigns
		Segregated waste services		Pilot waste segregation Provision of equipment for waste segregation Provision of segregated waste transport systems Promote Public Private Partnership in waste management
5	To promote resource recovery for materials	Recycling and composting facilities	Enhanced materials recovery and use	Enhance modern technologies for recycling and composting of waste
		Market availability for recovered materials		Explore market opportunities for recovered materials
		Acceptance of recovered materials		Develop promotion programs for use of recovered materials
		Collaborations in recycling		Enhance collaboration with stakeholders on recycling
6	To promote resource recovery through energy generation	Waste to energy generation plants	Enhanced fiscal and social benefits	Promote energy recovery plants
		Energy generated		Enhance waste to energy resources
		Collaborations in waste to energy recovery initiatives		Enhance collaboration with stakeholders on energy recovery
7	To establish environmentally sound infrastructure and systems for waste management	Improvement on existing waste management facilities, collection and transportation systems, transfer stations, treatment and disposal facilities	Existence of environmental sound waste management collection, transportation, transfer stations, treatment and disposal facilities	Improve existing waste management facilities, Provision of adequate and appropriate collection facilities and services Provision of adequate and appropriate transport systems for segregated waste Build and operate transfer stations Develop standard incinerators with

Overall goal: Sustainable solid waste management by the year 2030				
SN	Objectives	Key Result Areas	Outcomes	Activities
				energy recovery facilities with air cleaning systems Establish composting facilities Establish recycling facilities Develop sanitary landfills

4.1.1. Key approaches to implementing the strategy

Depending on the situational analysis of the solid waste management practices in a local government, the strategy will be implemented using the following approaches;

- a) Strategic alignment and recognition of partners through a public private partnership;
- b) Introduction of incentives in the solid waste management cycle (generation, storage, collection, transportation, treatment and disposal);
- c) Introduction of extended producer responsibility and public awareness campaigns and education;
- d) Establishment of efficiency and value addition in the solid waste management cycle;
- e) Complement the input from NGO's, CBO's and other private public activities;
- f) Phase out open waste burning;
- g) Establishment of solid waste operational zones;
- h) Upscale the activities of the informal sector to link up with the existing formal recycling industries; and
- i) Establishment of infrastructure and systems for residual waste through a stepwise phasing out of illegal and crude dumpsites to establish sanitary landfills.

4.2. Roles of Collaborating Agencies

Successful implementation of this strategy requires the involvement of several actors whose roles are outlined below:

President's Office - Regional Administration and Local Government (PO-RALG)

- a) Coordinate, rationalize and disseminate relevant policies in achieving sustainable waste management to Local Government Authorities in collaboration with the Ministry of Lands, Housing and Human Settlements Development; NEMC, National Land use Planning Commission, sector Ministries (e.g., MoHCDGEC, MITI, MoA) and other stakeholders;
- b) Coordinate and undertake a follow up to Regions and Local Government Authorities for policies and regulations compliance;
- c) Create an enabling atmosphere for implementation and monitoring of urban development and environmental management activities at the local levels through a supportive legal and policy framework; and

- d) Enable LGAs to make investments in improved urban development and environmental management through nationally compatible intergovernmental transfers.

Vice President's Office – Division of Environment:

- a) Give policy direction on solid waste management initiatives country-wide;
- b) Channel funding to NEMC, for benchmarking, capacity building and technology transfer; and
- c) Enforce policies, legislations and economic instruments relevant in achieving sustainable waste management.

National Environment Management Council (NEMC):

- a) Develop and disseminate public information on the regulatory requirements for waste management in Tanzania;
- b) Undertake benchmarking regionally and internationally on appropriate waste management technologies;
- c) Enhance the capacity of LGAs on waste management systems and approaches applicable in their respective municipalities;
- d) Employ social media to attract wider stakeholder participation and change attitudes, behaviour and practices towards waste management at a national level;
- e) Hold public awareness sessions (for example, school workshops, public consultation exhibitions and public events) on waste management initiatives;
- f) Support the dissemination of waste management research and development findings;
- g) Involve mass media dissemination techniques, such as the publication of news articles and press releases, in addition to ensure coverage in both print and media outlets; and
- h) Undertake enforcement activities of the laws developed on solid waste management and surveillance exercises on illegal waste related activities. Monitoring and evaluation of the strategy.

Local Government Authorities:

- a) Responsible for drawing up action plans for implementation of applicable solid waste management systems within their municipalities;
- b) Source adequate funding for development of sustainable waste management initiatives in the entire cycle;
- c) Put in place measures for enhanced Public-Private-Partnerships (PPP);
- d) Benchmark on best practices of appropriate technologies;
- e) Undertake periodic clean-up activities within their municipalities;
- f) Provision of equipment for waste segregation and transport systems;
- g) Zone the waste operational areas;
- h) Continuous management of activities/facilities to ensure all the waste is transported to the designated waste disposal sites in a timely manner;
- j) Monitoring and evaluation of the strategy;
- k) Ensure wide coverage and no littering of waste through improved collection methods and facilities; and
- l) Progressively improve the designated official county disposal site towards a sanitary landfill.

Ministry of Finance:

- a) Channel funding to the respective government agencies and institutions for development of

wastemanagementinitiativesandfacilities.

Civil Society Organizations (CSOs) and NGOs:

- a) Promoteand/orundertakeincomegeneratingventures inwaste management initiatives;
- b) Representthepublic'sinterestinthesolidwastemanagementagendanationwideand supportingidentificationofillegalwasterelatedactivities; and
- c) Advocate for change in the public's knowledge, attitude and practice towards sustainablewastemanagement.

Private Sector

- a) ThroughPPP,Involvementinthedevelopmentofeffectiveandefficientwaste management facilities;
- b) Prioritizeoncorporatesocialresponsibility(CSR)onwastemanagement; and
- c) Empowercommunitiesandotherstakeholdersinunderstandingwastemanagement relatedissuesandinfindingsolutions forthesame.

The Citizens/Public

- a) Change in attitude and practice to embrace the concept of a waste generator's responsibility by ensuring waste is appropriately managed at source and/or in all phases of thewastemanagementcycle;
- b) AdopttheReduce, Reuse, Recycleand/oranintegratedsolid wastemanagement approachinthemanagement of all wastestreams; and
- c) Collaboratewithothergovernmententities,CSOs,NGOsandotherinformalgroupsin wastemanagementthroughthePPPapproach.

5. IMPLEMENTATION MATRIX

Table 5.1: The Waste Management Strategy Implementation Matrix

Strategic Objective 1: To Review policies, legislations and economic instruments to reduce waste quantities

	Activity	KeyperformanceTargets	KeyPerformanceIndicators	Time frame (years)					outcomes	Actors
				1st	2nd	3rd	4th	5th		
Policies and economic instruments on waste reduction	Review and harmonize policies and economic instruments	Harmonized policies and economic instrument	Policies and economic instruments						Reduced quantities of waste	VPO, NEMC, LGAs& other relevant lead agencies, R&D institutions
	Implement policies and economic instrument		Policies and economic instruments implemented							LGAs& other relevant lead agencies
Uptake of efficient technologies	Undertake benchmarking on best practices of appropriate technologies	Best practices of appropriate technologies benchmarked	Appropriate technologies adopted							LGAs& other relevant lead agencies and R&D institutions
Compliance and Enforcement of waste management	Compliance and enforcement of waste management standards, regulations and legislations	Compliance and enforcement set standards	Level of compliance and enforcement							NEMC, LGAs

Strategic Objective 2: To inculcate responsible public behaviour on waste management

	Activity	Key performance Targets	Key Performance Indicators	Time frame (years)					outcomes	Actors
				1st	2nd	3rd	4th	5th		
Capacity building in waste management	Sensitize the public on responsible waste management	A sensitized public on responsible waste management	No of people sensitized						Public behaviour changed on waste management	NEMC, LGAs& other relevant lead agencies
Informed public on waste management	Create awareness on suitable waste management options	Awareness created on suitable waste management options	No of campaigns							NEMC, Media houses & other relevant institutions, CSOs, NGOs, the public/citizenry
	Educate the public on integrated waste management	Educated public on integrated waste management	No of people educated							NEMC, LGAs& other relevant lead agencies, CSOs, NGOs, the public/citizenry
	Undertake monthly clean-ups	Monthly clean-ups undertaken	No of clean-ups							LGAs& other relevant lead agencies, CSOs, NGOs, the public/citizenry

Strategic Objective 3: To promote waste as an income generating activity

	Activity	Key performance Targets	Key Performance Indicators	Time frame (years)					outcomes	Actors
				1st	2nd	3rd	4th	5th		
Market for the recovered and recycled products	Explore market opportunities for the recovered and recycled materials	Market opportunities for the recovered and recycled materials explored	No. of market opportunities sourced / explored for the recovered and recycled materials	████████████████████					Enhanced income from waste management activities	NEMC, LGAs & other relevant lead agencies
More entrepreneurship in waste management	Promote the use of recycled unrecovered materials	Recycled and recovered materials in use countrywide	Percentage of recycled and recovered materials in use in the country	████████████████████						NEMC, LGAs, public/citizenry
	Promote modern technologies on recovery and recycling	Modern technologies in use for recovery and recycling	Appropriate technologies adopted for recovery and recycling			████████████████				NEMC, LGAs, public/citizenry
	Promote Public Private Partnership in waste management	Public Private Partnerships enhanced on various aspects of waste management	No. of Public Private Partnerships in existence in the country	████████████████████						NEMC, LGAs & other relevant lead agencies, CSOs, NGOs, the public/citizenry

Strategic Objective 4: To promote waste segregation at source

	Activity	Key performance Targets	Key Performance Indicators	Time frame (years)					outcomes	Actors
				1st	2nd	3rd	4th	5th		
Segregated waste services	Provision of equipment for waste segregation	Equipment for waste segregation provided	No of equipment provided		—————				Segregated wastes	LGAs
	Provision of segregated waste transport systems	Segregated waste transport systems provided	No of transport system provided		—————					LGAs
	Intensified waste segregation	Campaigns on Segregation undertaken	No of campaigns		—————					NEMCLGAs, CSOs, NGOs, the public/citizenry
	Initiate pilot waste segregation	Waste segregation pilot schemes	No of pilot schemes initiated		—————					NEMC, LGAs, CSOs, NGOs, the public/citizenry

Strategic Objective 5: To promote resource recovery for materials

	Activity	Key performance Targets	Key Performance Indicators	Time frame (years)					outcomes	Actors
				1st	2nd	3rd	4th	5th		
Recycling and composting facilities	Enhance modern technologies for recycling and composting of waste	Enhanced recycling and composting of waste	Percentage of recycled and composted materials		—————				Enhance materials recovery and use	Local and international investors, LGAs, R&D institutions, Relevant government agencies, Private sector, NGOs, CBOs. Etc.
Market availability of recovered materials	Explore market opportunities for recovered materials	Market opportunities for recovered materials explored	No. of market opportunities sourced / explored for the recycled and composted materials		—————					LGAs, NGOs, CBOs, the public / citizenry

Strategic Objective 7: To establish environmentally sound infrastructure and systems for waste management

	Activity	Key performance Targets	Key Performance Indicators	Time frame (years)					outcomes	Actors
				1st	2nd	3rd	4th	5th		
Improvement of existing waste management facilities	Upgrade existing waste management facilities	Upgraded waste management facilities	No. Of upgraded waste management facilities	█					Existence of environmentally sound waste management collection, transportation, transfer station, treatment and disposal facilities	LGAs, and R&D institutions, with support from various funding bodies
Waste Collection and transportation systems	Provision of adequate and appropriate collection facilities and services	Adequate and appropriate collection facilities provided	No of appropriate facilities provided	█	█	█	█	█		Local and international investors, LGAs with support from various funding
	Provision of adequate and appropriate transport systems for segregated waste	Appropriate transport systems provided	No of appropriate transport systems provided		█	█	█	█		LGAs with support from various funding bodies
Waste transfer stations	Build and Operate transfer stations	Transfer stations built and operational	No of transfer station built and operational		█	█	█	█		Local and international investors, LGAs with support from various funding bodies
Waste treatment facilities	Establish recycling facilities	Recycling facilities established	No of recycling facilities established	█	█	█	█	█		Local and international investors
	Establish composting facilities	Composting Facilities established	No of composting facilities established		█	█	█	█		Local and international investors
Waste disposal facilities	Develop sanitary landfills	Sanitary landfills developed	No of Sanitary landfills developed		█	█	█	█		LGAs with support from various funding bodies
	Develop standard incinerators	Standard incinerators developed	No of Standard incinerators with energy recovery facilities developed		█	█	█	█		Local and international investors, LGAs and R&D institutions with support from various funding bodies

6. FUNDING MECHANISM

6.1. Appropriate economic instruments should be evaluated and implemented.

A critical precondition for the successful implementation of Waste Management Strategy is access to sufficient funding. Funding will be required for inter-alia: building capacity within the Local Government Authorities; the development and implementation of by-laws; development and implementation of WMS for individual municipalities; development, operation and maintenance costs of waste management facilities; and the design and commissioning of new waste management facilities.

Different sources that a municipality could potentially obtain funding from could include Equitable Share Funding, grant allocation, revenue from rates and tariffs, and revenue from fines. For once off projects, funding sources could include the Municipal Infrastructure Grant (MIG) funding for infrastructure related projects, donor funding to fund certain aspects to the delivery of waste services.

It must be noted that not all funding sources are sustainable; for example donor funding is sometimes only available for a limited period.

In order for municipalities to have sustainable sources of revenue, a full cost accounting of how much it realistically costs them to deliver waste management services should be developed. Once developed, municipalities will then be able to charge tariffs that are reflective of the cost of rendering waste management services and will generate accurate revenue for the waste services rendered. Municipalities will also be able to determine whether there is under-recovery of waste collection revenue from its customers or not.

6.2. Examples of economic instruments

Below are some examples of economic instruments that could be considered for funding the various aspects to waste management.

6.2.1. Funding mechanisms for recycling

- Recycling initiatives could be funded through public-private initiatives whereby the LGAs could provide receptacles for separation at source by households and a recycling company could, at their cost, collect the recyclables.
- Another scenario could be that of Community based recyclers; wherein they could organize themselves and with the help of a LGAs participate in recycling where they could be the ones employed in carrying the further sorting of recyclables in a buy back centre which could then be sold to recycling companies as a way of generating income to sustain the programme.

Further, the following funding models could be employed in order to ensure the financial sustainability of waste management initiatives:

6.2.1.1. Fiscal funding allocation

- User charges e.g. volumetric charging
- Revenue collection from penalties, fines or levies
- Establish partnerships with industry wherein the industry may finance aspects of recycling i.e. fund the transport costs to carry out recycling

6.2.2. Funding mechanisms for waste collection and transportation

To facilitate the funding of waste collection and transportation, possible sources of funding for waste collection and transportation could include:

- Payment for services rendered (full cost accounting will ensure that appropriate fees are charged) in order that waste management services are delivered sustainably, cross-subsidisation could be explored whereby poor communities could be subsidised by paying households in order that basic services are rendered to indigent households;
- Local government budgetary allocations (from Equitable share funding allocation); and
- Use of public-private partnerships.

6.2.3. Funding mechanisms for waste disposal

The cost associated with general waste disposal will mainly be funded by user fees or as part of waste charges for local authority's general waste disposal sites. The introduction of waste disposal tariffs at all waste disposal facilities, reflecting the real cost of waste disposal, should be encouraged.

Public-private partnerships may be established for the development and operation of waste facilities including regional waste disposal facilities. In this type of partnership, a memorandum of understanding/agreement could be signed between a municipality and a private company wherein it will be agreed on whether the private company will make an upfront payment towards the establishment of the waste disposal facility and once in operation the private company will utilize the disposal facility and in turn instead of being charged disposal fees the municipality would deduct from the amounts already paid in advance.

6.3. Investment Guide on Waste Management in Tanzania

In 2017 Tanzania developed an investment guide on waste management. These can be used to guide investment in waste management. The following are extracts from the guide:

6.3.1. Waste collection

Waste collection and transport is of limited coverage and largely inadequate in all urban areas in the country. The average cost of waste collection is estimated at around USD 10-15 per tonne, which is consistent with costs in other African cities. Increasing vehicle fleet and other related equipment to improve the coverage and efficiency in waste collection particularly in urban areas remains a priority. Table 6.1 presents indicative investment needs for improving solid waste collection in selected urban areas in the next 10 years.

Table 6.1: Investment opportunities in waste collection in selected urban areas

Municipality/ Council/Town	Investment opportunity	Indicative investment cost (million USD)
Dar es Salaam	Provision of waste collection facilities and equipment, to improve waste collection rate, including the following: <ul style="list-style-type: none"> • skip and side loaders • excavators • bulldozers • compactors • skip buckets • Road sweeping trucks • waste weigh bridge • Cesspit emptier • 4x4 vehicles for supervision 	10.4
Mwanza		3.5
Arusha		2.8
Mbeya		2.8
Dodoma		3.0
Morogoro		3.0
Tanga		2.5
Bukoba		2.5
Kigoma Ujiji		2.0
Tabora		2.0

6.3.2. Municipal solid waste recycling

Despite the fact that more than 30-40% of solid waste can be recycled, less than 10% is recycled. The materials that are usually known to be recycled are plastic and glass bottles, scrap metal, papers and aluminium cans. Other potential wastes include electronic waste (e-waste), lead acid batteries and used oil. Recycling plants are needed to capitalize waste recycling potential available in the country whose brief description is presented in Table 6.2.

Table 6.2: Potential investment opportunities in recycling of some of the components of MSW

Waste type	Plastics (PET and HDPE)	Paper Products	E-waste	Used Oil	Lead from Used Lead Acid Batteries
Annual generation rate	150,000 MT	400,000 MT	25,000 MT	25 million Litres	10,000 MT
Current recycling rate (%)	20-30%	20-30%	1-3%	2-5%	20-30%
Investment potential	Plastic recycling plants with a minimum annual capacity of 10,000 MT	Paper recycling plants with a minimum annual capacity of 10,000 MT	Recycling facilities with a minimum annual capacity of 10,000 MT	Used oil re-processing facility with an annual capacity of 30,000 MT (to produce low-grade industrial heating fuel)	Recycling plant of used lead acid batteries with an annual capacity of 3,600 MT

Indicative investment cost per facility	USD 1-2 million	USD 1-2 million	USD 1 million	USD 2-3 million	USD 300,000
Suitable localities	Mwanza, Arusha, Mbeya	Mwanza, Arusha, Mbeya	Dar es Salaam, Mwanza, Arusha, Mbeya	Dar es Salaam, Mwanza, Arusha, Mbeya	Mwanza, Arusha, Mbeya

6.3.3. Large-scale composting

Organic fraction of the generated municipal solid waste is in the range from 50-70% with less than 2-5% being currently composted. Municipal organic waste available for composting amounts to 3-4 million tonnes per year. There are plans to establish a pilot composting plant in Kinondoni Municipality (Dar es Salaam) with a capacity of 20-50 tonnes per day. Compost has significant market demand locally and internationally.

Large scale composting refers to a capacity of more than 100 tonnes per day of waste materials. Table 6:3 presents areas with potential investment in large scale (mechanized) composting.

Table 6.3: Potential investment opportunities in large scale composting

Proposed Locality	Amount of municipal organic waste generated (MT per day)	Proposed capacity of mechanized composting facility (MT per day)	Indicative Investment cost(million USD)
Dar es Salaam	2,400	800	1
Mwanza	250	200	0.4
Arusha	300	200	0.4
Mbeya	250	200	0.4
Tanga	150	100	0.2
Iringa	100	80	0.2

6.3.4. Electricity generation with biogas

Biogas feedstock may involve the use of various organic wastes particularly agricultural, livestock, and forestry residues (about 15 million tonnes per year); 200,000 tonnes of volatile solids of sisal waste; and municipal solid waste (4.7 million tonnes per year). There is a potential of more than 500 MW, sustained yield of 24.3 million cubic meters of biogas per annum.

Tanzania is required to expand its current electricity supply systems in the coming years. In this regard, electrification is the dominant market for biogas in the country.

Table 6.4: Potential investment opportunities in electricity generation from biogas

Proposed Locality	Feedstock	Amount of municipal organic waste (MT per day)	Proposed capacity of biogas facility (MW)	Indicative Investment cost (million USD)
Dar es Salaam	Municipal organic waste	2,400	2.2	5
Mwanza	Municipal organic waste	200	1.5	3
Tanga	Sisal residues	500	1	2
Kilimanjaro	Sisal residues	350	1	2
Iringa	Forestry residues	300	1	2

6.3.5. Thermal treatment of waste for electricity generation (Waste to Energy)

Municipal solid waste can be utilized to generate power through pyrolysis, gasification or incineration. The thermal treatment of MSW results in generation of 500–600 kWh of electricity per tonne of MSW combusted. Based on the municipal solid waste generated in the country, the potential to generate electricity is about 150-200MW.

Table 6.5: Potential investment opportunities in Waste-to-Energy (WTE)

Proposed Locality	Amount of municipal solid waste consumed(MT per day)	Proposed capacity of WTE facility(MW)	Indicative Investment cost(million USD)
Dar es Salaam	2,000	70	400
Mwanza	900	30	250

6.3.6. Solid waste disposal (sanitary landfill)

Municipal solid waste is disposed mainly in crude dumpsites with only five (5) municipalities having improved landfills (lining and leachate collection system). Investing in sanitary landfills, through public-private-partnerships, is important to protect public health and the environment. More than thirty (30) urban centres are considered in need of sanitary landfills. Table 6.6 presents some of these urban areas to provide a snapshot of actual needs in the coming years.

Table 6.6: Investment opportunities in construction and operation of sanitary landfills

Locality	Amount of municipal solid waste generated by 2050(MT per day)	Minimum land area required for sanitary landfill(ha)	Indicative Investment cost(million USD)
Dodoma	1,200	100	4
Simiyu	150	50	3

Shinyanga	100	50	3
Tabora	120	50	3
Moshi	650	50	3
Songea	140	50	3
Lindi	70	50	3

6.3.7. Municipal wastewater treatment

The amount of municipal wastewater generated is about 119 million m³ per year. However, most of it (70-80%) is inadequately treated before being released into the environment. Investing in community-level and municipal wastewater treatment schemes is a necessity. Such schemes include constructed wetlands, waste stabilization ponds, activated sludge or any other affordable, efficient, effective and environmentally friendly technologies.

6.3.8. Commercial hazardous waste incinerator

The country has very limited capacity for the disposal of hazardous waste generated by healthcare facilities, industry, agriculture and R&D institutions. More than 10,000 tonnes per year of hazardous waste are generated in the country and undesirably mixed with general municipal waste. In this regard, investing in a dedicated hazardous waste incineration is of urgent need particularly in Dar es Salaam City where more than 60% of the industrial establishments in the country are concentrated.

6.4. Strategic Services

6.4.1. Financial services (credit facilities)

The private sector has become increasingly more active and is highly encouraged to invest in the provision of waste management services. Despite mounting awareness of the merits of proper waste management within the business community and wider civil society, financing of investments in waste management activities remains problematic. The Government highly promotes, encourages and supports credit schemes customized to waste management investments.

6.4.2. Information and Communications Technology (ICT) in waste management

Information and communication technology (ICT) has become an inevitable part to plan and design of modern municipal waste management systems. Some of the applications of ICT in waste management include projections on total waste generated and identification of high waste generation areas; reporting (web/mobile/social media) waste-related activities which need urgent attention; route and truck fleet optimization and real-time tracking for the waste collection; integrated asset management of waste infrastructure assets; and mapping of waste management infrastructure and assets. Investing in such ICT applications would enhance efficiency and resource optimization and assist Local Government Authorities in improving the provision of waste management services.

6.4.3. Public parks/gardens

Public parks (green urban spaces) have a significant role in improving the aesthetic and recreational qualities, offsetting the urban heat island effect and enhancing quality of life of urban areas. Some of the activities to be accommodated in these parks include benches, outdoor running/walking tracks,

indoor pools, river/stream activities, botanical gardens, landscaping and playgrounds. Investments in establishing and maintenance of public parks are encouraged in partnership with Local Government Authorities.

7. MONITORING AND EVALUATION

7.1. Monitoring

Regular monitoring will be instituted to check on the progress in the implementation of the strategy. This is because poor solid waste management has direct and indirect effects to the public health and the environment and must be monitored. There are essential parameters to monitor the quality of the environment and does provide basic information on the levels of deviation on the set standards of environmental quality. Industry will monitor their activities by themselves through internal audits. While Government through NEMC and Local Government Authorities will monitor activities of industry through EMS and external audits.

7.2. Evaluation

The evaluation of the NSWMS will focus on assessing the progress of implementing the required improvements, and how far the objectives are being achieved through government and Public sector as well as community involvement. Therefore, there is need for regular collection of information of waste generation and disposal rates in each municipality. This information will then be linked to the population trends, economic growth and other social monitoring parameters. This undertaking will provide basis for planning of future waste management needs for example the need for additional landfills and material recovery facilities. The information will also inform on the effectiveness of strategies earlier put in place e.g. public awareness and education programmes. Improvements will be in the areas of producer responsibility, investments, service provision, public awareness and cost recovery. Review will be undertaken periodically, every 5 years.

8. CONCLUSION

The strategy which has been outlined above is intended to enable Tanzania to achieve a state of sustainable waste management within the next few years. The strategy will need to be updated at regular intervals, to take account of changes in Tanzania's situation and also of international developments in waste management technologies.

This strategy has been presented, discussed, commented upon and modified through inputs from various interest groups particularly the Vice President's Office, Ministry of Health, Community Development, Gender, Elderly and Children; Ministry of Industry, Trade, and Investment; Ministry of Regional Administration and Local Government; the Municipal Councils of Dar es Salaam; and the Environmental NGOs who have given overwhelming support for the novel concepts the document proposes.

Commitment to ensure compliance with this strategy will be obtained through continuous mass education campaigns until adequacy in its execution has been achieved. Interested and affected parties will periodically be addressed particularly householders, industrial waste producers, central and local government and environmental NGOs to promote interaction and continuous evaluation in its implementation. All these groups need to take appropriate responsible action in order for the strategy to stand the test of times.

The strategy has proposed a series of actions embodied in the text which will be monitored and supported by the Vice President's Office, particularly the National Environment Management Council throughout the execution phase. The Government is committed to the success of the strategy in order to achieve four cardinal goals: Employment Creation, Resources Conservation, Regional Integration and Sustainable Economic Diversification.

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