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ENVIRONMENTAL CHALLENGES IMPEDING THE COMPOSTING OF BIODEGRADABLE KITCHEN WASTES IN AKKARAIPATTU MUNICIPALITY

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ABSTRACT

Municipal Solid Waste Management (MSWM) in developing nations is challenged by urbanization, population growth, and constrained infrastructure. This study evaluates the current MSWM practices in Akkaraipattu, Sri Lanka, to identify environmental challenges. Data were collected through semi-structured interviews with 20 municipal officials and surveys of 385 households, supplemented by field observations and secondary data from the Akkaraipattu Municipal Council and local composting plant. The quality of compost (physical, chemical and biological Properties) were analysed. Results of moisture content, bulk density and sand content were. 20.7%, 734.096kgm-3 ,0.866% respectively, PH and Electrical conductivity were 6.896 and 5.52 respectively. N, P, K, Na, Mg,Ca, and organic carbon content were 1.36%, 1.105%,2.19%, 0.4%,0.88%,3.867%, 16.47% respectively. Compost was black in colour. Bacteria and fungi content of the compost were 1.2x1010 CFU/ml , 2x 107 CFU/ml respectively. Nematodes were detected . Quantitative analysis revealed that Akkaraipattu generates approximately 49.75 tonnes of solid waste daily, with kitchen waste constituting 6.5 tonnes. The average waste collection rate is only 50%, and composting efficiency remains low at 28.8%. Major environmental challenge was heavy monsoon rainfalls. Poor source segregation at household level causes several problems. Odour, flies and pathogens were observed in this composting process. Limited funding is the constraints here. Despite initiatives like community outreach, long-term success hinges on sustained local involvement and stronger policy enforcement. Recommendations include investing in waste-to-energy technologies, expanding composting facilities, implementing smart collection systems, enhancing public education. This study provides practical insights for policymakers and communities aiming to efficient composting and more sustainable environment.

Keywords: composting, sustainable, environment.

INTRODUCTION

In modern society, solid waste has become a critical concern, and many nations are struggling to find effective solutions as the issue continuous to burden communities, Sri Lanka is no exception solid waste disposal has emerged as a major environmental challenge and is now recognized as a national problem. According to Sri Lanka's National action plan, the improper dumping of hazardous waste is a significant contributor to land degradation(Bandara, 2010). Although several measures have been introduced to address the country's waste management crisis, none have achieved lasting success. As a result, solid waste disposal remains one of the most pressing environmental issues in Sri lanka.

Solid waste management involves carefully guiding every step of waste handling from it's creation to it's final disposal. This includes proper storage, collection, transportation, processing and safe elimination, all created out with a

strong focus on public health, environmental protection, engineering efficiency and economic sustainability.). Effective SWM is crucial for environmental protection, safeguarding public health, conserving resources, and ensuring regulatory compliance. However, improper waste management remains a pervasive environmental issue, particularly in developing countries like Sri Lanka, where unorganized systems, lack of public participation, and inadequate treatment and disposal mechanisms lead to significant environmental degradation and public health risks (Singh et al., 2011). Sources of kitchen wastes may come from leftovers from a meal, uneaten prepared food, spoiled food, coffee grounds vegetable wastes and fruit scraps from households. Most of the food waste goes directly to the landfill or incineration which will cause many problems. Kitchen waste disposal has given a great impact on the economy, society, and especially on the environment.

Composting is one of the methods to reduce organic fraction of municipal solid waste. Composting is a process of breaking down organic materials by microorganisms with the presence of oxygen to an accent where they can be safely stored, handled, and applied to the environment This study aims to investigate and evaluate the awareness of kitchen waste composting and to identify the environmental challenges faced by the Akkaraipattu Municipality Composting. Accordingly, municipal solid waste management is not limited only to waste collection, and rather it comprises of an array of important activities which need to be implemented along with the households located in the area covered by local government authority concerned. For instance, preparing manuals on effective solid waste management, making communities aware of waste-related matters, and providing basic infrastructure to facilitate effective and efficient solid waste management are some of expected tasks to induce household members' behaviors. The implementation of these types of activities is extremely lacking in Sri Lankan system of local governments due to resource constraints (Fernando, 2019).

Municipal Solid Waste is directly linked to the United Nations Sustainable Development Goals (SDG), specifically SDG 11 (Sustainable Cities and Communities) and SDG 12 (Responsible Consumption and Production). A key target under SDG 11 addresses the management of municipal solid waste, while SDG 12 emphasizes the need to substantially reduce waste generation through prevention, reduction, recycling, and reuse by 2030 (United Nations, 2024). For Sri Lanka, this implies an urgent need to minimize the per capita environmental impact of its cities (United Nations, 2024). Municipal solid waste management comes under the Sustainable Development Goal 11: sustainable cities and communities and Sustainable Development Goal 12: responsible consumption and production. One of targets coming under the SDG 11 is related to municipal and other solid waste management (United Nations, 2024). By paying attention to this, as a UN member country, Sri Lanka is expected to reduce the adverse per-capita environmental impact of cities by 2030. Further, the SDG-12 emphasizes that the sources of solid waste generation including the households need to substantially reduce waste generation through prevention, reduction, recycling, and re-use by 2030 (United Nations, 2024). Accordingly, the SDG-11 and SDG-12 combinedly emphasize the importance of responsible consumption with minimized-environmental impact and expanded-scope of local authorities for the subject of solid waste management.

Composting helps to strengthen environmental sustainability, as it helps to hold the soil particles together, from this soil erosion is prevented. It helps to keep

wastes in a controlled environment and recycled to a useful product. They help in the bioremediation of polluted soil. They also increase biodiversity in the soil by attracting different insects, bacteria, fungi, etc. that are beneficial to the crop. They are treated in a controlled environment where they do not stay forever. They also help to suppress diseases in plants and enrich the soil They help to reduce greenhouse effects by mitigating the production of gases like methane. Though CO2 is release during composting, lesser compared to other (combustion) modes of waste management Reduces the volume of wastes drastically. Recalcitrant substances, such as polythene bags, plastics among others cannot be composted. Waste management has become a critical area of practice and research. Because this activity concerns of environmental pollution and resources shortage Most of solid waste management professionals recognize that there is no single, simple solution to solid waste problems. Instead, an integrated approach, combining the elements of multiple techniques, is used in an increasing number of cases (Uif, 1998).

Various environmental issues may arise from composting process, including the formation of malodorous or toxic gases (Komilis et al., 2004, Mao et al., 2006, Maulini-Duran et al., 2014a), bioaerosols, and dust resulting in occupational health risks or disturbance to nearby residents). This is especially pertinent to composting plants operated in open spaces. Moreover, waste-derived compost may elevate heavy metal concentrations in soil and food products cultivated in soil amended with Municipal Solid Waste Composting, when managed properly, is a sustainable waste management option that has various benefits, including reducing greenhouse gas production and improving soil quality when used as a soil amendment. However, when improperly managed and performed, above mentioned environmental issues may be lead.

The challenges of MSWM are acutely felt in urban areas of developing nations, where rapid urbanization, population growth, and insufficient infrastructure converge Akkaraipattu, a growing urban center in Sri Lanka, exemplifies these challenges. This research aims to map the existing MSWM practices in Akkaraipattu, identify and analyze the environmental challenges in composting, benchmark these practices against international standards to identify gaps; and propose strategic, sustainable solutions for improvement., this study also contributes to the broader discourse on sustainable waste management and offers evidence-based guidance for local policymakers and communities (modify according to environmental challenges).

This paper provides a critical review of Municipal Solid Waste composting practices in Akkaraipattu Municipality, the environmental and ecological impacts of MSW composting and compost due to chemical or biological contaminants, their control strategies, and compost quality control measures. Such information may be particularly useful in assisting to upgrade sustainable waste management strategies.

LITERATURE REVIEW

Solid Waste refers to materials generated by humans from human and animal activities that are typically thrown away because they are no longer considered useful or needed .Municipal Solid Waste refers to dry waste materials produced by households, agricultural operations, industries and institutions across both public and private sectors (Samarasinha et al., 2015). Managing solid waste has emerged as a major sustainability challenge for local government across the globe. However, this problem is particularly severe in Sri Lanka. Municipal solid waste management policy gaps, largely due to

the limited research conducted on the subject. (Saja et al., 2021). Under current legal provisions of the Pradeshiya Sabha, the responsibility for managing this waste falls to local government authorities, yet they often lack the guidance and support needed for effective implementation. Additionally, at the national level, authorities work in partnership with relevant international organizations on matters related to municipal solid waste management (Saja et al., 2021). As per the relevant sections of the Municipal Council Ordinance, sections 129, 130, and 131, the Urban Council Ordinance Sections 118, 119, and 120; and Pradesheya Saba Act No. 15 of 1987, Sections 93 and 94, in Sri Lanka, all waste gathered by local authorities such as street litter and household refuse becomes the property of the respective council, which holds complete authority to sell or dispose of these materials as it deems appropriate As a result, solid waste has become a core responsibility of local government authorities. However, these authorities often lack the financial capacity to establish fully equipped composting centers that could function as income-generating ventures (Sinnathamby et al. 2016).

Municipal solid waste management aligns with sustainable Development Goal 11, which promotes Sustainable Development Goal 11, which promotes sustainable cities and communities, as well as Goal 12, focused on responsible consumption and production. A key target coming under Sustainable Development Goal 11 specifically addresses the management of municipal and other forms of solid waste. (United Nations, 2024). In line with this commitment, Sri Lanka, as a member of the UN, is expected to minimize the negative per-capita environmental impact of its cities by the year 2030. Additionally, SDG-12 highlights the importance of significantly cutting down solid waste generation from sources such as households by 2030, through strategies focused on prevention, reduction, recycling and reuse (United Nations, 2024).

Improper waste management is detrimental to human health. Apart from being unsightly, it causes air pollution, affects water bodies when dumped into the water, as well as depletes the ozone layer when burnt, thereby increasing the impact of climate change. Wastes are often improperly managed using conventional methods. Wastes are burnt, disposed into oceans, waterways, and dumped by the road sides. These practices breed insects and pests, release offensive odors, are unsightly and contribute to global warming (during combustion). Organic (degradable) wastes transformation is either aerobic or anaerobic. When transformed under aerobic conditions, compost is formed. When treated anaerobically, biogas as well as effluents that can be used as biofertilizers are formed. Composting is a safe method of waste management. Composting is an aerobic process where complex degradable materials are degraded and transformed by microorganisms into organic and inorganic by products. The byproducts contain 'humic-like' compounds that differentiate them from those found in native soil, coals, and peats. Composting is a means of transforming different degradable wastes into products that can be used safely and beneficially as biofertilizers and soil amendments

Although composting has many reported benefits that have been mentioned above, various challenges are posed by this method of waste management, from its effects on climate change to its release of carbon dioxide into the atmosphere and the depletion of oxygen, as well as the production of offensive smells from the release of hydrogen sulfide produced from anaerobic activity. As a result of these health impacts, various regulations have been put in place by different bodies in different countries concerning the use of the

method. These limitations show that this method should still be improved to address various concerns mentioned. Two major areas of improvement are the temperature regulation and the control of oxygen flow. These are key to the function of the microbes carrying out the composting process. The various microbes at each stage have the temperature at which they function, so these must be well-monitored, and they need oxygen so that the anaerobes will function less. Increased activity of the anaerobes increases the production of more carbon dioxide.

Soil organic matter plays a major role in maintaining soil quality In addition to supplying plant nutrients, the type and amount of soil organic matter influence several soil properties. Utilization of MSWC in agricultural land increase the soil organic matter improves soil properties, enhances soil quality, reduces soil erosion, increases plant productivity and soil microbial biomass. Thus, in the regions where organic matter content of the soil is low, agricultural use of organic compost is recommended for increasing soil organic matter content and consequently to improve and maintain soil quality. Apart of increasing soil organic matter content, application of organic compost can affect soil quality by decreasing the need of chemical fertilizers and pesticides, allowing for more rapid growth in plants (Bulluck and Ristaino ,2002) Sequestering C in soil that has received compost application improving tillage and workability of soil increasing soil microbial biomass and activity Bulluck and Ristaino (2002 Arau´jo and Monteiro (2006). Recently, Soil ecology is increasingly being used to evaluate soil quality. It is thought that soil microbiological properties are most sensitive to changes in the soil environment (Crecchio et al., 2001). Biomass N, C, and S showed increases in the soil immediately after compost addition and for up to 1 month, while biomass P showed an increasing trend for 5 months (Perucci, 1990). Application of 2.5, 10, 20, and 40 Mg ha#1 MSW compost increased soil microbial biomass C and soil respiration

Composting is the regulated decomposition of organic matter to produce a final product called compost; it is used in waste management as a method to recover organic waste The composting process entails managing and accelerating the biological and oxygen demanding process as a mixture of organic materials pass through a series of stages that are characterized by increases in temperature and bacterial types leading to a stable organic material called compost (Haight and Taylor 2000). Composting of organic waste is recognized as an effective method to manage this waste type as it aims to recovers organic waste in the waste stream and produces a useful end-product (Hoornweg 1999). Composting may be defined as part of a sustainable resource management strategy (Richard, 1992 Faucette, 2004). It is essential to encourage recycling, the only.Sustainable waste management practice which avoids the existence itself of wastes by transforming possible waste materials into a series of products (Campbell, 1990). With sustainable transformation of wastes into organic fertilizers, composting would complement sustainable agriculture (Cathcart et al., 1986). The sustainable agriculture and the use of compost can be considered as essential activities for a sustainable society (Sinha and Heart, 2002). Hence, sustainability considerations are major driving forces for composting technologies. Improvements in composting process control will help increase the efficiency and economic viability of the related technologies, and thus contributing to agricultural and societal sustainability.

Saja et al. (2021) mentioned that many areas face severe problems in managing 10 to 50 metric tons of waste per day in Sri Lanka. The generation of Municipal Solid

Waste (M.S.W.) in Sri Lanka is 7210 tons per day and the collection efficiency is only 27%; recyclables make up close to 46% of the total collected waste (approximately 12% of total waste generated), and composting accounts for 25% of the total collected waste (approximately 7% of total waste generated) (as cited in Saja et al.,2021). Approximately 60% of the total waste is collected in the Western Province, which is approximately 30% of the total population in Sri Lanka (Dharmasiri, 2020). "Inadvertently, with the current trends continuing, it is likely to rise from 3.5 Metric tons (M.T.s) to 6 M.T.s per day with, each person generating around 0.64 kg waste per day in Sri Lanka with an estimated 4.8 billion M.T. of waste collected per annum in the country" (Dharmasiri, 2020). It is evident that there is a severe issue of solid waste in Sri Lanka, but the country lacks an effective solution Community participation is an energetic method of successful integrated Solid Waste Management programs.

The results of several studies on solid waste management expressedl that composting is an appropriate and practical option in managing Municipal Solid Waste for many cities in Sri Lanka. Analyzing the composition of solid waste disposed of by the municipalities pointed out that the largest fraction of solid waste is organic, biodegradable, and appropriate for compost production..Applying organic compost is a valuable strategy in integrated plant nutrient management system. This practice helps to overcome limitations of entirely depending on inorganic fertilizers for crop nutrient management. Because it helps to maintain and improve soil carbon content and stabilize and improve soil fertility. In the late 1990s, the Department of Agriculture (DOA), Sri Lanka encouraged farmers to apply organic manure and introduced an integrated plant nutrient system (IPNS). Present fertilizer recommendations of DOA have been developed based on the IPNS strategy (Dandeniya & Caucci, 2020; Nadeesha et al., 2022).

Composting is a process in which organic matter, derived from plants, animals, or humans is decomposed under aerobic conditions by millions of microorganisms representing different groups. The composting process returns valuable nutrients representing organic matter to plant crops and improves the quality and fertility of the soil . Organic matter that has been decomposed by microbial communities through the composting process releases products and by-products such as H2O, CO2, NH3, SO2 , humid acid, and heat .The composting process has four phases: mesophilic, thermophilic, cooling, and maturation . Many factors affect the length of the composting process, including the pH of the compost, the C/N ratio, moisture, the nature of the feedstock, oxygen availability, and composting technology. Factors such as pH, carbon balance, temperature, and nitrogen change considerably during the composting process. Conversely, the carbon content and nitrogen NH4+ formation decrease throughout the composting process, whereas, the compost pH initially decreases during the first stage and then increases at the end of the process.

In recent years, sustainability concerns drew attention and encouraged the policy debate on the role of WM in reducing waste impact and moving toward a circular economy and sustainable urban development (Makarichi et al., 2018) A systemic approach involving the whole community is acknowledged as crucial to face many technical and social aspects of municipal solid waste management (MSWM) (Blengini et al., 2012).

RESEARCH DESIGN AND METHODOLOGY

This study employed a mixed-methods approach to gather comprehensive data on

Municipal Solid Waste Management in Akkaraipattu. The Study was carried out at the Akkaraipattu Municipality Region and Alim Nagar Composting Plant.

Data Collection

Primary data were collected through two pretested, structured questionnaire. A survey on MSWM services targeting 20 employees of the Akkaraipattu Municipal Council, selected purposively based on their roles. A household survey on kitchen waste management practices. The sample size of 385 households was determined using the Krejcie and Morgan (1970) formula for a finite population. Secondary data were obtained from official reports and records from the Akkaraipattu Municipal Council and the local composting plant. Qualitative insights were gathered through semi-structured interviews with key informants (see Table 1 for participant details) and field observations at waste management sites.

Table 1- Data Collection of Participants

No	Anonymous name	Designation	Years of experience
1	Participant A	Mayor	7 years
2	Participant B	Secretary	13 years
3	Participant C	Commissioner	3 years
4.	Participant D	Head for Waste Management Branch	10 years
5.	Participant E	Development Officer-Planning	6 years
6	Participant F	Development Officer-Planning	5 years
7.	Participant G	Management Assistant	2years
8.	Participant H	Management Assistant	3years
9.	Participant I	Compost Plant Supervisor	5 years
10.	Participant J	Management Assistant	4 years
11.	Participant K	Management Assistant	3 years
12.	Participant L	Development Officer	2 years
13.	Participant M	Development Officer	3 years
14.	Participant N	Development Officer	3 years
15.	Participant O	Management Assistant	2 years
16.	Participant P	Development Officer.	3 years
17.	Participant Q	Development Officer	2 years
18.	Participant R	Municipal waste collection Supervisor	3 years
19.	Participant S	Accounts Officer	5 years
20.	Participant T	Public Health Inspector	5 years

The Quality of compost was analysed. (Physical, Chemical and Biological Properties) Analysis of the Physical properties of compost was done at the University Lab, Technology Faculty, South Easten University of Sri Lanka.The Chemical Properties of compost (pH and Electrical Conductivity) of Compost were analysed at the University Lab, Faculty of Technology, South Eastern University of Sri Lanka.In Chemical properties analysis, Nutritional Analysis of compost was done at Coconut Research Institute, Lunuwila.In the Biological Properties Analysis of Compost, Nematode Content was analysed at Industrial Technology

Institute, Colombo.In Biological Properties, Bacteria and Fungus content were analysed at Sustainable Agriculture Research and Development Center, Makandura, Gonawila. Factors analysed were shown in the Table:02

Table 2: Quality analyses of compost

Quality of compost	Factors
Physical properties	Moisture, Bulk density, Compost colour, Sand Content
Chemical properties	pH, Electrical conductivity, Nutrient content
Biological properties	Biological qualities content (Bacteria, Fungus and Nematode content)

Data Analysis

Quantitative data from the surveys were analyzed using SPSS version 20.0, employing descriptive statistics to calculate means, standard deviations, and frequencies. Qualitative data from interviews and observations were analyzed thematically to identify recurring challenges and perspectives.

RESULTS

Waste Generation and Composition

Akkaraipattu generates an average of 49.75 tonnes of

solid waste daily (SD = 3.29), amounting to

approximately 1400 tonnes monthly (SD = 57.74).

Kitchen waste constitutes a significant portion, with 6.5

tonnes generated daily (195 tonnes monthly).

Waste Collection and Management Efficiency

The municipality collects only about 50% of the daily generated waste. Composting efficiency is low, at 28.8%. Financial allocations for SWM have fluctuated significantly, as shown in Table 3, with a notable spike in "Other Expenses" in 2023 (Table 3), indicating potential capital investments or irregular funding patterns

Table 3: Expenses of Solid Waste Management of Akkaraipattu Municipality in LKR

Year	Remuneration	Traveling expenses	Materials & Supply	Repairing Properties	Other expenses	Total Cost
2018	1, 009,198.50	78,500.00	75,000.00	65,000.00	10,669,199.00	10,887,699.00
2019	1,009,549.50	155,610.00	440,462.00	565 260.98	536,354.40	2,141,975.90
2020	878,500.00	78,500.00	480,462.00	350,000.00	354,513.90	2,141,975.90
2021	978, 500.00	79,500.00	470,400.00	250,000.00	2,721,599.78	4,499,999.78

2022	858,500.00	78,500.00	480,500.00	210,000.00	3,372,500.00	5,000,000.00
2023	858,500.00	99,500.00	480,500.00	220,000.00	48,341,500.00	50,000,000.00
2024	858,500.00	78,900.00	330,500.00	200,000.00	3,532,100.25	5,000,000.25

The household survey revealed a complex public perception of waste management in Akkaraipattu. Nearly half (43.6%) of the respondents identified waste disposal as a problem within their neighborhood, and a similar proportion (46.7%) rated municipal collection services as merely "fair." In contrast, a majority (58.8%) expressed satisfaction with the processes at the local waste management center. A significant disconnect between awareness and practice was evident: while public understanding was high, with 83.3% aware of recycling's importance and 89.4% acknowledging the environmental impacts of waste, 90.4% of respondents still reported seeing litter in public areas. Furthermore, an overwhelming majority (94.5%) were concerned about the health impacts of mismanaged solid waste, and 86.8% believed that most environmental issues in Akkaraipattu could be minimized with proper waste management.

This study analyzed the composting procedures and efficacy. It also devised a comparative analysis of various technologies and approaches for the composting process It also analyzed the decentralized and on-site treatment of composting and acknowledged the socio-economic and environmental concerns regarding the sustainability perspectives. Complementing these public views, interviews with municipal officials identified several systemic institutional challenges. The foremost issue is inadequate infrastructure, where existing waste processing facilities are insufficient to handle the current volumes of waste generated. This is compounded by significant financial constraints, as insufficient and inconsistent funding severely hampers daily operations and long-term development. Officials also cited public indifference, particularly poor adherence to waste segregation practices, as a major impediment to efficiency. Additional operational obstacles include logistical and human resource issues, such as a shortage of skilled labor and challenges in transportation. Finally, the existing policy and regulatory framework was described as outdated and, crucially, poorly enforced, which significantly limits its overall effectiveness.

CONCLUSION

This study concludes that MSWM in Akkaraipattu is hampered by a combination of environmental challenges. Although a foundational policy framework and public awareness of the issues exist, effective implementation is lacking. Sustainable improvement requires an integrated approach that addresses infrastructure, technology ,policy and community behavior.

DISCUSSION

The findings of this study paint a comprehensive picture of a Municipal Solid Waste Management (MSWM) system in Akkaraipattu that is under significant strain, grappling with the interconnected challenges of increasing

waste generation, operational inefficiencies, and a gap between public awareness and action.The daily waste generation of 49.75 tonnes underscores the substantial burden placed on the municipality's waste management system. This volume, which is characteristic of rapidly urbanizing areas in developing nations aligns with global trends where economic development and population growth directly correlate with increased waste production (Hoornweg & Bhada-Tata, 2012). The significant portion of kitchen waste (6.5 tonnes daily), a biodegradable stream, represents both a challenge and a critical opportunity. While its high organic content contributes to leachate formation and greenhouse gas emissions. However, the system's capacity to manage this waste is severely limited. A collection rate of only 50% is alarmingly low and signifies a critical failure in the first step of the waste management hierarchy. This result is consistent with challenges noted in other Sri Lankan municipalities, where collection systems often fail to keep pace with urban expansion (Saja et al., 2021). Uncollected waste, as reported by 90.4% of respondents seeing litter in public areas, inevitably leads to illegal dumping, environmental pollution, and public health risks, creating nuisance and obstructing drainage systems Furthermore, the low composting. This inefficiency suggests potential issues such as poor feedstock quality (due to a lack of source separation), inadequate technology, or operational mismanagement at the composting plant, leading to missed opportunities for waste diversion and soil amendment production (Samarasinha et al., 2015). Poor source segregation at household level affects composting in Akkaraipattu Municipality. Too much green wastes make composting unstable and reduce composting efficiency. Odour, flies , leachate formation and pathogen affect also observed. Heavy monsoon rainfalls also complicates operations. Improve source separation and door to door collection, basic engineering at sites, process control and training enforce schedules, public awareness and market development, Regular institutional support and clear guidance and monitoring by local authorities may be useful and upgrade the sustainability of composting.

The financial analysis reveals a pattern of instability that directly contributes to these operational shortcomings. The dramatic fluctuation in annual budgets, points towards inconsistent funding and a reactive rather than strategic approach to financial planning. This inconsistency hampers the ability to invest in reliable collection vehicles, maintain infrastructure, or launch sustained public awareness campaigns. As noted by Sinnathamby et al. (2016), a lack of financial capacity is a fundamental barrier for local authorities in Sri Lanka to establish effective, income-generating waste processing facilities. Stable and adequate funding is a prerequisite for the long-term planning and investment required for sustainable MSW

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