International Journal of Innovative Social Sciences & Humanities Research 13(2):27-42, April-June, 2025

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doi:10.5281/zenodo.15186894

Integrating Waste Management into Sustainable Development Planning: A Framework for Urban Areas

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ABSTRACT
Achieving the Sustainable Development Goals (SDGs) by the year 2030 is one of the challenges and among the cross-cutting issues that countries around the world strive to achieve and waste management plays an important role in this regard. The innovative management of waste will result in minimizing the adverse effects of climate change for environmental, social and economic sustainability. The establishment of Sustainable Development Goals (SDGs) by the United Nations in 2015 is a vital tool towards environmental sustainability, whereby the 17 goals focus on strengthening the means of implementing and revitalizing the Global Partnership for Sustainable Development. This paper extensively discusses the context of waste management, SDGs, waste indicators in SDGs, and the relationship between SDGs and waste management. This paper highlights that traditional systems for waste disposal and recycling are no longer appropriate, as many developing nations are facing major challenges in improving their inadequate and unsustainable waste management systems. Soil, air and water pollution are continuously posing risk to sustainable development. The paper emphasized that waste must no longer be deposited in residential areas and uncontrolled landfills. Waste management hierarchy has been described in the present study to deal with waste disposal problems. Further, benefits of opting sustainable waste management strategies as well as challenges in the area of waste disposal are also covered in this paper. It is identified that sustainable waste management provides a suitable decision in adopting a methodology for reducing waste with the involvement of all stakeholders in a community.
Keywords: Waste management; SDGs; waste indicators; solid waste; sustainable waste management Sustainable Development and Planning

INTRODUCTION
Approximately 2.01 billion tons of municipal solid waste is produced annually around the world (AlDailami et al., 2022). Out of this total, about 33% is managed in a conservative and unsafe manner. Sustainable development was defined in Brundtland Report of the World Commission on Environment and Development as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs." This definition implies that actions of present practices should not threaten the cultures or living standards of societies.

There are different international, regional, and national policies that deal with waste management. The 2030 Agenda for Sustainable Development, also called the SDGs (SDGs), were launched by the United Nations in 2015(Gurbo, M, 2021). The SDGs can be used to measure the well-being of people, challenges in terms of economic development and the creation of a better environment, as well as focus on how such changes can be included.

The 17 goals of the SDGs focus on how to "Strengthen the means of implementation and revitalize the Global Partnership for Sustainable Development". The overall aim of these specific goals of waste management focuses on reducing waste generation by the year 2030 by preventing, reducing and recycling or reusing waste (United Nations., 2020). At the same time, the key principles of the circular economy are underpinned by three key factors, commonly known as the 3Rs: reduce, reuse and recycle. In essence, the SDGs are significant drivers behind the development of sustainable waste management activities as well as other current issues, such as environmental concerns, public health and enhancing the value of resources, with involvement in inclusivity and climate change. Several policies have been implemented to effectively manage waste in urban centers.

For instance, the integrated solid waste management practice (ISWM) is an effective policy tool in all cities, regardless of their level of development and existing waste management practices. Through careful planning, ISWM can help mitigate the influence of external stressors (e.g., economic and population growth) on waste management, and contribute numerous benefits, including to:

a. Human Health: ISWM can help improve air quality (e.g., by reducing open garbage burning) and water quality (e.g., by managing leachate from open dumps and landfills), and reduce the spread of disease (e.g., by improving pest management).

b. Climate Change and the Environment: A major benefit of ISWM is the mitigation of emissions of short-lived climate pollutants (SLCPs) that have a warming influence on the climate, including methane

from landfills and black carbon from open burning. In addition, ISWM reduces the environmental impacts that result from poor waste management practices (e.g., land degradation from dump sites and landfills).

c. The Economy: Waste management can be one of the most expensive aspects of local government operations. ISWM can help reduce costly inefficiencies (e.g., overconsumption of waste collection vehicle fuel), encourage the development of new markets (e.g., for energy and compost), and lead to job creation.

d. Social Benefits: ISWM results in other benefits to society, including reducing bad odors and improving the quality of life for marginalized groups, such as the informal recycling sector (i.e., "pickers").

Statement of the Problem

Effective waste management is a critical component of sustainable development, particularly in urban areas where population growth, consumption patterns, and waste generation rates are high. However, many urban areas struggle to manage waste in a sustainable manner, resulting in environmental pollution, health risks, and economic losses. The lack of integration of waste management into sustainable development planning is a significant gap that needs to be addressed.

Main Aim and Objectives

The main aim of this study is to develop a framework for integrating waste management into sustainable development planning in urban areas. Specifically, the study seeks to:

1. Identify the role of Integrated Solid Waste Management (ISWM) in Realizing SDGs
2. Examine the Strategies for Planning SDG on Waste Management
3. Assesse the Waste Management Hierarchy
4. Highlight the Problems & Opportunities of SDGs in waste management

Research Questions

The following research questions guided the study:

1. What is the role of Integrated Solid Waste Management (ISWM) in Realizing SDGs?
2. What are the Strategies for Planning SDG on Waste Management?
3. What is the Waste Management Hierarchy?
4. What are the Problems and Opportunities of SDGs in waste management?

Scope of the Study

This study will focus on developing a framework for integrating waste management into sustainable development planning in urban areas. The study will explore the current state of waste management practices in urban areas, identify the gaps and challenges, and develop a comprehensive framework that can be applied in different urban contexts.

Significance of the Study

This study is significant because it addresses a critical gap in sustainable development planning in urban areas. The framework developed in this study will provide a practical tool for urban planners, policymakers, and practitioners to integrate waste management into sustainable development planning. This will contribute to achieving sustainable development goals, reducing environmental pollution, and improving public health.

Literature Review

Conceptual Framework

What is Waste Management? Waste is a product or substance which is no longer suited for its intended use. Waste management refers to the processes involved in managing waste from cradle to grave. Waste management focuses on removing potentially harmful substances or materials away from human settlements (Ahmed et al., 2021). This includes the collection, transportation, disposal/recycling and monitoring of waste materials produced as a result of human activities. Waste management or disposal according to the E. S. United Nations Statistics Division, (2020) includes the processes and actions essential to managing waste from production to final treatment. Also, waste management encompasses all types of waste, such as household, industrial and hazardous wastes, which can be solid, liquid or gas; each

of which have their own methods of management and disposal. The whole purpose of waste management is to reduce the amount of waste that goes into landfill.

Classification of Waste:

Classification of waste management by Origin: Different Activities Generate Different Types of Waste

The Concept of Integrated Solid Waste Management (ISWM)

Solid waste can be defined as non-liquid and non-gaseous products of human activities, regards as being useless. It could take the form of refuse, garbage and Sludge (Leton and Omotosho, 2004). While on the other hand, integrated solid waste management refers to the strategic approach to sustainable management of solid wastes covering all sources and all aspects, covering generation, segregation, transfer, sorting, treatment, recovery and disposal in an integrated manner, with an emphasis on maximizing resource use efficiency.

The core concept of ISWM has been developed out of the experience to address certain common problems with municipal waste management. The international agencies realized that improvements in waste management could not be achieved through a piecemeal approach. An integrated approach was required to reduce the increasing amount of waste that requires the proper collection, treatment, and disposal. This integrated approach tries to take into account all the dimensions that may affect the solid waste management processes, in addition to taking into account all the actors and influencers on the solid waste management processes.

Developing an ISWM plan requires careful assessment of numerous issues. Key considerations when developing an ISWM plan include:

a. Analyze weaknesses, strengths, and capacities. Completing an analysis of the weaknesses, strengths, and capacities of their waste management activities will help cities identify the most suitable waste management options and effectively and efficiently implement an ISWM plan.

b. Conduct triple-bottom line assessment. A robust assessment of the economic, environmental, and social impacts of waste management options can help inform decisions about which options to pursue.

c. Consider all aspects of waste. To maximize the efficiency of a waste management program, an ISWM plan should account for all aspects of waste, including generation, segregation, collection, transportation, sorting, recovery, treatment, and disposal.

d. Involve stakeholders. Involving all stakeholders, especially the public, in developing and implementing an ISWM plan will enhance its efficacy (e.g., by engaging support for the program).

e. Select suitable waste management options. Waste management options should be based on local needs and conditions. Cities should identify opportunities to use environmentally preferable waste management options (e.g., waste prevention and reduction) whenever possible.

f. Coordinate with the national government. National governments play a key role in waste management, especially in establishing and enforcing waste management policies. Cities should work closely with national governments to clarify their respective roles and identify opportunities for mutual support.

g. Identify sustainable sources of funding. An ISWM plan must include reliable sources of funding (e.g., user fees) to sustain waste programs. Incorporating the private sector into waste management activities can offer a way to reduce the costs of managing waste while also leveraging private sector expertise.

The Role of Solid Waste Management in Realizing SDGs

The ADBI reiterates the need of integrated solid waste management for sustainable development of societies. It has noted that all SDG targets have been driving waste management reforms for decades & bringing the positive changes in living conditions, public health, sanitation, terrestrial and marine ecosystems, resources conservation, greenhouse gas emissions & climate change. The sustainable waste management practices plays important role in achieving following SDGs targets:

SDGs are founded on interconnectedness and interdependence of their pillars of economic, social, and environmental sustainability. The interconnectedness is also evident if integrated SWM plans and programs are in place as it steers up many aspects of development. Specific SDGs that are influenced by SWM are discussed below:

1) **SDG 1: SWM for Poverty Eradication:** Most SWM programs around the globe and especially in developing countries are run by waste pickers who are instrumental in waste reuse and recycling as they try to earn their living. The waste pickers are mobile and vary seasonally and hence, it is difficult to quantify them. The informal nature in which waste pickers are treated makes it difficult to quantify them despite their vital role in SWM. The number of waste pickers relying on recycling for their livelihoods around the world is estimated at 15 to 20 million people and their formal recognition is crucial in strengthening their role as waste managers and in poverty reduction. However, reliable statistical data are difficult, as waste pickers are mobile and their population may fluctuate by seasons. For example, Brazil's official statistical system found over 229,000 people did this work in 2008 (Dias S, 2011).
2) **SDG 2: SWM for Food Security:** Reuse and recycling of organic waste provides an opportunity to produce organic fertilizers that can be used to improve soil fertility, quality and quantity of crop produced and hence, nutritious, and safe food year-round and ultimately, eradication of hunger. A World Bank (2018) report however noted that only 13.5% of global solid waste is recycled and out of this total only, 5.5% is used to produce organic fertilizer (The World Bank, 2018)). As such, greater efforts are needed in raising the recycling rates and advances towards SDG 2 realization.

3) **SDG 3: SWM for Healthy Lives (Good Health and Well-being)**
3.2 End preventable deaths of children under 5 years of age
3.3 End malaria, combat water-borne and communicable diseases
3.9 Reduce number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination: In low-income countries, SWM especially medical waste is rudimentary, based on disposal and in crowded hospitals and environs, it can become a health hazard enabling spread and transmission of pathogens. In such facilities, adopting sound SWM approaches including sterilization, shredding and incineration could safeguard the health of lives. The health of waste collectors and pickers need to be safeguarded during sorting of waste and for vulnerable groups such as pregnant and nursing mothers. Lack of precautionary measures during waste collection and picking can result to infectious diseases such as hepatitis C.

4) **SDG 4: SWM to Achieve Quality Education & Life Long Learning**
4.7 Ensure all learners acquire the knowledge & skills needed to promote sustainable development: SWM systems especially those involving waste picking in developing countries actively involve children. Such tendencies are associated with school dropouts in search for daily livelihoods and souring illiteracy levels. To prevent these tendencies, waste pickers should be formalized into the SWM system to safeguard children against such forms of labour that do not prioritize their literacy goals.

5) **SDG 5: SWM for Gender Equality:** Girls and women play a key role in informal waste picking particularly at the sorting stage, which takes place in residential streets or spaces and especially in developing countries. The practice makes them vulnerable to diseases and some girls even dropout of schools to do such informal waste picking and collection practice. Unlike their male counterparts, they are more vulnerable and hence the need to adopt sorting and recycling practices that are gender inclusive and safeguard the health of the vulnerable in society.

6) **SDG 6: SWM for Clean Water and Sanitation.**
6.3 Improve water quality by reducing pollution, eliminating dumping, and minimizing release of hazardous chemicals and materials, substantially increasing recycling and safe reuse: The dumping of solid waste in freshwater resources contaminates them making them unsafe for human and animal consumption as well as plant growth. A case example is plastic pollution, whereby a third of the total plastic waste ends up in freshwaters and is associated with nano-/micro-plastic loading in water bodies and eventually in food chains. To safeguard such water resources, it is imperative to avoid waste dumping in or on water ways.

7) **SDG 7: SWM for Energy Security (Affordable and Clean Energy)**
7.2 Increase renewable energy share in the global energy mix: Modern advances are focusing on solid waste recovery for energy production. In this case, solid waste is chemically treated to produce renewable energy which is rated third after solar and wind energy. Through processes such as anaerobic digestion, pyrolysis, gasification and combustion, energy in the form of biogas, biomethane, syngas, biochar, bio-oil, and thermal energy can be produced. Additionally, solid waste contributes biomass energy of more than 50% of total renewable energy used around the world. With the recognition of the ability of SWM to contribute to energy security, countries are striving to develop plans and technologies to separate and recycle waste and valorise it to green energy.

8) **SDG 8: SWM for Economic Growth, Employment and Decent Work for All**
8.5: Achieve full and productive employment and decent work for all women and men: Informal employment is challenging in providing better livelihoods for people. In the SWM system, informal waste pickers are increasing in number especially in low-income countries but have no guaranteed safety standards and social insurance. Human resources development in the SWM system would improve the working environment for informal waste pickers by promoting their economic growth and productivity rates. Such advances require enhanced recycling technologies, use of valorised waste as raw materials in industries and transfer of recycling technology to small enterprises for decent job opportunities.

9) **SDG 9: SWM for Enhanced Innovation and Industrialization:** Sustainable SWM tendencies are promoting recycling in small industries that are a backbone of industrial growth in developing countries. Recycling solid waste has the potential to provide employment opportunities and unlimited industrial innovation considering the availability of raw materials. However, the success of the recycling industry is based on waste sorting to fish out for recyclables in addition to advancing technology to compost organic waste for bio-fertilizer production among other products.

10-11) **SDG 10 and 11: SWM for Better Socio-economic Inclusion of Informal Communities**

SDG 11: Sustainable Cities and Communities

11.1 Ensure access for all to adequate, safe, and affordable basic services, upgrade slums

11.6 Reduce environmental impacts of cities, particularly municipal and other waste management: In low-income countries, SWM contributes positively to reducing inequalities: Its formal and informal sectors influence socio-economic development at varied degrees and therefore, a merger of the two would induce more synergy. For this reason, many countries are enacting policies geared to supporting informal waste pickers, easing their tax and insurance burden, and providing them with affordable healthcare policies to reduce the socio-economic inequalities.

According to a UN (2019) report, more than 2 billion people globally do not have access to waste collection services while more than 3 billion are not able to use controlled landfills to dispose the waste they produced between 2010 and 2018. As such, their quality of life and the sustainability of their communities is compromised. However, sound SWM practices such as waste-for-energy, recycling, reuse, and reduction are key components of safe energy valorisation and disposal in addition to being enhancers of sustainable communities and especially in cities. A World Bank (2018) report noted that the creation of sustainable lives in cities is pegged on rational SWM since it has implications on health, safety, and climate. As such, improving the waste management infrastructure should be prioritized in both developing and developed worlds.

12) **SDG 12: SWM for Sustainable (Responsible) Consumption and Production**

12.1 Sustainable consumption and production national action plans or targets incorporated into national policies

12.2 Sustainable management and efficient use of natural resources

12.3 Halve per capita global food waste at the retail and consumer levels and reduce food loss during production, supply chains, and post-harvest steps

12.4 Environmentally sound management of chemicals and waste to minimize their adverse impacts on human health and the environment

12.5 Promotion of 3Rs to substantially reduce waste generation: Sound SWM systems value reduced production and controlled consumption tendencies that prioritise circular rather than linear economic models. As such, the life cycle of materials including solid waste is prolonged through recycling and valorisation to useful resources and products. Ultimately, less finite natural resources are used for manufacturing and there is extended producer responsibility among waste producers to properly manage, reduce, reuse, and recycle waste. Additionally, consumers prevent waste production and if produced, they can recover it while reducing environmental pollution).

13) **SDG 13: SWM for Climate Change Mitigation and Adaptation**

13.2 Integrate climate change measures into policy and planning

13.3 Build knowledge and capacity to meet climate change SDG: Unsystematic SWM such as uncontrolled landfilling and open dumping result to emission of GHGs in the atmosphere and consequently air pollution, climate change and its associated effects. In 2016, studies showed that at least 5% of total GHGs emissions emanated from solid waste. Improved SWM should therefore be prioritized to manage climate change effects considering that not doing so would lead to increased GHGs emissions to the tune of 2.6 billion tons.

14) **SDG 14: SWM to Conserve Oceans, Seas, and Marine Resources (Life below Water)**

14.1 Prevent marine pollution, particularly from land-based activities: Large water bodies including seas and oceans produce 50% of oxygen needed by living organisms and are climate regulators

since they absorb heat from the atmosphere and sequester carbon dioxide among other GHGs. Consequently, acidity in the water bodies increases and threatens the survival of marine resources. By reducing plastic disposal and open burning of waste at dumpsites and landfills, such waste bodies and their associated resources can be conserved. Through scientific SWM, life below water can also be preserved.

15) **SDG 15: SWM to Improve Terrestrial Ecosystems (Life on Land) Target**

15.3: End desertification and restore degraded land: The growing tendencies in urbanization, population increase, and industrialization promote waste production and are a threat to healthy ecosystems. However, through better SWM, the function of land ecosystems can be preserved through safe disposal and efficient use can be enhanced through reuse, recycling, and recovery in circular economic models. Ultimately, less pollution on soil, water and air will occur and the land space and resources used will evenly reduce.

16) **SDG 16: SWM for Stronger Institutions:** Integrated SWM is being advocated in contemporary society due to its capacity to distribute and delegate functions and responsibilities among involved institutions including local administrations and central governments. Such a system also values partnerships with stakeholders including civil societies and the private sector to ensure representative, participatory, responsible, and inclusive decision-making. Adopting the principle of decentralization in SWM has proven to enhance citizen participation in the process while improving economic efficiency and protecting the interests of locals through accountability and transparent communication as well as monitoring and evaluation of the delivery of waste services.

17) **SDG 17: SWM in Promoting Partnerships:** The current SWM system is shifting from the conventional model where local governments were charged with waste services to a multi-partnerships model. The partnerships are formed between such governments, non-governmental organizations, local communities, and the private sector and come due to the inability of such governments to meet the rising demand for waste services. The partnerships will improve SWM performance through knowledge sharing on best practices in the sector, utilization of human capital and in particular, the informal sector and financial boost from international partners and NGOs for better waste service delivery. In this context, SWM will promote partnerships that enhance efficient resource mobilization and use and at the same time promote extended producer responsibility.

Strategies for Planning SDG on Waste Management

1. Waste Prevention: Our consumption and production is a driving force of the global economy. This economy is based on the environment and natural resources we derive from it. United Nations noted that our economic and social progress over the last century has been accompanied by environmental degradation that is endangering the very systems on which our future development & our survival depends. Each year, an estimated one third of all food produced – equivalent to 1.3 billion tonnes worth around $1 trillion – ends up rotting in the bins of consumers and retailers, or spoiling due to poor transportation and harvesting practices. If people worldwide switched to energy efficient light bulbs the world would save US$120 billion annually.

   By 2050 the global population will reach 9.6 billion, the equivalent of almost three planets could be required to provide the natural resources needed to sustain current lifestyles. Waste prevention in first place is about doing more and better with less. It is also about looking at materials and products throughout their life cycle in order to provide a complete picture of their environmental impact, increasing resource efficiency and promoting sustainable lifestyles, substantially reducing poverty and the transition towards low-carbon and green economies.
2. Recycling: In cases where waste management does not work properly it results in to wastage of valuable material and can lead to environmental, health, sanitation & soil and water pollution problems. The aim of recycling is to make use of the resources contained in waste & reduce the adverse impact on environment, reduce the emissions of methane gas from landfill, carbon dioxide from burning activities & emissions of heavy metals and organic environmental

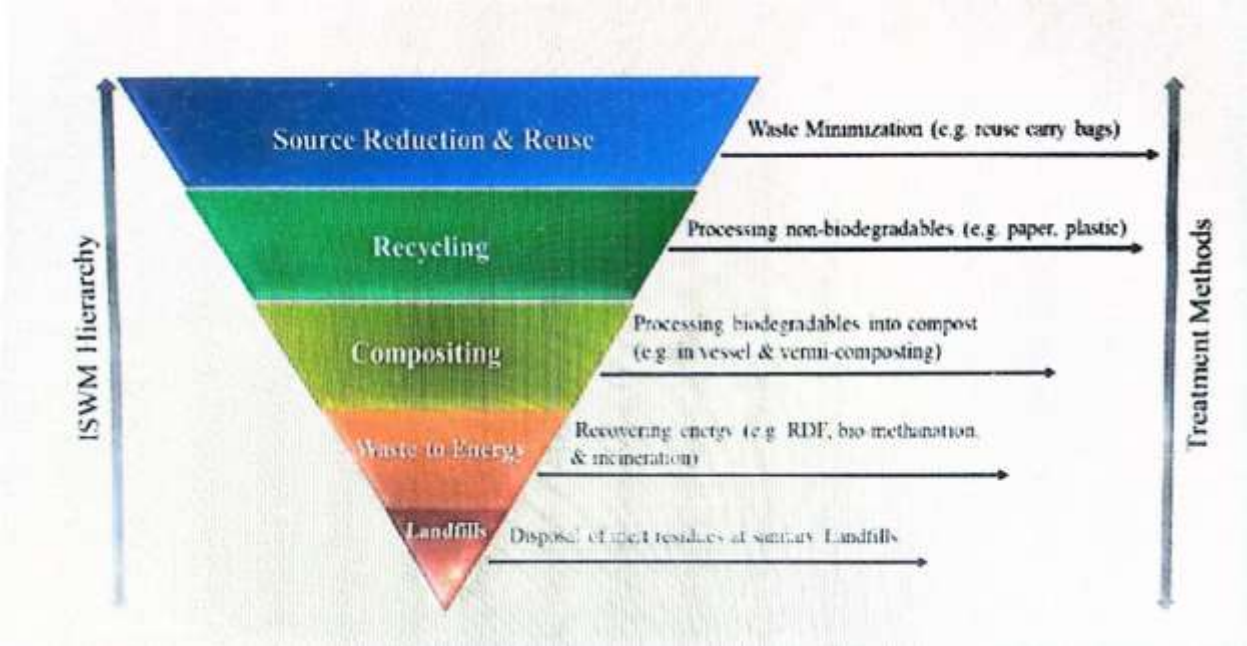
pollutants. Various measures that reduce the volumes of waste are required. The most effective one is the biological treatment which reduces greenhouse gas emissions from landfills and be able to make use of the plant nutrients & food waste.

3. Hazardous Waste Management: Substances that can cause health hazards should be removed from the cycle. The report on waste management by UN Sweden recorded that incorrect management of hazardous waste can pose a great risk of harm to humans and the environment. It is therefore important not to mix it with other waste but to present it separately to professional waste receivers. Some of the characteristics that distinguish hazardous waste are that it may be toxic, carcinogenic, corrosive, and harmful to the foetus, eco- toxic, infectious or combustible. Especially human excreta and other toxic waste should be kept away from the waste cycle, collected and treated separately.
4. Infrastructure: In many places the World Bank provides capital investments to build or upgrade waste sorting and treatment facilities, close dumps, construct or refurbish landfills, and provide bins, dumpsters, trucks, and transfer stations. The infrastructure development cost can be recovered through taxes and fee structures.
5. Citizen Engagement: Behavior change and public participation is key to a functional waste system. It is essential to design incentive structure and awareness systems to motivate waste reduction, source separation and reuse.
6. Social Inclusion: As per the World Bank segregation of the waste is mostly done by the informal workers, who collect, sort, and recycle 15%–20% of generated waste. Any waste management projects should address waste picker livelihoods through strategies such as integration into the formal system, as well as the provision of safe working conditions, social safety nets, child labor restrictions, and education.
7. Climate change and the environment: The projects which promote environmentally sound waste disposal should be supported. These projects help mitigation of greenhouse gas through food loss and waste reduction, organic waste diversion, and the adoption of treatment and disposal technologies that capture bio-gas and landfill gas. Waste projects also support resilience by reducing waste disposal in waterways, addressing debris management, and safeguarding infrastructure against flooding.
8. Segregation at Source: It is essential to promote the household to separate the waste at source of generation so as to keep our environment better. Well formulated information is the single most important factor in attaining good results for household waste.
9. Awareness: The large quantities of waste including hazardous waste are being piled up regularly in the developing countries where there is no capacity or knowledge to deal with waste in an environmentally correct way. This can lead to risks to the environment and human health. Creating awareness on the importance of waste management, process. Locally appropriate solutions & technical know-how and data and analytics are important.

Waste Management Hierarchy

The framework or approach for achieving reductions in waste in sustainable waste management is the Waste Hierarchy. The waste hierarchy provides a framework where waste management options are set out in priority in order to enable the correct choice to be made while assessing “how to deal with waste”. The hierarchy applies to almost all waste streams.

One of the key principles underlying sustainable waste management is to ensure that waste should be dealt with waste hierarchy as much as possible. Since all waste disposal options have some impact on the environment, the only way to avoid impact is not to produce waste in the first place, and waste prevention is therefore at the top of the hierarchy. Then it is reuse of materials followed by recovery techniques (recycling, composting and generating energy from waste). Disposal to landfill or by incineration, is considered as the worst option, and kept at the bottom of the hierarchy.



1. **Waste Prevention / Reduction:** Prevention is associated with product design and manufacturing phase. It also aims to help consumers in keeping products longer life and reuse them by preventing waste before it occurs. Money can be saved in the collection, treatment or disposals of waste. It also reduces the environmental impact and costs of extracting more raw materials, production and use. This is a critical point as it aims to minimize waste before that is even generated by improving product design and packaging. Promoting waste prevention by using targets or other means could help in reducing over packaging in supermarket goods. Household packaging waste makes up a substantial amount of overall household and municipal waste.
2. **Materials Reuse:** This means different processes of checking, cleaning, repairing, refurbishing, whole items or spare parts that have become waste are prepared so that they can be re-used. Reusing products and materials for the same (or alternative) purpose is the next preference. Before a material can be reused it should be assessed for its quality as it may be necessary to make minor repairs or additions before the product can reach the required standard. According to recent estimates, one third of all material arriving at recycling centers and other sites can still be re-used; at least 25% of electronic waste still has significant re-use value. For example, Spain is the only country that has a separate preparation for re-use target to incentivize operators to extract materials that have been collected as waste but are useful and do not need to undergo further treatment processes such as recycling or energy recovery.
3. **Recycling and Composting:** Recycling involves the collection, separation and process involves turning waste into a new substance or new products, e.g. newspapers are regularly recycled either to make new newspapers or eco-friendly home insulation. Composting is the same process but with organic wastes, e.g. food waste composted to make new fertilizer products. Recycling and composting processes usually require some energy to work well, however, the energy and cost to alternatively make new products from scratch are usually much greater. The economic viability of recycling/composting depends on factors such as the quality of the waste stream, the transport distances involved and the market price for the recycled materials which can fluctuate significantly. The aim should be to recycle construction wastes as close to their source as possible as they are typically heavy and bulky to transport. Despite that most of us have easy access to recycling; the sobering truth is that over 60% of the trash that ends in the trash could be recycled. A UK study also found that almost 40% of the packaging found in a typical shopping basket

cannot be easily recycled. So, both manufacturers and consumers need to step up efforts on recycling.

4. **Energy Recovery:** Energy from waste ignition recovers a proportion of energy from the waste stream; usually much less than by recycling/composting, reusing or reducing the waste generated in the first instance. Recovery includes processes of waste management such as anaerobic digestion, incineration, gasification or pyrolysis which produces energy (fuels, heat and power) and materials from waste. When recycling is not possible, other recovery options need to be identified so that the material does not end up in landfill.
5. **Landfill Disposal:** Disposal is the last option in the waste hierarchy and therefore the aim is to divert waste from this end destination. The bottom tier of the waste hierarchy for sustainable waste management involves landfill and incineration without energy recovery. This is the least favorable option of waste management systems.

Problems and Opportunities of SDGs in Waste Management

In 2020, the world was estimated to generate 2.24 billion tonnes of solid waste, amounting to a footprint of 0.79 kilograms per person per day. In low-income countries, over 90% of waste is often disposed in unregulated dumps or openly burned. These practices create serious health, safety, and environmental consequences. Poorly managed waste serves as a breeding ground for disease vectors, contributes to global climate change through methane generation, and can even promote urban violence. For the societies to be sustainable we need sustainable practices like prevention of waste, minimizing consumption, more efficient production methods and waste management with a greater focus on recycling. Improving solid waste management is essential for achieving the Sustainable Development Goals, particularly target 11.6 (environmental impacts of waste generation in urban areas), which most regions of the world are not on track to meet.

Effective waste management is expensive, often comprising 20%–50% of municipal budgets. Operating this essential municipal service requires integrated systems that are efficient, sustainable, and socially supported. Households are not motivated to change their consumption habits and waste disposal practices due to a lack of information about the negative health and environmental impact caused by waste generation and disposal. The introduction of enforcement and incentive programs along with education campaigns can encourage the public to view waste more as a resource. Also, collaborative decision making involving all stakeholders while formulating a waste management plan is crucial for ensuring its acceptance and boosting the chance of success.

Producers should consider product's environmental impact when it is manufactured. Design and material selection, as well as energy consumption in manufacturing and use must be taken into account. Sustainable waste management can only be achieved if a greater proportion of waste can be reused and recycled. This saves both materials and energy and reduces hazardous chemicals and its environment impact. Cities are generating enormous levels of waste including hazardous and toxic wastes. With the increased awareness there is a growing realization of the negative impacts of wastes on environment, land, human health, and climate and so on. In many places waste is considered as a business opportunity to extract valuable resources contained within it that can still be used and to safely process and dispose wastes with a minimum impact on the environment.

BENEFITS OF SUSTAINABLE WASTE MANAGEMENT

Sustainable waste management delivers lots of benefits:

1. The greatest advantage of waste management is keeping the environment fresh and neat.
2. Saves the Earth and conserves energy.
3. Reduced waste disposal costs (especially Landfill and Aggregate taxes).
4. Reduced greenhouse gas emissions from landfill and incineration.
5. Reduced energy consumption from the manufacturing process.
6. Improving economic efficiency through the means of resource use, treatment and disposal and creating markets for recycles can lead to efficient practices in the production and consumption of products.

7. Reduced requirement for additional landfill capacity.
8. Reduced nuisance created by odor and visual intrusion from landfill sites.
9. Improved corporate reporting and green credentials for business.
10. Saves valuable time and resources during an incident.
11. Allows more efficient and effective waste management decision-making during an incident.
12. Encourages stakeholders (e.g., state, local, tribal and territorial governments; owners of private storage, treatment and disposal facilities; residents) to work together before an incident occurs.
13. Minimally detracts from, or otherwise impacts, the broader response and recovery efforts due to the efficient implementation of waste management activities.

CHALLENGES TO DELIVERING SUSTAINABLE WASTE MANAGEMENT SYSTEMS

Limited environmental awareness along with low motivation has inhibited innovation and the adoption of new technologies that could transform waste management. Public attitudes to waste are also a major barrier to improving it. Following are some challenges for developing sustainable waste management –

1. Lack of training in waste management and the availability of qualified waste management professionals is limited.
2. High transportation cost.
3. Uncontrolled scavenging.
4. Inadequate budget.
5. In efficient waste collection and transportation.
6. Inadequate management and maintenance of equipment.
7. Low public education and awareness of waste management issues.
8. No alternative treatment strategy.
9. Improper disposal method - Illegal burning & dumping.
10. Aesthetic problem.

METHODOLOGY

The research focuses on the role of ISWM in achieving SDGs; a survey approach was adopted to assess the impact of solid waste management plans and programs on achieving the seventeen sustainable development goals and identifying the sustainable development goals that are the most/the least affected by solid waste plans and programs. The methodology of the research is based on "the concept of integrated solid waste management and "the role of SWM sector in achieving the SDGs" by analyzing the seventeen sustainable development goals from the perspective of solid waste management plans and programs. Data was collected through primary and secondary sources which consist of site visits, observation, and focus group discussion with residents. Geo-Spatial Information System was further used to map out the area and different waste sites were captured.

This methodology explains the development, evaluation and implementation of a waste management strategy. A hierarchy, whose levels operate in isolation of each other, serves to undermine the concept itself. Inherent in the hierarchy levels is that they are linked by way of preference and benefit, thus the importance of viewing the entire concept as a model for increasing resource use efficiency and reducing impacts associated with consumption.

The SDG is guided by the purposes and principles of the Charter of the United Nations, including full respect for international law. It is grounded in the Universal Declaration of Human Rights; international human rights treaties, the Millennium Declaration and the 2005 World Summit Outcome Document. It is informed by other instruments such as the Declaration on the Right to Development.

CONCLUSION

It is evident to analyze the possibility of achieving the SDGs from the perspective of WM plans and programs, as it supports the achievement of a wide range of specific targets set within the 17 SDGs, whether directly or indirectly, starting with the development of the natural and urban environment by improving the quality of life for cities, maintaining the sustainability of local communities, reducing the

individual negative environmental impacts of cities, and preserving the ecosystems on earth, and its ability to contribute to economic and social development by providing job opportunities. In addition to its support for building transparent institutional frameworks that guarantee partnerships with different sectors and various stakeholders as well.

Managing waste properly is essential for building sustainable and livable cities. Our production and consumption, urbanization, economic activities, changing lifestyles & our increasing prosperity results in enormous volume of waste. Many of the articles which circulate in society contain toxic or hazardous wastes are harmful to the environment. This necessitates the need to handle the waste properly & phasing out the harmful substances. The integrated solid waste management is a strategic approach to sustainable management of solid wastes covering all sources and all aspects, covering generation, segregation, transfer, sorting, treatment, recovery and disposal in an integrated manner.

RECOMMENDATION

The following recommendations are put forward:

1. Develop a comprehensive waste management plan: Urban areas should develop a comprehensive waste management plan that incorporates sustainable development principles and integrates with existing urban planning frameworks.
2. Implement waste reduction and recycling programs: Urban areas should implement waste reduction and recycling programs to minimize waste generation and promote sustainable consumption patterns.
3. Monitor and evaluate waste management performance: Urban areas should establish monitoring and evaluation systems to track waste management performance, identify areas for improvement, and inform policy and decision-making.
4. Enhance community engagement and education: Urban areas should enhance community engagement and education on waste management practices to promote behavioral change and encourage active participation.

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