

**“CONCEPTUALISING A SUSTAINABLE PRACTICE MODEL FOR PLASTIC
MANAGEMENT IN KERALA”**

Dissertation submitted to
Mahatma Gandhi University, Kottayam in partial fulfillment of the requirement for
the degree of
MASTER OF SOCIAL WORK
Specializing in
COMMUNITY DEVELOPMENT

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CERTIFICATE

This is to certify that this dissertation titled “Conceptualising a sustainable practice model for plastic management in Kerala” is a record of genuine and original work done by FATHIMA AFRIN K S, 220011000180 of IVth semester Masters of Social Work course of this college under my guidance and supervision and it is hereby approved for submission.

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DECLARATION

I FATHIMA AFRIN K S hereby declare that the research work titled “ Conceptualising a Sustainable Practice Model for Plastic Management in Kerala” Submitted to the M G University, Kottayam, is a record of genuine and original work done by me under the guidance of Dr.SHEENA RAJAN PHILIP, Head of Department, Bharata Mata School of Social Work, Thrikkakara, and this research work is submitted in the partial fulfillment of the requirements for the award of the degree of Master of Social Work Specializing in Community Development.

I hereby declare that the results embedded in this research have not been submitted to any other University or Institute for the award of any degree or diploma, to the best of my knowledge and belief.

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ABSTRACT

Pollution, particularly plastic pollution, remains a significant challenge despite various initiatives and laws aimed at waste management. In Kerala, plastic pollution poses a multifaceted challenge impacting both the environment and human well-being. As plastic waste persists in the environment for hundreds of years, breaking down into smaller particles known as microplastics, which can enter the food chain and harm marine life. In addition to physical pollution, plastics can leach harmful chemicals, posing risks to both wildlife and humans. Effective solutions require concerted efforts from individuals and governments to reduce plastic usage, improve waste management systems and promote the development and adoption of sustainable alternatives. Addressing plastic waste pollution is crucial for safeguarding the health of our planet and future generations.

This qualitative research explores the issue of plastic pollution in Kerala examining the challenges and potential solutions. Drawing on successful waste management practices observed in Ooty, the study aims to develop a comprehensive waste management model tailored to Kerala's socio-economic and environmental context. By integrating principles of social work, the research aims to propose practical solutions to mitigate plastic pollution and promote sustainable development, thus contributing to the well-being of communities and the environment. Through Case study and interviews, the study seeks to understand demographic factors influencing plastic waste generation and disposal. Also, it examines public perceptions of government efforts and awareness of plastic waste management systems. The research aims to develop a model for effective plastic waste management in Kerala, emphasizing individual accountability, corporate action, and government policies to mitigate the harmful effects of plastic pollution on humans and the environment.

In the aspect of social work, interventions can extend beyond immediate relief efforts to address the underlying systemic issues contributing to plastic pollution. This may involve engaging in community organizing and collective action to address broader environmental justice concerns, such as industrial pollution or inadequate waste infrastructure. By mobilizing communities and fostering collaboration between stakeholders, social workers can contribute to the development of sustainable solutions that address the root causes of plastic pollution. By adopting a comprehensive approach that integrates education, advocacy, and community empowerment, it is evident that social workers can contribute to the development of sustainable solutions that promote environmental justice and improve quality of life for all residents of Kerala.

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CHAPTER 1

INTRODUCTION

“**Waste**” is the byproduct of a process, which has a very little economic value for which it is let out into the environment through solid, liquid or gaseous routes. This causes pollution. The main social issue still prevalent in our society, even after the implementation of various laws, is the problem of pollution. Disposal of wastes or the management of wastes is an uphill task for any governments, their agencies or organizations. Government of India had put forward the hazardous wastes (Management and handling rules) in 1989 and amended these in 2000. From then onwards, efforts to inventorise the hazardous wastes generation was initiated. Despite efforts and initiatives to combat and address various activities and practices contributing to pollution, achieving complete pollution-free living in our Kerala is still challenging. This remains a significant challenge concerning the sustainable development goals of our global community.

A crucial aspect of this issue is the diverse forms of pollutants that infiltrate our daily lives without any utility. One such pollutant that continues to be a major concern is plastic. Researcher’s attention has been drawn to the **menace of plastic pollution**, which seems almost impossible when it comes to removal. Plastic waste, particularly poses a significant threat to our environment. Despite awareness and efforts to reduce its usage, the persistence of plastic pollution remains a pressing concern. One specific aspect of this pollution that has captured my concern is plastic degradation. Over the years, plastic waste accumulates and its degradation process is slow, causing long-lasting environmental damage. The most hazardous among them is plastic, primarily because it takes years to degrade naturally. Realizing the gravity of the situation, Researcher believe that we must take proactive measures to tackle plastic pollution from the very beginning. To address the pressing need for an efficient plastic waste management system in Kerala, this research turns to **Ooty**, a region renowned for its successful waste management practices. By analyzing and adapting successful models, the study aims to formulate practical model that align with Kerala's socio-economic and environmental context. This qualitative research aims to study and **develop a comprehensive waste management model tailored for the state of Kerala**, drawing insights from the effective practices observed in Ooty.

Plastic waste management has emerged as a pressing global issue due to the proliferation of single-use plastics and their adverse environmental impacts. With the widespread use of plastics in various sectors such as packaging, consumer goods, and construction, the accumulation of plastic waste has reached alarming levels worldwide. This introduction provides an overview of the challenges posed by plastic waste and outlines the importance of effective management strategies to mitigate its environmental consequences.

The Rise of Plastic Pollution

Plastics have become an integral part of modern life due to their versatility, durability, and cost-effectiveness. However, the exponential increase in plastic production and consumption has led to a corresponding rise in plastic pollution. Single-use plastics, in particular, such as bottles, bags, and packaging materials, contribute significantly to environmental degradation. These plastics often end up in landfills, water bodies, and natural ecosystems, where they persist for hundreds of years, releasing harmful chemicals and microplastics into the environment.

Environmental Impacts of Plastic Waste

The environmental impacts of plastic waste are far-reaching and multifaceted. Plastic pollution poses a threat to terrestrial and aquatic ecosystems, endangering wildlife through ingestion, entanglement, and habitat destruction. Marine environments, in particular, are heavily impacted by plastic debris, with millions of metric tons of plastic entering the oceans annually. Plastic pollution not only harms marine life but also poses risks to human health through the consumption of contaminated seafood and the leaching of toxic chemicals from plastics.

Challenges in Plastic Waste Management

Managing plastic waste presents numerous challenges, ranging from logistical and technological hurdles to policy and behavioral barriers. The sheer volume and diversity of plastic waste make collection, sorting, and recycling complex and resource-intensive processes. Inadequate waste infrastructure, limited recycling capabilities, and low public awareness further exacerbate the challenges associated with plastic waste management. Additionally, the global nature of plastic pollution necessitates coordinated efforts at the national, regional, and international levels to address the problem effectively.

Importance of Effective Management Strategies

Given the scale and severity of plastic pollution, effective management strategies are essential to mitigate its environmental and social impacts. Sustainable plastic waste management involves a combination of waste reduction, recycling, and resource recovery measures aimed at minimizing the generation of plastic waste and maximizing its value through reuse and recycling. Adopting circular economy principles, such as extended producer responsibility and product stewardship, can help incentivize sustainable production and consumption practices while reducing the reliance on single-use plastics.

Plastic waste management is a critical environmental challenge that requires urgent attention and concerted action from governments, industries, and civil society. By implementing comprehensive waste management strategies, investing in infrastructure and technology, and promoting sustainable consumption patterns, it is possible to mitigate the environmental impacts of plastic pollution and move towards a more circular and sustainable plastic economy. This introduction sets the stage for exploring various aspects of plastic waste management in greater detail, including current practices, innovative solutions, and future directions for addressing this global issue. Urgent action is needed to prevent further degradation of the environment and mitigate the harmful effects of plastic waste. By reducing plastic production, increasing recycling rates, and investing in innovative technologies, we can minimize the environmental footprint of plastic consumption and transition towards a more sustainable future.

Moving forward, it is essential to prioritize investments in waste management infrastructure, research and innovation, and public education campaigns. Embracing circular economy principles, such as product stewardship and extended producer responsibility, can help shift towards a more sustainable approach to plastic consumption and waste management. By working together and taking decisive action, we can address the plastic waste crisis and create a cleaner, healthier planet for future generations.

Practices and Challenges of Plastic waste management system in Kerala

Managing plastic waste in rural and remote areas of growing nations presents challenges for local administrations, especially due to limited budgets. The financial constraints are more pronounced in such regions, where Panchayats and Municipalities struggle with waste collection, lack proper management equipment and face difficulties accessing treatment centers. The uneven distribution of infrastructure in Kerala adds to these concerns, stemming from historical political-economic disparities. These obstacles contribute to issues like littering and illegal waste dumping. Household plastic waste in Kerala primarily comes from daily activities like using disposable plastic items, synthetic clothing, and carrying plastic bags for shopping or plastic toys. Most of these items are single-use and lack recycled content, including plastic containers, buckets, bins and furniture. The **Government of Kerala** aims to shift from open dumping to **recycling-based waste management** to reduce plastic waste and improve local waste management practices.

As part of the plastic waste management initiatives, the local bodies like panchayats, municipalities and corporations are playing a vital role in the plastic waste management system of government. Therefore, the support of the local bodies is essential to ensure an effective plastic waste management system in Kerala. The household's plastic disposal practices are highly related to their demographic factors such as gender, age and education. When it comes to plastic waste challenges, it is directly related to household's demographic profile. The Kerala government is implementing various initiatives aimed at reducing household plastic waste and actively engaging in waste management efforts. However, public perception suggests that the government needs to strengthen awareness campaigns on plastic waste management across different districts. This underscores the government's responsibility to broaden awareness and educational programs pertaining to plastic waste within society. This study underscores the importance of implementing measures to reduce plastic waste through proper disposal practices, thereby mitigating its adverse impacts on both humans and the environment.

To address this environmental concern, researcher focuses on raising awareness and emphasizing the need to take action against the catastrophic effects caused by plastic, starting with its responsible disposal. The first step towards mitigating the adverse effects of plastic pollution is awareness and understanding of the impact it has on nature. According to the researcher, we, as individuals, need to take responsibility for our actions and contribute to a

sustainable environment by reducing plastic usage and adopting eco-friendly alternatives. Living without the presence of plastic is practically impossible in today's world, considering its extensive use in various aspects of life. Understanding the environmental impact of plastic and adopting sustainable practices should be ingrained in our consciousness.

Through this study the researcher underscores the importance of taking necessary measures to reduce plastic waste, adopting proper disposal practices to mitigate harmful effects on humans and the environment. Controlling plastic waste requires individual accountability, corporate action, and government policies. While it may be challenging to completely eliminate plastic from our lives, minimizing its use and promoting eco-friendly alternatives can significantly contribute to mitigating the adverse effects of plastic pollution. Therefore, finding **alternative materials** that are environmentally friendly and **developing a model** to completely ban plastic in Kerala are essential goals that researcher aim to pursue through this study.

GENERIC WASTE MANAGEMENT WORKING PROCESS MODEL

Collection

(Household Level)

1. Distribution of separate bins for plastic waste at households
2. Collection of waste by municipal or local authorities.

(Commercial and Public Areas)

1. Installation of public bins for plastic waste in commercial and public areas.
2. Scheduled collection services.



Transportation

Efficient transportation of collected plastic waste to sorting facilities.



Sorting

(Automated Sorting)

Utilize machinery for further sorting based on plastic types (PET, HDPE, etc.).



Cleaning



Recycling

(Recycling Unit)

1. Send cleaned plastics to recycling units
2. Utilize local or regional recycling facilities for processing



Manufacturing

Distribute recycled materials to manufacturers for producing new plastic products.



Reuse and Reduce



Promotion of Reusable Products

Encourage the use of reusable bags, containers, and products.



Awareness Programs

Conduct educational programs to reduce single-use plastic consumption

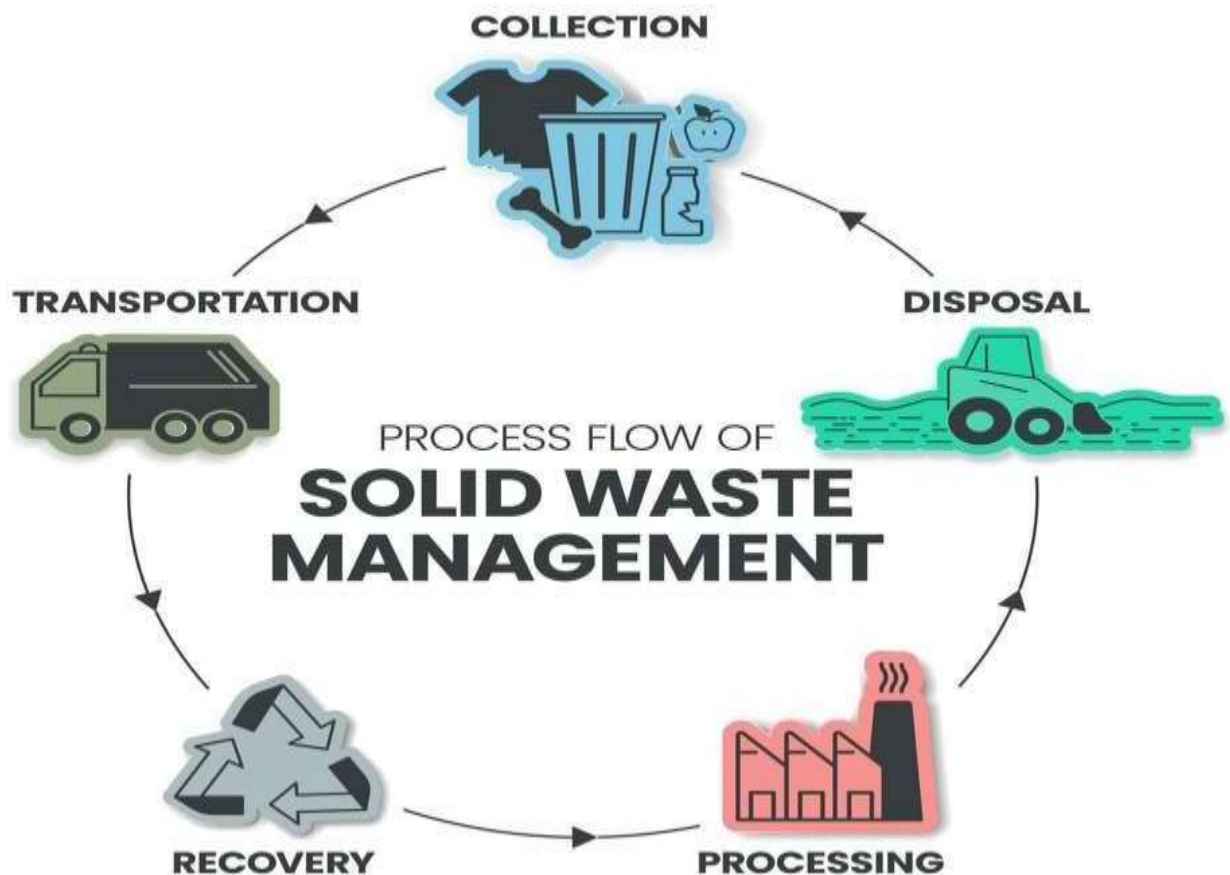


Disposal



Monitoring and Enforcement

Establish and enforce regulations for plastic waste management.



CHAPTER 2

REVIEW OF LITERATURE

Plastic has become an integral part of modern life due to its versatility and durability. However, it is widely used in a wide variety of products, including packaging, material construction, medical devices, electronic components etc. However, plastics also pose significant environmental problems, as they can take hundreds of years to degrade and if not disposed of properly, can pollute soil, waterways and oceans, caught up and suffocate wildlife and disrupt ecosystems. The widespread use and disposal of plastics has led to devastating effects on the environment. Plastic pollution is ubiquitous, contaminating the soil, oceans and even the air. Discarded plastics slowly decompose and persist in the environment for hundreds to thousands of years, posing a serious threat to ecosystems and biodiversity. Marine life is particularly vulnerable as plastic debris becomes entangled and ingested by marine animals, leading to suffocation, starvation and reproductive complications. In addition, microplastics, small particles formed by the breakdown of larger plastics, enter aquatic and terrestrial environments, enter the food chain and potentially harm human health. The economic costs of plastic pollution are significant and include cleanup efforts, health care expenditures, and losses in tourism and fisheries. Municipalities around the world spend billions annually on waste management and litter control, burdening taxpayers and straining public resources. In addition, industries dependent on a clean environment, such as tourism and fishing, suffer from degraded ecosystems and reduced incomes.

The effects of plastic pollution are deeply established in social and economic spheres, disproportionately impacting marginalized communities and severe environmental injustices. Developing nations and low-income neighborhoods often lack adequate waste management infrastructure and regulatory frameworks, leading to heightened pollution levels and health risks. Moreover, the labor-intensive processes involved in plastic manufacturing and disposal prolong its existence to hazardous working conditions, particularly in regions with lax labor standards. This environmental degradation also exacts a negative impact on aesthetic values, public health and community well-being, perpetuating social stigmatization and hindering socio-economic development.

In addition, the ubiquitous presence of plastics in the environment contributes to a decline in aesthetic value, public health concerns, and social stigmatization of affected communities. Solving the plastic problem requires a multi-pronged approach involving policy interventions, technological innovation, consumer behavior change and corporate social responsibility initiatives. In addition, to promote a culture of sustainability, it is essential to promote public awareness and promote individual actions such as reducing plastic consumption, reusing products and practicing proper waste disposal.

1. The effectiveness of current practices and initiatives with regard to plastic waste management in Kerala

The state of decentralized Solid Waste Management in Kerala Report (2021)

Waste management holds a vital role as both a constitutional obligation and a statutory duty of local governments. They believe that it presents substantial potential for generating livelihoods across various stages, including collection, storage, segregation, processing and recycling. To optimize waste management efficiency and foster sustainable livelihood opportunities, the Government of Kerala, through the Haritha Keralam Mission, has mandated the establishment of Haritha Karma Sena in all wards.

Haritha Karma Sena comprises trained entrepreneurs tasked with providing technical services and solutions for waste management endeavors. Their responsibilities encompass the collection, transport, processing, removal and overall management of waste in collaboration with local governing bodies. The researchers highlight that these entrepreneurs are recruited from Kudumbashree Neighborhood Groups and establish micro-enterprises known as HKS (Haritha Karma Sena) ME Units. They emphasize that these women entrepreneurs receive assistance and training from local self-governing institutions to effectively manage waste collection.

The researcher underscores the significance of training individuals in treating biodegradable waste at its source in households, gated communities, markets, and institutions. They note that HKS members also handle the collection, sorting, and storage of non-biodegradable waste. Additionally, they point out that each department is supported by a team of task force members overseen by a green supervisor, capable of generating reports and managing multiple teams. They estimate that a total workforce of 31 individuals is required in each Grama Panchayat comprising 15 wards. In the researchers' perspective, HKS ME units typically collect non-biodegradable waste once a month, based on survey findings. They mention the establishment of Material Collection Facilities (MCFs) in Grama Panchayats, Municipalities and Corporations for segregation and storage purposes. Furthermore, they highlight the presence of Resource Recovery Facilities (RRFs) with crushing and pressing capabilities set up in blocks, large municipalities, and all corporations. Lastly, they outline the primary sources of income for Haritha Karma Sena Micro Enterprises, which include user fees collected from households and institutions, the sale of organic waste compost, and revenue generated from the sale of non-biodegradable waste.

Household waste collection

The main responsibility of HKS is to gather non-biodegradable waste from both households and institutions. According to the survey data, nearly half (47 percent) of households in Local Self Government Institutions (LSGI) throughout Kerala entrust their non-biodegradable waste to HKS. Kannur stands out as the most successful district, with HKS collecting waste from as many as 70 percent of households, whereas Thiruvananthapuram district trails behind, with only 27 percent of households utilizing HKS for waste collection.

The table below illustrates the district-wise collection of non-biodegradable waste by HKS members from households. (Table illustration from **The state of decentralized Solid Waste Management in Kerala Report (2021)**)

District	Total No. of households in the LSG	Total No. of Households from where Non Biodegradable waste is collected	Percentage of coverage
Alappuzha	6,42,082	2,85,478	44%
Ernakulam	10,31,547	3,96,238	38%
Idukki	3,47,860	1,78,262	51%
Kannur	7,17,866	5,00,068	70%
Kasargod	3,63,721	1,76,386	48%
Kollam	8,51,160	5,41,027	64%
Kottayam	5,89,718	2,51,228	43%
Kozhikode	8,56,188	5,16,694	60%
Malappuram	11,57,451	4,54,303	39%
Palakkad	8,38,302	4,64,724	55%
Pathanamthitta	4,15,507	2,63,725	63%
Thiruvananthapuram	11,62,404	3,11,749	27%
Thrissur	9,37,692	3,25,441	35%
Wayanad	2,40,584	1,29,179	54%
Grand Total	1,01,52,082	47,94,502	47%

Table 3.1 - Total No. of Households from where Non Biodegradable waste is collected- District Level

(Illustration: The state of decentralized Solid Waste Management in Kerala Report (2021))

Collection of institutional waste

Institutional waste includes waste generated in facilities such as hospitals, schools, restaurants and hotels. When it comes to non-biodegradable institutional waste, more than 53 percent of facilities across all 6 groups rely on HKS' services for waste disposal. In Thiruvananthapuram Corporation, one of the largest in the state, waste is collected from 92 percent of the institutions. This is in stark contrast to the behavior of households within the same corporation, of which only 7 percent use the services of HKS for waste disposal. Such significant differences in waste disposal between households and establishments within the same corporation highlight the need for a more targeted information, education and communication campaign for households in Thiruvananthapuram Corporation.

It's worth noting that the corporation relies on external income generated from the services provided by Sena members, and the profitability of HKS micro-enterprises is contingent upon the collection of user fees from both households and establishments within each local authority. These user fees are based on the quantity of non-biodegradable and biodegradable waste collected from doorsteps every month. The rules implemented in 2015 permit the collection of user fees from individual households and institutions at rates determined by the Local Self-Government (LSG) authorities.

Biodegradable waste

The higher rate of household waste collection in Kannur is largely credited to the effective performance of households and HKS members within the Panchayats. Specifically, 77 percent of households in Kannur Panchayats opt to utilize HKS services for waste disposal, compared to only 52 percent and 46 percent in Kannur Corporation and Municipalities, respectively.

In contrast, the survey reveals that in Thiruvananthapuram district, only around 30 percent of households in Panchayats engage with HKS for waste management. This is notable, especially given the ongoing dispute between Thiruvananthapuram Corporation and Vilapilsala Panchayat, which has fueled demands for a revamped decentralized waste management framework. Hence, there's a pressing need for intensified Information, Education, and Communication (IEC) campaigns in Thiruvananthapuram to encourage households to utilize HKS services.

Interestingly, among the three types of Local Self Government Institutions (LSGI) Panchayats, Municipalities, and Corporations — it is observed that HKS collects waste from a higher percentage of households in Gram Panchayats (48 percent) compared to Municipalities (45 percent) and Corporations (44 percent). This suggests that HKS Micro Enterprises perform relatively better in household waste collection initiatives in rural Gram Panchayats compared to more urbanized areas.

Another significant issue concerns the frequency of waste collection. Typically, households and institutions are provided with a calendar dictating the waste collection schedule by HKS members. However, the evident report indicates that only 24 percent of households and institutions across LSGI have received such calendars. Additionally, calendar-based collection is only implemented for 20 percent of households and institutions across LSGI. This underscores the necessity to streamline the collection process, ensuring adherence to schedules and effective distribution of calendars.

At the household level, the responsibility for managing biodegradable waste typically falls on the waste producer. In smaller Local Self-Government Institutions (LSGIs) like gram panchayats and smaller municipalities, biodegradable waste is often handled directly at the source. This might involve methods such as composting pits or utilizing the waste as feed for domestic animals and poultry. The survey revealed that 95 percent of gram panchayats (out of 941) do not enforce any user fees for biodegradable waste collection. Similarly, approximately 77 percent of municipalities do not have fixed user charges for collecting biodegradable waste. Among the surveyed companies, 3 out of 6 also do not levy any fees for collecting biodegradable waste. There is concern regarding service providers that do not cover the entire area of the corporation and whose performance quality is not regularly evaluated. These companies have been encouraged to devise a clear strategy to address the areas that are not covered.

Non-biodegradable waste

Regarding institutions, user fees were notably high across all Local Self-Government Institutions (LSGIs). 41 percent of Gram Panchayats set Rs 100 as the user fee, while 34 percent set Rs 50. Similarly, 47 percent of municipalities, totaling 41 out of 86, established Rs 100 as the user fee. Additionally, three out of six companies also implemented Rs 100 as the user fee.

The following section will delve into the various components of Material Collection Facilities (MCFs), Mini-MCFs, and Resource Recovery Facilities (RRFs), which are integral to the solid waste management process. This process is built upon the establishment of sustainable systems led by LSGs to fulfill their constitutional obligations in planning, implementing, and managing waste management facilities (SWM Rules 2016). Each LSG area comprises components aimed at ensuring segregated waste collection, transportation, processing, and disposal. The effective establishment and management of these three main components—MCFs, Mini-MCFs, and RRFs—are essential to the smooth functioning of the system. Any disruption in any component within this chain of systems can significantly impact the entire process. While MCFs serve as the primary entry point, the availability of necessary equipment in these units profoundly influences the entire system's operation. For instance, an overloaded MCF could result in waste overflow, impacting the regular collection carried out by HKS. Moreover, the absence of basic hygiene facilities or equipment can hamper the overall performance of workers in the unit. Thus, not only the presence of effective forward and backward feedback mechanisms but also the proper functioning of these individual units are vital to ensure the system's performance. The evaluation study focuses on three aspects of these system components.

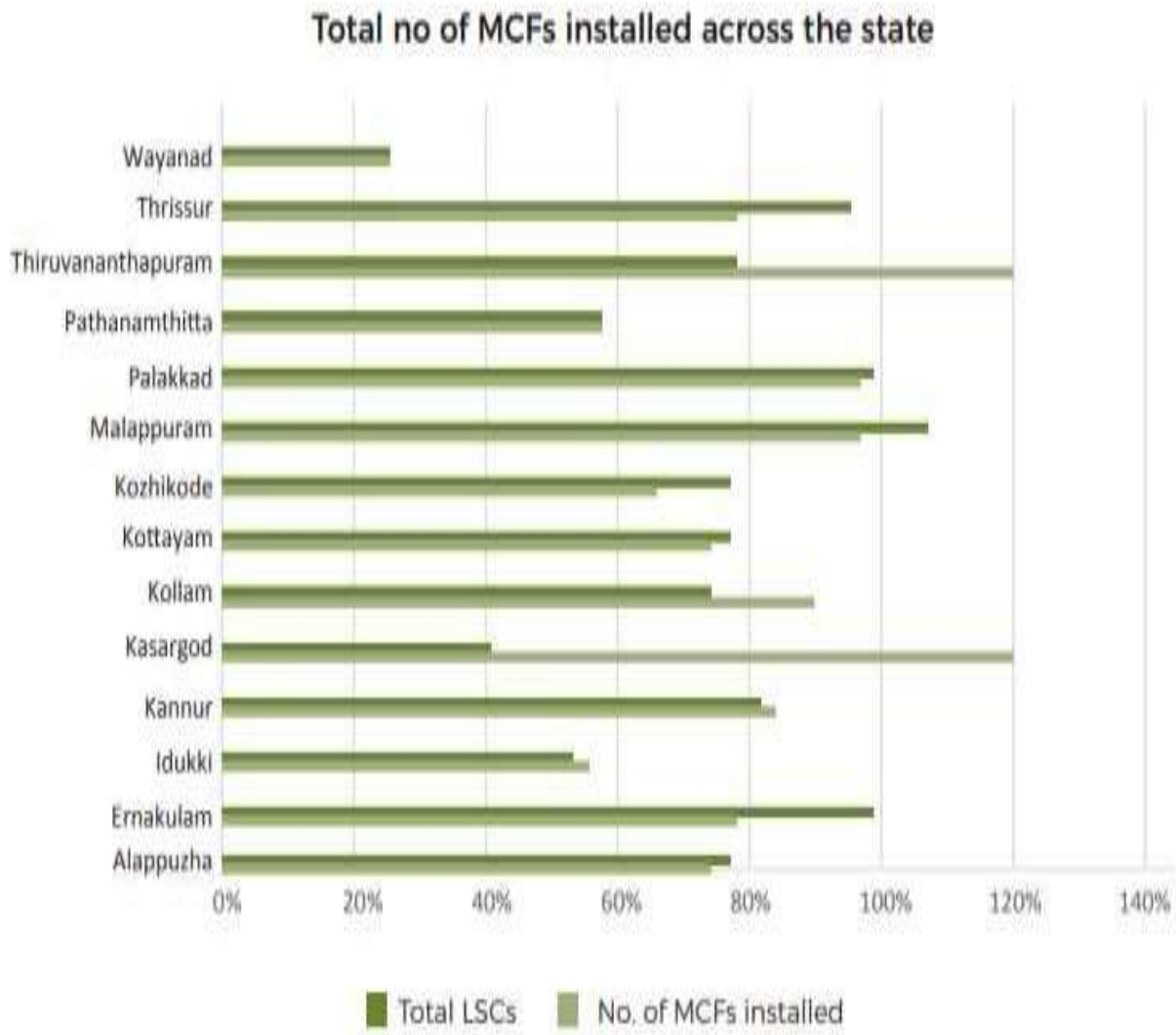
Non-biodegradable waste poses several environmental and health hazards. When improperly disposed of, it can accumulate in landfills, water bodies, and natural habitats, leading to pollution, habitat destruction, and harm to wildlife. Plastics, in particular, are a major concern due to their widespread use, persistence in the environment, and detrimental effects on marine ecosystems. Proper management of non-biodegradable waste is essential to mitigate its environmental impact. This includes strategies such as recycling, reuse, and responsible disposal. Recycling allows materials like plastics, metals, and glass to be collected, processed, and converted into new products, reducing the need for virgin materials and minimizing waste sent to landfills. Reuse involves finding alternative uses for items instead of discarding them after a single use, thereby extending their lifespan and reducing waste generation.

In addition to recycling and reuse, responsible disposal practices are crucial for managing non-biodegradable waste effectively. This may involve incineration in controlled facilities equipped with pollution control measures to minimize emissions, as well as the proper containment and management of hazardous materials to prevent environmental contamination. Overall, addressing the challenges associated with non-biodegradable waste requires a combination of waste reduction strategies, improved recycling infrastructure, and public awareness and education initiatives to promote sustainable consumption and waste management practices.

Overall functioning of the units

Material Collection Facility (MCF)

The Material Collection Facility (MCF) serves as the primary point for waste collection in any Local Self Government Institution (LSGI), aimed at storing sorted non-biodegradable waste at the LSG level. As per the guidelines provided by the Suchitwa mission, each LSG is required



Graph 3.4 - Total number of MCFs across LSGIs in Kerala (includes Municipal Corporations, Municipalities, GPs)

Graph Illustration: The state of decentralized Solid Waste Management in Kerala Report 2021

to establish at least one MCF. The Local Self Government Department (LSGD) issued a circular outlining the preparation of a work calendar to facilitate the efficient functioning of the MCF. This calendar specifies collection dates for various waste categories, including pet bottles, plastics, medicine packaging, used sandals, etc. By implementing this work calendar, waste sorting at the source is ensured, systematic waste collection by category is facilitated, and ultimately, the workload for HKS and other MCF workers is reduced. The governance responsibility of the LSG includes ensuring that door-to-door collection is calendar-based

Resource Recovery Facilities (RRFs)

Resource Recovery Facilities (RRFs) play a crucial role in modern waste management systems, signaling a transition from mere waste management to resource utilization. RRFs serve as locations where non-biodegradable waste undergoes further sorting after an initial categorization, preparing it for potential use in various production and consumption activities. These facilities are equipped with essential infrastructure, tools, and equipment, such as baling machines, and typically involve human labor in their operations. Recyclable waste is directed towards recycling processes, while non-recyclable plastics are shredded for utilization, particularly in road construction projects. RRFs are intended to be established at the cluster or block level, although the lack of available data regarding their prevalence within Local Self Government Institutions (LSGIs) across districts presents a challenge for conducting district-wise analysis.

Community composting facilities

According to the reports, these initiatives are introduced to enhance decentralized waste management efforts, acknowledging the challenges of treating all waste at the source level. Various composting methods are employed at the household level, including Ring Composting, Pipe Composting, Kitchen Bin (Biobin) Composting, Pot Composting and Bio-gas plants. Such facilities are eligible for subsidies from Suchitwa Mission, with a 75 percent subsidy for composting facilities and a 50 percent subsidy for biogas plants. Additionally, Local Self Governments (LSGs) contribute subsidies of 15 percent for source-level composting facilities and 25 percent for biogas plants. A significant number of households, totaling 11,83,892, have adopted composting facilities, significantly contributing to decentralized waste management efforts. Notably, Kannur District leads with 2,92,828 units, followed by Kozhikode and Kottayam with 1,83,990 units and 1,29,022 units, respectively. Conversely, Kasargod has the lowest number of units, with 23,370 households possessing composting facilities, followed by Pathanamthitta with 25,361 households.

Kochi Corporation lacks households with composting units, while other corporations have coverage exceeding 1,000 households, with Thiruvananthapuram Corporation leading at 46,601 households. Moreover, community composting facilities cater to establishments such as hotels, restaurants, fast-food joints, convention halls, and auditoriums, primarily managed by LSGs. Various methods are employed, including Thumboormuzhi Model, Windrow composting, Vermicomposting, and Biogas Plants, totaling over 3,810 facilities across the state. These facilities have a combined composting capacity of 7,66,252 kgs per day, yet only 30 percent of this capacity is utilized, indicating underutilization. District-wise, Thrissur faces significant overburdening, receiving over 64,000 kgs above its total composting capacity.

In contrast, Ernakulam and Pathanamthitta exhibit good utilization rates, at 93 and 82 percent, respectively. Kollam and Kozhikode utilize around 70 percent of available facilities, while the remaining districts utilize less than 50 percent of their capacity. Wayanad reports no biodegradable waste received at community facility centers, attributed to a lack of forward linkages.

Numerous Local Self Governments (LSGs) have emerged as exemplary models in diverse aspects of waste management, spanning organized waste collection, enforcement of green protocols, branding of fertilizers derived from composting plants, and achieving zero waste status. Some LSGs have pioneered innovative practices deserving recognition and commendation. Notable innovations identified in the reports during the assessments include:

1. "Sanchikk oru Saree" initiative: In Edavaka Gram Panchayat, Wayanad District, sarees were collected from over 300 households to transform them into cloth bags. This initiative aims to promote the use of cloth bags while discouraging the reliance on plastic shopping bags.

2. Introduction of Pen Booths in schools: Padiyoor Gram Panchayat, Kannur District, has installed pen booths in all schools. These booths serve as collection points for plastic pens that cannot be reused, facilitating their proper recycling. The presence of these booths serves as a visual reminder for students about the volume of plastic generated daily, fostering awareness and encouraging them to minimize their usage of single-use plastic.

3. Implementation of Green Protocol at Kanichukulangara Temple Festival: Mararikulam North Gram Panchayat, Alappuzha District, has taken proactive measures to ensure adherence to Green Protocol during the Kanichukulangara Temple Festival, which draws massive crowds from across the state.

4. Establishment of Green Check Posts: Checkpoints have been set up in Vagamon, Idukki District, where single-use plastics are collected from vehicles, particularly those of tourists who often contribute to plastic waste littering scenic spot

(V.R. Prakasam, A., Soya. Y. Das, B.,” Waste management” 2016)

From the **(V.R. Prakasam, A., Soya. Y. Das, B.,” Waste management” 2016)** Report, according to the researcher, Solid waste management presents a significant global challenge, especially with the rapid growth of urbanization and industrialization leading to the accumulation of vast amounts of solid waste. Projections from the United Nations indicate that by 2050, approximately 66 percent of the world's population will inhabit urban areas, emphasizing the pressing need to tackle this issue urgently. In India, where the urban population is expected to reach 550 million by 2021 and 800 million by 2041, waste management has become increasingly complex. The country generates an estimated 62 million tonnes of waste annually, including substantial quantities of plastic and biomedical waste. Despite the implementation of Management & Handling Rules in 2000, Indian municipalities have generally struggled with compliance. In response to these challenges, the Ministry of Environment, Forests, and Climate Change introduced new Solid Waste Management (SWM) rules in 2016, broadening their application to encompass various urban settings beyond municipal areas.

A comprehensive study on municipal solid waste management (MSWM) was conducted in Neyyattinkara Municipality, located in Thiruvananthapuram District, Kerala. Neyyattinkara has a population of 70,850 according to the 2011 Census and consists of 44 wards. Field observations were carried out in all wards to assess current waste generation and disposal practices, aiming to compile a status report, evaluate existing systems, gather resident feedback, and propose improved MSWM strategies suited to local conditions. It was noted that waste in Neyyattinkara originates from various sources, including markets, households, institutions, and construction sites. However, despite the presence of multiple waste-generating entities, the municipality lacks adequate waste storage facilities, primary waste collection practices, and source segregation of waste. Instead, waste disposal primarily involves crude dumping in inappropriate locations such as low-lying areas, roads, and riverbanks.

Resident attitudes towards waste management were evaluated through a questionnaire survey, revealing dissatisfaction with the current SWM system among a significant portion of respondents. Suggestions were provided for reducing plastic usage and enhancing recycling facilities. Additionally, the study estimated a per capita waste generation rate and underscored the importance of recycling and composting organic waste to mitigate environmental impact. Various composting techniques, including vermicomposting and Effective Microorganisms (EM)

application, were explored as effective means to manage organic waste.

The study underscores the urgent need to address solid waste disposal practices in Neyyattinkara, stressing the importance of implementing the principles of Reduce, Reuse, Recycle, and Restoration (the four R's) for effective waste resource management. Encouraging public participation and cooperation between stakeholders, including municipalities, the public, producers, and environmental organizations, is deemed essential for achieving sustainable urban solid waste management. Ultimately, the adoption of economically feasible strategies and a holistic, decentralized approach are recommended to address the pressing challenge of solid waste management in Neyyattinkara.

(Dr. Raveesh Agarwal, A., Mona Chaudhary, B., et al, "Solid waste Management"2015)

From an everyday perspective, anything deemed undesirable or no longer useful is typically labeled as garbage or waste. However, from a scientific viewpoint, there's no such thing as actual waste, as nearly all components of solid waste hold potential value when treated or converted scientifically. Thus, solid waste can be defined as "Organic or inorganic waste materials produced from household or commercial activities, which have lost their value in the eyes of the first owner but may be of great value to somebody else" (Robinson, W.D. 1986).

From the **(Dr. Raveesh Agarwal, A., Mona Chaudhary, B., et al, "Solid waste Management" 2015)** Report it is evident to the researcher that, throughout history, human societies have gradually deviated from nature, leading to significant changes in lifestyle and subsequently influencing the nature and volume of waste generated by communities. Waste management offers the opportunity to either dispose of or reuse waste, potentially leading to financial benefits. In India, the rapid economic development of cities has presented challenges in effectively managing the substantial quantities of waste generated. With approximately 27.8 percent of the total population living in urban areas, and an anticipated rise to 33.4 percent by 2026, the surge in population and GDP has contributed to the increase in solid waste generated in Indian cities. This has grown from six million tons in 1947 to 48 million tons in 1997, with an annual growth rate of 4.25 percent, projected to reach 300 million tons by 2047 (CPCB, 1998).

While there used to be a marked distinction between solid waste from urban and rural areas, urbanization, the adoption of the "use and throw" concept, and enhanced communication have narrowed this gap. Although solid waste in rural areas tends to be primarily biodegradable, urban areas typically contain more non-biodegradable components like plastics and packaging.

However, a common repugnant attitude towards solid waste management persists in both sectors, often resulting in the universal practice of discarding garbage out of sight.

In India, urban local bodies, such as municipal corporations/councils, are entrusted with overseeing public health-related activities, including solid waste management. Despite heightened awareness and economic growth prompting increased focus on solid waste management from diverse stakeholders, landfilling remains the prevailing option for solid waste management in India and similar countries like the United States. Recognized as unsustainable in the long run, prevailing waste management policies are undergoing a notable transition towards more sustainable alternatives.

This review explores advancements in waste management, focusing on current practices in India and initiatives by the US federal government, states, and industry groups. The objective is to understand initiatives in both countries and identify opportunities for improvement in waste management practices. It emphasizes the need for a more stringent, integrated, and strategic waste prevention framework to effectively address waste-related issues, suggesting the urgency of implementing a well-defined strategic waste management plan in India to ensure economic and environmental health and prevent epidemics.

Achieving financial sustainability, socio-economic goals, and environmental objectives in waste management necessitates a systematic analysis of the strengths and weaknesses of both the community and the municipal corporation. With the participation of various stakeholders, including the public, NGOs, private companies, and government bodies, an effective waste management system can be developed in India. Public apathy can be addressed through awareness-building campaigns and educational measures, with community sensitization being essential, particularly considering the health risks associated with ineffective waste management. While the general public may not directly influence policy formulation, they can play a crucial role in waste management by adopting environmentally friendly practices. This includes staying informed about environmental issues, consuming fewer resources, refusing plastic bags, segregating garbage for recycling, composting organic waste, and avoiding the burning of solid waste, thereby contributing to environmental sustainability.

(Dr. P.V. Radhakrishnan,A., Er. Gireesh T.N.,B.,et al.,”Science, Technology and Innovation for Environment and Development” 2017)

According to the **(Dr. P.V. Radhakrishnan,A., Er. Gireesh T.N.,B.,et al.,Science, Technology and Innovation for Environment and Development” 2017)** Report Ensuring efficient public service delivery and infrastructure provision remains a top priority for urban local authorities (ULBs) across many developing nations. Local self-government institutions bear the responsibility of furnishing citizens with essential amenities and addressing critical infrastructure needs such as water supply, sanitation systems, and municipal waste management. Solid waste management has emerged as a pressing concern in numerous countries due to its significant impact on both public health and the environment. The widespread practice of unscientific and improper solid waste management not only holds local ramifications but also carries global implications, contributing to climate change and greenhouse gas emissions.

India has an urban population of around 285 million people, spread across 4,378 cities and towns. Within this urban landscape, cities—accounting for 423 urban areas according to the 2001 census—contribute to more than 72 percent of the total municipal solid waste (MSW) generated in urban regions. These cities include mega cities with populations exceeding 4 million, metropolitan cities with populations surpassing 1 million, and other urban areas with populations exceeding 100,000. In Indian urban areas, per capita waste generation typically falls between 0.2 and 0.6 kilograms per day, with waste collection rates ranging from 50 to 90 percent. However, a significant portion of the collected waste, up to 94 percent, is disposed of without adhering to scientific methods, leading to severe contamination of groundwater, surface water, and air. Solid waste management encompasses the handling of various waste types, including recyclable materials, hazardous waste requiring careful treatment, and organic waste suitable for composting. The primary objective of solid waste management is to minimize the amount of waste sent to landfills, prioritizing material recovery and energy generation from solid waste. Municipal Solid Waste Management (MSWM) adheres to the principles of Integrated Solid Waste Management (ISWM), employing appropriate techniques, technologies, and management approaches to achieve waste reduction and efficient management.

Understanding the patterns and attributes of waste generation is crucial in assessing various options for equipment systems, plans, and management strategies. The physical and chemical properties of the waste guide the selection of suitable processing methods and the identification of appropriate technologies. Factors like waste density, moisture levels, and particle size distribution shape the design of solid waste management systems. For instance, moisture content directly impacts the expenses associated with waste collection and transportation, while particle size distribution influences the design of mechanical separators and shredders. A comprehensive examination of waste characteristics is imperative for devising effective initiatives for separation, collection, and recycling.

From the studies it becomes evident that technology plays a critical role in solid waste management and complements social engineering efforts aimed at community participation and waste reduction. The bioconversion method focuses on the organic portion of the waste and converts it into compost or biogas (e.g. methane) along with the residual sludge. Composting technologies include aerobic, anaerobic and vermicomposting. Thermal conversion technologies include incineration, pyrolysis, gasification, plasma pyrolysis and pelletization to produce RDF (Diaz et al, 2002; Benedict et al, 1998; Corey, 1969; Tchobanoglous, 2003; UNEP, 2005; Salvato, 1992).

In Kerala, there is a serious crisis in urban solid waste management as evidenced by the deadlock in waste disposal plans in municipalities, corporations and urban Grama Panchayats. With the urban population accounting for nearly 48 percent, the urbanization trend in Kerala deviates from the national average. It is characterized by a continuum between urban and rural areas, reinforced by ribbon-like expansions along major roads. Even rural areas have urban-like characteristics, including high population density and mixed primary and tertiary occupational structures. The hotspots of waste management in the state reflect a collective failure to develop appropriate strategies and adopt suitable technologies.

Although solid waste management is the responsibility of local authorities, most of them have not prioritized the establishment of adequate waste management systems, resulting in inadequate resource allocation and technical and institutional deficiencies. As a result, the state struggles with indiscriminate dumping, uncollected waste and lack of waste segregation. Both citizens and authorities do not fully recognize the importance of waste management. They often give it low priority and opt for convenient waste dumping practices.

Despite existing national and state laws on waste management, weak implementation and poor practices have left towns and villages overwhelmed with their own waste, posing a significant threat to public health and the environment.

(Sabu joseph,Vishnu sagar, A., M K, B.,et al..”Solid waste Management” 2020)

From the above Study envisages that , Solid waste comprises unwanted or discarded solid materials resulting from human activities in residential, industrial, or commercial settings. It can be categorized based on its composition (biodegradable/non-biodegradable), origin (household, industrial, etc.), and potential hazards (toxic, flammable, etc.). Municipal solid waste (MSW) specifically refers to waste generated in households and commercial establishments, excluding industrial and biomedical waste. Effective waste management entails regulating the generation, storage, collection, transportation, processing, and disposal of solid waste to address various public health, environmental, and economic concerns.

Establishing an operational waste management system necessitates incorporating principles of sustainable development, integrated waste management, and waste management hierarchy at all levels (national, regional, municipal). Selecting appropriate technologies that strike a balance between cost-effectiveness and efficiency is critical, considering climatic, geographical, and socio-economic factors. Waste management strategies typically revolve around the 4Rs: reduce, reuse, recycle, and recover. Prevention, such as minimizing waste at the source, is the most preferable approach for optimizing environmental resources. Reduction aims to minimize waste, while recycling involves gathering and reusing materials. Recovery entails ensuring that waste is not disposed of but repurposed or converted into energy.

Various waste management techniques exist, including landfilling and waste-to-energy (WTE) conversion. Landfilling, while widely used and cost-effective, poses pollution risks, particularly in humid tropical regions. WTE conversion employs diverse process technologies like mechanical extraction and biochemical conversion to derive energy from waste. Biological methods like composting and vermicomposting extract organic material from solid waste, producing nutrient-rich compost. Thermal conversion technologies such as incineration, combustion, pyrolysis, and gasification effectively treat solid waste. For instance, incineration thermally oxidizes combustible waste components to produce energy, significantly reducing solid waste volume.

In Kerala, solid waste management remains challenging due to the high proportion of biodegradable waste, limited land availability, and environmental vulnerability. Centralized waste management has proven inadequate, resulting in environmental pollution and health risks. Given these limitations, landfills and incinerators are not recommended waste management methods. Achieving effective waste management necessitates a multi-faceted approach integrating technological solutions, community involvement, and environmental considerations to ensure sustainable outcomes.

Approaches to Solid Waste Management in Kerala

The Clean Kerala Mission, under the Government of Kerala, has identified and approved a suitable technology for solid waste management and started a trial in selected residential complexes in Kochi in 2007. This eco-friendly approach uses an aerobic microbial composting system for waterless biodegradable waste. It is implemented through Biobin and bio-port systems and utilizes naturally occurring microbes in a scientific process known as bio-trigger mechanism. Through this method, organic waste is naturally biodegraded and transformed into valuable organic fertilizer. By spraying a microbial solution (inoculum) onto the waste, the bio-trigger mechanism is set in motion. It usually takes 15-30 days for the waste to be converted into decomposed organic matter. This allows biodegradable waste to be treated at source. In addition, water-rich biodegradable waste can be processed in a biogas plant using biomethanation techniques, while non-biodegradable waste is separated, collected and transported for recycling by authorized local self-government agencies.

Globally, waste management has become a pressing issue, especially in developing countries like India, where rapid population growth, urbanization and economic development are leading to large quantities of municipal solid waste. Effective management depends on the careful selection of suitable options that are both cost-effective and efficient. Techniques vary depending on climatic, geographical and socio-economic factors. Conventional methods such as landfills require a lot of land, while composting and vermicomposting have inherent limitations. Incineration and pyrolysis can release greenhouse gases. In Kerala, population growth poses a major challenge to solid waste management. Incineration is unsuitable due to the high organic content and moisture content of municipal solid waste. Therefore, sustainable and economically viable solutions for waste management with holistic approaches that tackle waste at source are imperative. Composting and bio-methanization are recommended for biodegradable waste management in Kerala, while recycling is suggested for non-biodegradable waste.

PLASTIC WASTE MANAGEMENT AND THE GOVERNING RULES IN INDIA 2020

The management of plastic waste has become a critical issue globally, especially in countries like India where the production and consumption of plastics has reached massive proportions (Sheela A.M, 2020). Plastic has become an indispensable part of our daily lives with its versatile properties such as lightweight, flexible, moisture resistant and relatively inexpensive. However, the disposal of plastic waste poses a major challenge to the environment.

The widespread usage of plastic carrier bags has emerged as a significant contributor to waste accumulation. Every year, millions of plastic bags are released into the environment, where they undergo slow decomposition, lasting for centuries. This phenomenon leads to severe environmental consequences, including soil, waterway, and ocean pollution, adversely affecting marine ecosystems and human well-being. Alarmingly, approximately 70 percent of plastic packaging ends up discarded in a relatively short timeframe. According to research conducted by the **Central Pollution Control Board, India** produces a staggering 9.4 million tonnes of plastic waste annually, equivalent to 26,000 tonnes per day, with only 5.6 million tonnes being recycled.

Plastics are categorized into various types by organizations like the Society of the Plastics Industry (SPI), each possessing distinct properties and characteristics. These include PETE (PET), HDPE, PVC, LDPE, PP, PS, and other variants. Plastics are broadly classified into two groups: Thermoplastics and thermosets, each exhibiting unique traits regarding recyclability and reusability. In response to the escalating plastic waste crisis, efforts have been underway to explore alternatives to petroleum-based plastics, such as compostable plastics. Compostable plastics meeting standards like IS/ISO 17088 offer a promising solution, as they undergo biological degradation during composting, leaving behind no harmful residues. However, the implementation of such products requires registration by the Central Pollution Control Board.

The Plastic Waste Management Rules (2016) provide an important legal framework to address the problem of plastic waste in India (Sheela A.M, 2020). These rules, which were notified under the Environment Protection Act, 1986, have been revised to make them more comprehensive and inclusive. Key stakeholders, including waste generators, local authorities, manufacturers, importers, producers and brand owners, are subject to these rules, which cover both urban and rural areas. The rules impose bans and restrictions on various aspects of plastic use, including the thickness of carrier bags, the type of dyes used and the use of recycled plastic for certain purposes (Sheela A.M, 2020).

They also mandate proper recycling practices, direct recyclable plastic waste to registered recyclers, and promote the use of plastic waste in road construction and energy recovery initiatives.

Compliance with these rules is crucial for the effective management of plastic waste and the reduction of its negative impact on the environment. Managing plastic waste in India requires a comprehensive approach that includes regulatory measures, technological innovations and public awareness campaigns. By adopting sustainable practices and adhering to strict regulations, India can mitigate the negative impact of plastic waste on the environment and pave the way for a more sustainable future.

The state government has enacted strict rules, effective from January 1, 2020, banning single-use plastic items, including plastic carry bags of any thickness, across the state (Sheela A.M, 2020). The ban also extends to various other items such as single-use plastic sheeting used on venue tables, plates, cups and decorative material made from polystyrene or thermoplastics, and single-use utensils such as cups, plates, spoons, forks, straws and stirrers. In addition, non-woven bags, plastic flags, plastic packaging for fruit and vegetables, PET drinking water bottles with a capacity of less than 500 ml and plastic drinking bags are also banned.

The government has issued directives outlining alternative materials to replace banned single-use plastic items. According to the 2019-2020 annual report, Kerala generates 1,33,316 tonnes of plastic waste per year. Door-to-door collection of non-biodegradable waste is operational across all urban local bodies, with material resource recovery facilities established in 59 urban local bodies. The Haritha Karma Sena operates in most urban local bodies and in 720 out of 941 Grama Panchayaths. Across the state, there are a total of 937 collection centers, 678 mini collection centers, and 166 resource recovery facilities. Recyclable plastic waste is segregated and sent for recycling, while non-recyclable plastics are utilized in road construction projects by local authorities and the Public Works Department, with support from the Clean Kerala Company, a government entity. In the year 2019-2020, the Clean Kerala Company reported collecting 655.59 tonnes of soft plastic waste. Furthermore, 308.92 km of roads under the Public Works Department and 764.8 km of roads under the Local Self Government Department were tarred during the same period. Ongoing endeavors to manage plastic waste effectively are aimed at achieving a plastic waste-free state.

2. The limitations & challenges in the present scenario of waste management

(Dr. P.V. Radhakrishnan, A., Er. Gireesh T.N.,B.,et al.,”Science, Technology and Innovation for Environment and Development” 2017)

According to(Dr. P.V. Radhakrishnan, A., Er. Gireesh T.N.,B) in Technology and Innovation for Environment and Development, 2017 Report shows inadequate state policy or strategy. There is no well-defined state policy or strategy for waste management. An international hierarchy of waste management is being promoted to reduce, reuse and recycle. But no concerted effort is seen by the national government to practice the same. For example, changing a process and product to reduce waste is not under the control of the state; therefore, if the first principle of waste reduction is to be achieved, intervention at national level is necessary. It was found that despite strict legislation, open dumping is the most widespread form of waste disposal.

Most of the existing methods for waste management are traditional and are viewed primarily as technical challenges that can be addressed through engineering interventions. The focus is primarily on waste collection and disposal rather than prioritizing reuse, reduction, recycling, and recovery. Over time, a culture of indiscriminate dumping has developed, with the prevailing belief that waste management is solely the responsibility of municipal authorities. However, it's increasingly acknowledged that effective solid waste management requires social, financial, and administrative solutions. Many local authorities either lack awareness or are resistant to adopting modern technologies, often citing the success of models from other regions as a reason for not investing in waste management. Given the unique conditions of Kerala, there's a pressing need to develop technologies tailored to the state's requirements, necessitating investment in experimental and research-based projects in this field.

Lack of public cooperation

The role played by the local body is negatively perceived by the public, mainly because of the huge amount of uncollected waste and the unscientific disposal practices associated with it. At the same time, there is widespread resistance to the development of WWTP sites and effective IECs need to be planned and implemented to change behaviour.

Failure to recognize the role of the informal services sector

The informal sector, consisting of waste pickers, removes a significant amount of waste from households and streets. Scrap dealers who buy these materials are also an integral part of the waste management chain. Most waste pickers have an "invisible status" because society does not see them as legitimate stakeholders. The positive steps taken by Mission Suchitwa to recognize the informal sector are expected to yield good results.

Absence of Infrastructure:

1. Inadequate Database and Documentation:

Local authorities lack effective record-keeping systems to evaluate waste volumes processed. The absence of realistic databases hampers the enhancement of planning and delivery of Solid Waste Management (SWM) services in Local Self Government (LSG) bodies.

2. Shortage of Processing Facilities and Recycling Units:

The state grapples with a severe land scarcity, impeding the establishment of processing facilities within local bodies. Residential settlements often encroach upon potential landfill areas, exacerbating the situation. Additionally, operational challenges arise from public resistance to facility installations. The state also faces a dearth of recycling units for plastic, paper, glass, and metal, necessitating reliance on neighboring states for recycling services. Addressing the shortage of recycling facilities is imperative to ensure effective recycling of all recyclable materials.

3. Absence of Sanitary Landfills:

Local government authorities are endeavoring to locate suitable land for constructing sanitary landfills. However, due to high population density in the rapidly urbanizing state, acquiring large land parcels outside main settlements proves challenging. Consequently, no sanitary landfills have been established in the state, leaving a critical gap in waste disposal infrastructure.

4. Limited Technical Expertise of Local Authorities:

In recent years, efforts by Suchitwa Mission and the Kerala Government have aimed at bolstering the technical capabilities of LSG bodies for Solid Waste Management (SWM) through the preparation provided them with model detailed project reports (DPRs) and even facilitated their preparation, but the technical capabilities of the local authorities are still insufficient. The SM was to fill the gaps in the DPR that lacked technical hands at the district and state levels. Local body engineers can't do it either task because they are not trained enough.

The effectiveness and efficiency of waste management is undoubtedly influenced by the issue of human resources. Under current circumstances, they had very little opportunity to expand their knowledge horizons and expand their technical know-how.

(Sunil Kumar Stephen R.,A., Smith Geoff Fowler., B.,et al., "Solid waste Management in India" 2017)

From the Report it is evident that,

India grapples with significant environmental challenges linked to waste generation and inadequate waste collection, transport, treatment, and disposal. The existing systems struggle to handle the escalating volumes of waste produced by a growing urban population, adversely affecting both the environment and public health.

Insights from International Seminar

The Report (**Solid waste Management in India" 2017**) discusses insights from an international seminar on 'Sustainable solid waste management for cities and opportunities in South Asian Association for Regional Cooperation (SAARC) countries, organized by the Council of Scientific and Industrial Research-National Environmental Engineering Research Institute and the Royal Society. A crucial priority is transitioning from reliance on environmentally unprotected waste dumps to waste management systems that retain valuable resources within the economy.

Importance of Waste Segregation and Resource Extraction

The (**Solid waste Management in India" 2017**) emphasizes the importance of waste segregation at the source and the utilization of specialized waste processing facilities to separate recyclable materials. The disposal of residual waste post-material extraction necessitates engineered landfill sites and/or investments in waste-to-energy facilities.

Challenges and Opportunities in Waste Management

Population growth, particularly in the development of megacities, poses a major problem for solid waste management (SWM) in India. The current reliance on insufficient waste infrastructure, the informal sector, and waste dumping contribute to the prevailing challenges. Public participation in waste management faces obstacles, and there is a general lack of community responsibility towards waste.

Addressing Fundamental Requirements

For sustainable and economically viable waste management, the focus should be on maximizing resource extraction from waste and ensuring the safe disposal of residual waste through the development of engineered landfills and waste-to-energy facilities. Challenges persist in waste policy, waste technology selection, and the availability of adequately trained individuals in the waste management sector. Addressing these fundamental requirements is crucial for India to overcome poor waste management and its associated impacts on public health and the environment.

Understanding the Waste Disposal Challenge in Kerala

As responsible citizens, it is our duty to ensure that the environment we live in remains clean and healthy for generations to come. One of the major concerns that affect our society today is waste disposal. Improper waste disposal can have severe consequences on the environment and can lead to several health hazards.

Waste Generation in Kerala

Waste management has emerged as a significant obstacle in Kerala, primarily due to insufficient infrastructure and awareness levels. However, with appropriate interventions, we can address this hurdle and pave the way for a cleaner and healthier future. Kerala, renowned for its natural splendor, has historically prided itself on its pristine and verdant surroundings. Nevertheless, the state has encountered challenges in waste disposal recently. With a population exceeding 33 million inhabitants, Kerala generates around 10,000 tonnes of waste daily. Regrettably, only a small portion of this waste undergoes proper treatment or disposal.

The primary obstacle in waste disposal within Kerala stems from inadequate infrastructure and resources. The state grapples with a shortage of suitable landfill sites and waste treatment facilities, resulting in the bulk of waste being indiscriminately dumped in open areas, waterways, or incinerated in open spaces, consequently contributing to air pollution. Additionally, Kerala faces a deficiency in public awareness and education regarding waste management practices, leading to widespread littering and unlawful dumping.

3. The primary step of the intervention and initiatives taken by the authority of Nilgiris district for the plastic waste management in Ooty

Inception Report for the Nilgiris (July 2023)

Plastic Pollution Challenges in Nilgiris District

Despite being declared "plastic-free" more than two decades ago, the Nilgiris District in Tamil Nadu continues to grapple with plastic pollution, posing threats to its watercourses, forests, and reservoirs. Despite a state-wide ban on single-use plastics, the situation remains alarming. Nilgiris, renowned for its natural beauty, abundant flora and fauna, and thriving tourism industry, faces mounting challenges in waste management and environmental conservation.

Overview of Nilgiris District

Situated amidst the lush Western Ghats, Nilgiris stands as a biodiversity hotspot, drawing global attention from tourists and nature lovers alike. Its geographical expanse encompasses six Taluks, four Blocks, and a multitude of Panchayats and Municipalities, showcasing a diverse terrain with majestic mountain ranges, cascading waterfalls, and meandering streams. However, the district grapples with the strains of rapid urbanization and population expansion, particularly evident in its waste management infrastructure.

State Regulations and Plastic Waste Generation

In a bid to regulate plastic production and disposal, the Ministry of Environment, Forest, and Climate Change has rolled out the Plastic Waste Management Rules of 2016. Despite concerted efforts, Tamil Nadu continues to wrestle with significant volumes of plastic waste, with approximately 96 percent being collected and sorted by urban entities. Nonetheless, challenges persist in effectively managing non-recyclable plastic waste.

Ban on Single-Use Plastics and Enforcement

Responding to the escalating plastic pollution crisis, governmental authorities have enforced bans on various single-use plastic products, gradually implementing stricter compliance measures. Measures such as shutting down non-compliant manufacturing facilities and undertaking widespread awareness campaigns aim to mitigate plastic usage. Moreover, the District Administration actively engages in environmental preservation endeavors.

Initiatives by the District Administration

The District Administration of Nilgiris has spearheaded diverse initiatives to combat plastic pollution effectively:

Mass Cleaning Campaigns: Collaborative endeavors involving local bodies, NGOs, and volunteers focus on cleansing critical areas like railway tracks of plastic waste.

Awareness Activities: Regular forums, media releases, and public announcements serve to enlighten citizens about the perils of plastic pollution and promote the adoption of alternative materials.

Engagement with Stakeholders: Collaborative partnerships with merchant associations, hospitality sectors, and tourism bodies foster mutual cooperation in adhering to plastic bans and embracing eco-friendly practices.

Government Campaigns: State-driven initiatives like the "Meendum Manjappai" campaign advocate for alternatives to plastic carry bags, instilling sustainable habits among residents and visitors alike.

Understanding Plastic Pollution

Plastic pollution arises from the widespread use of synthetic materials, primarily derived from petrochemicals. The durable nature of plastics, coupled with their affordability, contributes to their extensive use in various industries and packaging. The rise in plastic consumption, especially single-use packaging products, exacerbates pollution levels, leading to littering and marine debris.

Plastic pollution poses a significant environmental threat in Nilgiris District, despite regulatory efforts and awareness campaigns. Addressing this challenge requires sustained collaboration between government bodies, local communities, and stakeholders. By implementing stringent regulations, promoting alternative materials, and fostering public awareness, Nilgiris aims to protect its pristine environment and promote sustainable living practices.

In response to the plastic pollution crisis, initiatives such as the Meendum Manjapai campaign in Tamil Nadu aim to address the reliance on single-use plastics. However, the effectiveness of such measures hinges on the availability and adoption of viable alternatives. This section delves into the strategies and challenges associated with transitioning away from single-use plastics in

favor of more sustainable options.

Development of Alternatives

The Tamil Nadu government's Meendum Manjapai campaign seeks to develop alternatives for single-use plastics, particularly targeting 1 to 4-liter water cans and soft drink bottles in Nilgiris District. Efforts include plans to introduce trendy school bags made of jute and other alternative materials to popularize among children and youth. Self-help groups across districts are being engaged in producing alternative products, with 14 alternatives to single-use plastic identified by the Department of Environment. However, the successful implementation of the ban hinges on the widespread availability and acceptance of these alternatives.

Challenges and Enforcement

Despite regulatory measures, the absence of readily available alternatives poses challenges to enforcing the ban effectively. While surprise checks at commercial establishments aim to ensure compliance, the continued use of single-use plastics persists due to the lack of viable alternatives. Environmental activists stress the cultural significance of reverting to reusable cloth bags and jute bags, emphasizing the need to preserve both the environment and traditional practices. Officials from the Tamil Nadu Pollution Control Board acknowledge that cloth and jute bags are the primary alternatives but stress the need for increased availability to facilitate the successful implementation of the ban.

Transitioning away from single-use plastics requires not only regulatory measures but also the widespread adoption of viable alternatives. Initiatives like the Meendum Manjapai campaign highlight the importance of developing and promoting sustainable options to mitigate the environmental impact of plastic pollution. However, ensuring the availability and accessibility of these alternatives remains a crucial factor in realizing the goal of a plastic-free environment. Waste management is a critical issue in both Kerala and Tamil Nadu due to environmental and public health problems associated with inadequate collection, transportation, treatment and disposal of waste. This review aims to examine the status of waste management in these regions by examining existing literature and initiatives undertaken to address waste-related issues.

The studies shows that both Kerala and Tamil Nadu face significant challenges in managing the escalating volumes of waste produced by a growing urban population. The studies highlighted the composition of the waste and highlighted the predominance of organic, plastic and other non-biodegradable materials. In Kerala, for example, disposal of single-use plastics remains a major problem despite regulatory measures.

The regulatory framework governing waste management in both states plays a key role in shaping policies and initiatives. The Plastic Waste Management Rules 2016, issued by the Ministry of Environment, Forests and Climate Change, provide guidelines for plastic waste management across India, including Kerala and Tamil Nadu. In addition, state-level regulations and guidelines, such as bans on single-use plastics, aim to address specific waste management issues.

Various initiatives have been taken in Kerala and Tamil Nadu to improve waste management practices. These include door-to-door waste collection, material recovery facilities and awareness campaigns on waste sorting and recycling. However, challenges remain, including inadequate infrastructure, limited resources, and insufficient public participation. The informal sector also plays a significant role in waste management, particularly in recycling activities.

Going forward, efforts to improve waste management in Kerala and Tamil Nadu must focus on sustainable solutions that prioritize resource recovery, waste reduction and community involvement. Research suggests the importance of adopting integrated approaches to waste management that include technology, policy interventions and community participation. Collaboration between government agencies, private stakeholders and civil society organizations is essential to effectively address complex waste management issues.

In conclusion, waste management in Kerala and Tamil Nadu presents multifaceted challenges that require comprehensive solutions. Although regulatory measures and initiatives have been put in place to address waste-related issues, further efforts are needed to improve infrastructure, promote sustainable practices and encourage community involvement. By using research findings and best practices, both states can work towards more efficient and environmentally acceptable waste management systems.

A review of literature reveals multifaceted approaches and challenges in addressing this pressing concern. One prevalent theme is the adverse effects of plastic pollution on marine environments. Studies such as Jambeck et al. (2015) highlight the staggering amounts of plastic entering oceans annually, posing threats to marine life through ingestion, entanglement, and habitat degradation. Moreover, plastics break down into microplastics, exacerbating their impact by entering the food chain and potentially harming human health.

Efforts to mitigate plastic waste have focused on various strategies, including legislation and policy interventions. Research by Hahladakis et al. (2018) underscores the importance of regulatory frameworks in shaping waste management practices and promoting recycling initiatives. Additionally, economic instruments such as extended producer responsibility (EPR) have gained traction as a means to incentivize producers to take responsibility for the end-of-life disposal of their products. However, the effectiveness of such measures is contingent upon robust enforcement mechanisms and stakeholder collaboration across sectors.

Community engagement and public awareness campaigns emerge as critical components in fostering behavioral change towards plastic consumption and disposal. Studies like Ho et al. (2018) emphasize the role of education and outreach programs in promoting waste reduction, reuse, and recycling at the grassroots level. Furthermore, the concept of circular economy has gained prominence, advocating for a systemic shift towards a closed-loop model wherein plastics are reused, repurposed, or recycled to minimize waste generation and environmental impact.

Technological innovations offer promising avenues for advancing plastic waste management practices. Research by Andrady (2017) discusses emerging technologies such as pyrolysis, biodegradable plastics, and microbial degradation as potential solutions to mitigate plastic pollution. However, scalability, cost-effectiveness, and environmental implications necessitate rigorous evaluation and research investment to ensure their viability and sustainability.

In conclusion, the complexity of plastic waste management, necessitating a holistic and interdisciplinary approach encompassing policy interventions, community engagement, technological innovation, and stakeholder collaboration. Addressing this multifaceted challenge requires concerted efforts at local, national, and global levels to transition towards a more sustainable and resilient plastic economy.

CHAPTER 3

METHODOLOGY

SIGNIFICANCE OF THE STUDY

Plastic, once hailed as an extraordinary revolutionary material, now presents a significant environmental challenge, serving as both a testament to human ingenuity and a growing menace to our planet. Despite the Government of Kerala's order for a complete ban on single-use plastics, the persistent use of such materials continues in various areas. This ongoing usage underscores the urgency and importance of studying plastic management practices. The issue of waste, often deemed as the byproduct of processes with minimal economic value, raises a critical concern due to its contribution to pollution through solid, liquid, or gaseous routes. Despite the implementation of various laws, pollution remains a prevalent social issue in our society. Waste disposal or management is a formidable challenge for governments and organizations. However, achieving complete pollution-free living in Kerala continues to be a significant hurdle, aligning with the sustainable development goals of our global community.

Understanding the significance of studying plastic management becomes imperative as plastic pollution poses a severe threat to the environment. It has the potential to alter habitats and disrupt natural processes, consequently impacting ecosystems. The adverse effects extend to people's livelihoods and overall social well-being. Notably, the persistence of plastic in the environment is alarming; it can take hundreds of years to degrade naturally. Moreover, the improper disposal of plastic exacerbates the problem, leading to pollution of essential resources and further disrupting ecosystems. The study of plastic management gains relevance in addressing these critical issues, aiming to develop effective strategies to control plastic pollution, safeguard ecosystems and preserve the well-being of both the environment and the communities that depends on it. Within the spectrum of pollutants affecting our daily lives, plastic emerges as a persistent and concerning menace. Despite efforts to reduce its usage, plastic waste poses a substantial threat to the environment. The issue of plastic pollution gains added urgency due to the slow degradation process of plastic waste, contributing to enduring environmental damage. The prolonged degradation of plastics, which can take years, underscores the gravity of the situation. Of particular concern is the hazardous nature of plastics, given their prolonged degradation period. Recognizing the severity of the issue, proactive measures are deemed essential to address plastic pollution comprehensively.

The significance of this research lies in its focus on developing an efficient plastic waste management system tailored for Kerala, building upon successful waste management practices observed in Ooty. Ooty's reputation for effective waste management makes it an ideal source of insights to formulate practical models that align with Kerala's unique socio-economic and environmental context.

STATEMENT OF THE PROBLEM

Plastic waste has emerged as a critical environmental challenge globally, and its management poses a significant concern for regions like Kerala. Despite legislative measures and awareness campaigns, the issue of plastic pollution persists, with adverse effects on ecosystems, human health, and the overall well-being of communities. The existing plastic waste management practices in Kerala face challenges related to collection, segregation, disposal, and the enforcement of regulations. Understanding the intricacies of these challenges and identifying effective strategies for sustainable plastic waste management in the context of Kerala's socio-economic and environmental landscape is imperative.

The existing methods for managing plastic waste in Kerala may lack efficiency, resulting in improper disposal, littering, and environmental pollution. Understanding the limitations and gaps in the current practices is crucial for developing targeted interventions. Examining the demographic and socio-economic factors contributing to plastic waste generation is essential. Factors such as consumption patterns, lifestyle choices, and economic disparities may influence the amount and types of plastic waste produced. Despite legislative measures, there may be challenges in enforcing regulations related to plastic waste management. Understanding the factors contributing to non-compliance and evaluating the effectiveness of enforcement mechanisms is vital. The environmental and health implications of inadequate plastic waste management need thorough investigation. Understanding how plastic pollution affects local ecosystems, water bodies, and public health is crucial for devising comprehensive solutions. Assessing the level of awareness and participation within the community regarding plastic waste management practices is essential. Identifying factors that hinder or promote community engagement can inform targeted awareness campaigns and educational initiatives. Exploring innovative approaches and best practices from other regions, such as Ooty, known for successful waste management, can provide valuable insights. Understanding how these practices can be adapted and implemented in Kerala is integral to formulating an effective

plastic waste management model. Addressing these facets of the problem will contribute to the development of a comprehensive and context-specific plastic waste management strategy for Kerala, fostering a cleaner and more sustainable environment for future generations.

AIM OF THE STUDY

The study aims for a plastic free sustainable environment by analysing the effectiveness of the existing treatment practices for plastic waste management and developing a sustainable practice model for a plastic free eco-friendly zone as a result to meet the environmental sustainability in Kerala.

RESEARCH OBJECTIVES

General objective:

To conceptualize a sustainable practice model for plastic management in Kerala.

Specific objectives:

- To analyse the effectiveness of current practices and initiatives with regard to plastic waste management in Kerala.
- To identify the limitations & challenges in the present scenario of waste management.
- To analyse the primary step of the intervention and initiatives taken by the authority of Nilgiris district for the plastic waste management in Ooty.
- To identify the alternative materials to plastic by assessing their feasibility and affordability for adopting in Kerala.

CONCEPTUAL DEFINITIONS

Plastic waste management: it is the systematic handling, collection, efficient and precise conversion of plastic waste into innovative products that are better, environmentally-friendly.

Sustainable: the development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs.

Effectiveness: the degree to which a specific goal or objective is successfully achieved, reflecting the efficiency and capability of a process, system or action in producing desired outcomes.

Plastic free: the state of minimising or eliminating the use of plastic materials in various aspects of daily life aiming to reduce environmental impact.

Feasibility: it is the practicality and viability of adopting substitutes for traditional plastics in various applications.

Affordability: economic feasibility and accessibility of substitute materials or products that aim to replace traditional plastics involving the cost effectiveness of these alternatives.

(Conceptual Definitions: Google Scholar)

OPERATIONAL DEFINITIONS

Plastic management: the systematic implementation of strategies aimed at minimising, collecting, processing to create an environmental impact and to promote sustainable practices.

Sustainable: Mainly focusing on the environmental protection on reducing plastic waste by promoting eco-friendly practices and economic viability to create a balanced approach for the future development.

Effectiveness: An extent to which how much waste management practice is successful in the current scenario making a desired output according to the comfortability of people in an efficient manner.

Plastic free: the systematic efforts that aim to eliminate or reduce the plastic materials by investigating alternative materials, evaluating their environmental impact and assessing the overall success in achieving a plastic free status.

Feasibility: referred in the context of analysing the potential alternatives for plastics by assessing and the practical viability and suitability for the practical implementation of the product.

Affordability: the evaluation of the cost implications associated with the production costs and economic feasibility for adopting alternative materials for plastics in order to minimise the use.

UNIVERSE OF THE STUDY

The universe of the study is based on the present scenario of plastic waste management in Kerala and Tamil Nadu.

SAMPLING PROCESS

For the purpose of the study, non-probability sampling method is used in which purposive sampling design is selected based on the expertise, knowledge, experience on providing valuable insights into the study.

INCLUSION AND EXCLUSION CRITERIA

Inclusion

The study includes the state authority of waste management and the residents.

Exclusion

It excludes children and adolescents.

TOOLS AND METHODS OF DATA COLLECTION

The primary data was collected through unstructured interview and case study. The data was collected through direct face-to-face meeting with the authorities and the residents of the area. The secondary data was collected from various sources of articles, books, case reports and journals.

PILOT STUDY

The pilot study focused on refining research methods and procedures before conducting the full-scale study.

DATA ANALYSIS AND INTERPRETATION

The analysis and interpretation of data collected is done by using the comparative analysis of the data between the regions, demographic groups to identify the variations and patterns in plastic management practices. Also interpreted conclusions from the data to provide recommendations for improving plastic management practices based on the study.

LIMITATIONS OF THE STUDY

Using qualitative as the methodology, researcher cannot easily generalize the findings to the larger population.

CHAPTERISATION

CHAPTER1- Introduction

CHAPTER 2- Review of Literature

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CHAPTER 4

CASE STUDIES

Case Study 1

Sustainable and Community Led Plastic Waste Management in Ooty

Demographic Details of the Participant

Name	-	A
Location	-	Ooty, Nilgiris District
Type of community	-	Urban
Age	-	55
Gender	-	Male
Occupation	-	Sanitary Officer
Marital status	-	Married
Health status	-	Diabetic Patient
Languages Spoken	-	Tamil

Participant: **“plastic waste is generated when tourists arrive”**

Introduction

Plastic waste management has become a worldwide concern, but strategies and effectiveness vary by region. This study focuses on Ooty city and plastic waste management. Located in the Nilgiri Hills, Ooty is known for its beautiful scenery and attracts a large number of tourists. This study aims to delve into Ooty's approach, evaluate its results and draw practical model for Kerala. By examining the strengths and weaknesses of Ooty's plastic waste management system and comparing it with Kerala's existing model, it seeks to develop an optimized and contextually relevant plastic waste management model for Kerala. Through a qualitative lens, it is aimed to uncover insights that can inform sustainable practices and contribute to the broader discourse on effective plastic waste management in diverse regional settings.

Background

‘A’ revealed the past background of Ooty;

For several years, Ooty has been at the forefront of sustainable practices, having implemented a plastic ban that significantly contributes to its pristine environment. Despite these efforts, the presence of plastic waste is primarily attributed to the influx of tourists. Ooty, boasting four checkposts, regulates the entry of visitors, ensuring they adhere to environmentally conscious practices. However, challenges persist, especially in managing the impact on women, with tourism being a significant factor in the introduction of plastic waste.

Participant’s understanding:

➤ Tourist Contribution to Plastic Waste

The Participant revealed that, Tourists, often unaware of local practices, leave behind plastic items such as Lay's packets, straws, and covers in the serene surroundings of Ooty. The local residents, in contrast, have embraced sustainable living, refraining from the use of plastics in their daily lives. Consequently, the government has intensified its efforts to address this issue, recognizing the need for robust measures to combat plastic pollution.

➤ Government Initiatives and Waste Management

A crucial aspect of Ooty's waste management is the dedicated work of sanitary officers. Over the past years, they have played a pivotal role in overseeing waste management operations. Through a government-private contract, waste collection is efficiently carried out, with women assigned to households collecting diverse waste types daily. The town, divided into 36 wards, ensures each individual is responsible for six wards, resulting in the comprehensive collection of various waste materials.

The collected waste, including both food waste and plastic waste, undergoes a meticulous segregation process. It is then transported to either the composting unit and the biomethanation plant, utilizing specialized vans for efficient transportation. A notable feature is the **large composting unit specifically designated for plastic management**. This unit serves as a hub for sorting plastic items, and the processed materials find purpose as fuel in cement factories.

➤ Waste disposal methods and practices

Respondent also shared that the plastic waste obtained are brought to the composting unit where every plastic collected are disposed. It is then smashed and made into fine powders and

covert to cement which is then sold to cement Factories. Also, there is a biomethanation plant established for the food waste disposal in Ooty. The food waste is grinded initially, extracted under anaerobic condition and produce methane and carbon dioxide rich biogas, suitable for energy production. The residents of Ooty also obtain electricity from this Biomethanation Plant.

➤ **Community education Involvement and Success**

Integral to the success of waste management in Ooty is the active cooperation of the local community. Plastic items are diligently picked up from the environment, ensuring they do not end up being burned or thrown into rivers. There are animators assigned in each ward of the district to educate and aware on waste management and amplify the importance of preserving our environment by following eco-friendly practices. This conscientious effort, combined with the community's commitment to reduce littering and burning, has contributed significantly to the overall success of the waste management system.

Conclusion

From the researcher's understanding of the case, Ooty's journey toward sustainable and effective plastic waste management showcases the profound impact of community-led initiatives. The collaboration between local residents and the government, coupled with innovative waste management practices, has resulted in a cleaner, greener Ooty.

The practices followed for the management of waste is practically applicable without any harmful effects to the residents of Ooty. As the community actively engages in waste reduction efforts by following the rules and regulations of the current waste management system in Ooty, the residents stand as a testament to the efficacy of cooperation and unity in creating a sustainable plastic-free environment.

Case Study 2

Name	-	B
Location	-	Ooty, Nilgiris District
Community type	-	Urban
Age	-	35
Gender	-	Male
Occupation	-	Ward Counsellor
Marital Status	-	Married
Health Status	-	No issues
Languages Spoken	-	Tamil, Malayalam

Participant:- **“Ooty is well known for its sustainable waste management Practices”**

Known for its commitment to sustainability, Ooty implemented a plastic ban a few years ago in a bid to preserve its natural beauty. Despite these plans, plastic waste is still an ongoing problem, especially due to the influx of tourists. This case study aims to shed light on plastic waste management in the context of Ooty's unique tourism landscape.

Participant’s Knowledge

Participant states the current scenario of Ooty where Tourists, often unaware of local practices, inadvertently contribute to plastic waste by leaving items such as Lay's packets, straws, and covers in Ooty's serene surroundings. In contrast, the local residents have embraced sustainable living practices, refraining from the use of plastics in their daily lives. The challenges arising from tourism-related plastic waste necessitate a closer examination to identify targeted solutions.

Sanitary officers have played a crucial role in overseeing waste management operations in Ooty over the past four years. Through a government-private contract, waste collection has been streamlined, with women assigned to households collecting various waste types daily. The town's division into 36 wards ensures a comprehensive approach, and the collected waste undergoes meticulous segregation before being transported to the composting unit or the biomethanation plant. The plastic management unit stands out as a key element, serving as a sorting hub and contributing to fuel production in cement factories.

Active cooperation from the local community has been integral to Ooty's waste management success. Residents diligently pick up plastic items from the environment, preventing them from being burned or discarded into rivers. The community's commitment to reducing littering and burning has significantly contributed to the overall success of the waste management system. Despite the notable achievements, challenges persist, particularly in managing the environmental impact of tourism-related plastic waste. As Ooty continues to attract visitors, future efforts must focus on sustainable tourism practices, public awareness campaigns, and enhanced waste reduction initiatives.

Conclusion

From the study, could able to get a picture of Ooty's strong commitment to sustainable tourism and effective waste management is a testament to the community's presence, capability and resilience. By building on existing successes, strengthening collaboration between residents and authorities, and exploring new solutions, Ooty can continue to lead by example in creating plastic-free and eco-friendly destinations. The sustainability journey continues, and lessons learned shed light on other areas of business facing similar challenges.

Case Study 3

Impacts of Plastic Ban in Tamil Nadu: A Call for Equitable Environmental Practices

Name	-	C
Location	-	Ooty, Nilgiris District
Type of community	-	Urban
Age	-	33
Gender	-	Female
Occupation	-	Senior Consultant
Marital status	-	Single
Health status	-	No issues
Languages Spoken	-	English, Tamil, Hindi

Participant:” I could see our people face shape and reaction going wrong making them to bring their own bags. Good sign, really!”

Introduction about the case

The plastic ban in Tamil Nadu triggered a wave of curiosity about its efficacy. As a concerned citizen, I pondered the potential changes and doubted whether people would adhere to the rules. This case study delves into my personal experiences and observations following the plastic ban, shedding light on the unexpected shifts in behavior and the broader implications for the environment and employment.

Upon learning about the plastic ban, doubts arose regarding its practical implementation. The assumption that people would continue to use plastic persisted. However, my perceptions were challenged on the first day post-ban when I, forgetting my reusable bag, encountered a community strictly adhering to the rules. Purchasing goods became a challenge as everyone emphasized the need for bringing personal bags, highlighting the newfound commitment to the ban.

From the participant's information,

An interesting phenomenon unfolded as individuals transitioned from feeling ashamed to carry reusable bags to embracing them proudly. The ban spurred a cultural shift, steering people away from environmentally harmful polythene bags. This unexpected shift marked a positive impact on the mindset of the community, highlighting the potential for change in environmental practices. The plastic ban in Tamil Nadu, though met with initial struggle has made a substantial positive impact. People have gradually forsaken polythene bags, taking a collective step toward a cleaner environment. The case study serves as a testament to the transformative power of legislation in influencing public behavior. However, the plastic ban has not been without its challenges. More than two lakh individuals lost their jobs in the wake of the ban, raising questions about the broader societal implications. The issue of job losses highlights the need for a balanced approach in environmental policymaking, ensuring that measures are implemented equitably across different sectors. Also Government of Tamil Nadu campaign called “**Meendum Manjappai**” campaign is being organized to promote alternative to plastic carry bags.

Analysis & Conclusion

The case study underscores the importance of equitable environmental policies. While the ban targeted the use of plastic bags at the consumer level, it has yet to address the broader issue of corporate reliance on plastic packaging. Food industries, in particular, continue to use plastic for packaging, contributing to environmental degradation. A call to action is made for the government to extend regulations to encompass corporate practices, inspiring innovation in eco-friendly packaging solutions.

From the researcher's view, the plastic ban in Tamil Nadu has brought about a positive cultural shift in individual behaviors. However, the unintended consequences, especially job losses and corporate practices, highlight the need for a more comprehensive and equitable approach to environmental policies. The case study serves as a plea for the government to consider a holistic strategy that encompasses all stakeholders, fostering a sustainable and balanced approach to environmental conservation.

Case study 4

Navigating Waste Management Challenges in Kerala: A Complex Quandary

Name	-	K
Location	-	Ernakulam
Type of community	-	Urban
Age	-	28
Gender	-	Male
Occupation	-	Teacher
Marital status	-	Married
Health status	-	No issues
Languages Spoken	-	English, Malayalam

Introduction on the Case

Waste management in Kerala is a multifaceted challenge, stemming from a combination of factors that intricate to create a complex problem. As there is no permanent solution for waste management kerala known for its high population density, faces unique geographical constraints, limited landfill space, public resistance to landfill sites, and a lack of effective waste segregation at the source. These factors, coupled with insufficient infrastructure and governance challenges, contribute to the ongoing struggle in establishing a waste management system. As the **Participant put forward the insights** based on the knowledge available up until September 2021, where reveals the importance to note that specific developments or changes that have occurred since then may not be covered,

Kerala's elevated population density presents a unique challenge, with a high volume of waste generated daily. The demand for effective waste disposal and management escalates as the population continues to grow, putting additional strain on existing systems. The state's hilly terrain and limited availability of flat land exacerbate the challenge of finding suitable sites for landfills. The scarcity of flat land impedes the establishment of new landfill areas, creating a pressing need for alternative waste disposal solutions. Communities in Kerala often resist the establishment of new landfill sites, expressing concerns about environmental pollution, health risks, and potential decreases in property values.

This public opposition complicates the identification and approval of suitable locations for waste disposal, contributing to the overall waste management dilemma. Effective waste management necessitates proper waste segregation at the source. However, there is a notable lack of awareness and compliance with waste segregation practices among the general public in Kerala. This shortfall impedes the implementation of efficient waste management systems and contributes to the contamination of recyclable materials.

Analysis & Conclusion

The participant's understanding has given a picture of Kerala facing challenges in developing and maintaining essential waste management infrastructure. The scarcity of waste treatment plants, composting facilities, and recycling units limits the available options for managing diverse types of waste. The lack of infrastructure hampers the state's ability to adopt modern and sustainable waste management practices.

The effective management of waste requires seamless coordination among various stakeholders, including local government bodies, waste management authorities, and the general public. The intricate governance structure and coordination challenges in Kerala contribute to inefficiencies in waste management practices, hindering the implementation of cohesive and sustainable solutions.

The study provides a loop to understand the complex web of challenges surrounding waste management in Kerala which demands comprehensive and integrated solutions. Addressing the issues of population density, limited landfill space, public resistance, waste segregation, infrastructure development, and governance coordination is imperative for the state to navigate its waste management quandary successfully. A holistic approach that incorporates public awareness campaigns, infrastructure investments, and community engagement is crucial for forging a sustainable path forward in waste management for Kerala.

Case study 5

Revitalizing Waste Management in Kochi, Kerala

Name	-	E
Location	-	Edathala
Type of Community	-	Urban
Age	-	26
Gender	-	Female
Occupation	-	Software Engineer
Marital status	-	Married
Health status	-	No issues
Languages Spoken	-	English, Malayalam, Hindi

Participant: **“The main reason for the increase of this problem in the city is the lack of effective waste management practices in the city”**

Introduction on the case

Kochi, a bustling city in the Indian state of Kerala, grapples with a pervasive issue—garbage management. In the current Scenario, the city confronts a substantial daily influx of solid waste, contributing to environmental degradation and escalating health concerns. The root cause lies in the absence of efficient waste management practices, marked by deficient infrastructure and a prevailing lack of awareness and civic responsibility.

The participant also reveals the background of waste management where there was Inadequate facilities for waste collection, transportation and disposal compound the problem. Indiscriminate disposal of garbage in public spaces, on roadsides, and in water bodies by some residents further exacerbates the environmental and health issues.

Addressing the Issue:

According to the Participant, to combat this escalating crisis, a multifaceted approach is imperative, encompassing infrastructure development, public awareness campaigns, educational initiatives and strategic partnerships.

The city authorities need to establish efficient systems for the collection, transportation, and disposal of waste. Implementing waste segregation at source and creating designated dumping sites are critical steps in this regard. Raising awareness about the importance of proper waste management is indispensable. Educational programs and awareness campaigns should be strategically conducted in schools, colleges, and public spaces. These initiatives aim to instill a sense of responsibility and environmental consciousness among residents. Governments can collaborate with non-governmental organizations (NGOs) and other entities to promote eco-friendly products and packaging. Joint efforts can encourage waste reduction and recycling practices. Workshops and seminars can be organized to disseminate information and foster community participation. Encouraging the use of eco-friendly products becomes a pivotal aspect of waste management. Government incentives and campaigns can promote sustainable practices, influencing both businesses and consumers to opt for environmentally conscious choices. To enforce responsible waste disposal, stringent penalties and fines should be implemented. Legal measures, coupled with public awareness, create a deterrent effect, compelling citizens to abide by waste management regulations.

Conclusion

Through this Case Study, it reveals, Kochi which underscores the need for a comprehensive waste management overhaul. By addressing infrastructure deficiencies, fostering public awareness, collaborating with stakeholders, promoting sustainable practices and enforcing regulations, Kochi can pave the way for a cleaner, healthier, and more sustainable future.

This case study serves as a valuable research foundation for understanding the intricacies of waste management challenges in urban settings within the state of Kerala. It highlights the potential impact of a holistic approach in mitigating these challenges and fostering a culture of responsible waste management.

Case study 6

Name	-	F
Location	-	Aluva
Type of Community	-	Urban
Age	-	35
Gender	-	Male
Occupation	-	Marketing Manager
Marital status	-	Married
Health status	-	No issues
Languages Spoken	-	English, Malayalam

Introduction

Kerala, known for its lush greenery and rich biodiversity, faces a pressing issue in managing plastic waste. The prevailing practices of private agencies collecting plastics every three months, residents burning garbage, and the accumulation of waste in common grounds demand immediate attention. The participant reveals the current state of plastic waste management in Kerala, highlighting challenges, potential solutions, and the role of government intervention.

Participant's knowledge,

Kerala's waste management practices have struggled to keep pace with urbanization and population growth. The reliance on private agencies for sporadic plastic collection, coupled with residents resorting to burning waste, has contributed to environmental degradation. The presence of unattended tree cuttings further exacerbates the issue, leading to a complex waste management challenge. The current system, where private agencies collect plastics once every three months, is inefficient and does not encourage regular waste disposal. Residents burning garbage, including plastic, not only releases harmful pollutants but also contributes to air quality deterioration. Neighbours around garbage grounds resist government intervention, making it challenging to implement effective waste management policies. The presence of decaying tree cuttings without demand highlights a lack of an organized wood disposal system.

The practice of depositing municipal-collected garbage in common grounds without proper disposal methods results in the persistence of waste.

The participant reveals the need of enforcement in stricter regulations on waste disposal and burning, penalizing those who violate these rules. Also building an adequate waste management infrastructure, including recycling facilities and composting units, to ensure effective disposal of collected waste. Participant also added the need to strengthen local governance bodies to facilitate the implementation of waste management policies and address community concerns.

Conclusion

From the information provided by the respondent, it is understood that plastic waste management crisis in Kerala requires a multi-pronged approach involving public awareness, community engagement, and robust government intervention. By addressing the challenges and implementing potential solutions, Kerala can transition towards a more sustainable and efficient waste management system, ensuring the preservation of its natural beauty and biodiversity.

CHAPTER 5

DISCUSSION & FINDINGS

DISCUSSIONS

Plastic waste often constitutes a significant portion of the overall waste stream in urban areas like Kochi. Strategies for plastic waste management should be seamlessly integrated into the broader waste management framework. Similar to general waste, efficient segregation at the source is crucial for plastic waste. Given the prevalent issue of indiscriminate disposal, targeted public awareness campaigns should highlight the environmental impact of plastic waste. Educational initiatives in schools, colleges, and public spaces can specifically address the challenges posed by plastic waste and the need for responsible disposal.

Conducting a study on plastic waste management practices with the objective of formulating a model for Kerala involved a comprehensive examination of the current waste management practices in the state. This comparative analysis extended to Ooty, a prominent region in the Nilgiris District, which has been notably effective in the process of managing plastic waste. From the comparative study between Kerala and Ooty waste management practices, the researcher came to identify a model for plastic waste management in Kerala which is adopted in Ooty.

IDENTIFIED MODEL TO BE ADOPTED IN KERALA:

CO-PROCESSING UNIT FOR PLASTIC MANAGEMENT

From the study conducted in Ooty has given the knowledge of the disposal methods of waste. Plastic waste has been brought to the composting unit where the plastics are crushed and made into fine powders and then given to the cement factories and earning an income it. In Kerala, from the understanding of the case study arrives at a conclusion that on segregating the types of plastics in MCF the materials are sent for recycling. A plastic can't be recycled more than three times. I didn't find recycling as a permanent option for plastic waste control.

From the Ooty's following method of **Composting unit** where **plastics** are made into fine powders and given to cement factory which is then co-processed. One of the models which can be **conceptualised in Kerala**. The model doesn't cause any harm to the environment and useful in production of energy.

CO-PROCESSING UNIT FOR PLASTIC WASTE IN CEMENT KILNS

Compared with landfilling and incineration, co-processing of plastic waste in a cement kiln is a more economical and environment-friendly method as it reduces emissions and leaves no residue after treatment. Supporting this approach is a win-win situation for a world drowning in plastic waste. By converting plastic into energy, cement kilns could keep waste out of landfills and oceans and enable cement factories to stop burning coal, which is key to global warming. Since plastic waste has material and energy value, the option of co-processing in a cement kiln offers a good option to use waste as a resource in cement production without affecting emissions or good substances.

PHASES OF THE CO-PROCESSING OF PLASTIC WASTE

- Gather and sort all types of discarded plastic materials from municipal, NGO, or authorized personnel.
- Collect plastic waste from residential areas, factories, and other designated locations within the jurisdiction.
- Utilize shredders, if necessary, to resize the waste and securely store it in designated containers.
- Sign a memorandum of understanding with a cement kiln for collaborative plastic waste management.
- Import plastic waste into the kiln furnace while maintaining meticulous records.
- Receive plastic waste from offices and maintain detailed records of the collection.
- Transport plastic waste collected under extended producer responsibility (EPR) to the cement plant for joint processing.
- Ensure the implementation of Plastic Waste Management (PWM) policies by appointing responsible individuals from relevant authorities.
- Implement standards for the utilization of plastic waste as alternative fuel and feedstock in cement kilns, with appropriate emission monitoring and control measures in place.
- Monitor emissions and share relevant information with State Pollution Control Boards (SPCBs), Pollution Control Committees (PCCs), and the Central Pollution Control Board (CPCB).

APPLIED THEORY- ECOLOGICAL SYSTEMS THEORY

Ecological Systems Theory, developed by Urie Bronfenbrenner, provides a comprehensive framework for understanding the complex interactions between individuals and their environments. At its core, this theory emphasizes that individuals are influenced by multiple systems or layers of environments, ranging from the immediate microsystem (such as family and peers) to the broader macrosystem (including cultural norms and societal values). These systems are interconnected and dynamic, shaping individuals' development and behavior over time. In the context of waste management, Ecological Systems Theory highlights how environmental factors, such as waste disposal practices and pollution, can impact individuals and communities across different levels of the ecological system. For example, improper waste management in a community can lead to environmental degradation, which in turn affects individuals' health, social relationships and overall quality of life. Children growing up in environments with high levels of pollution may experience adverse health outcomes and developmental challenges, illustrating the interconnectedness between environmental factors and individual well-being.

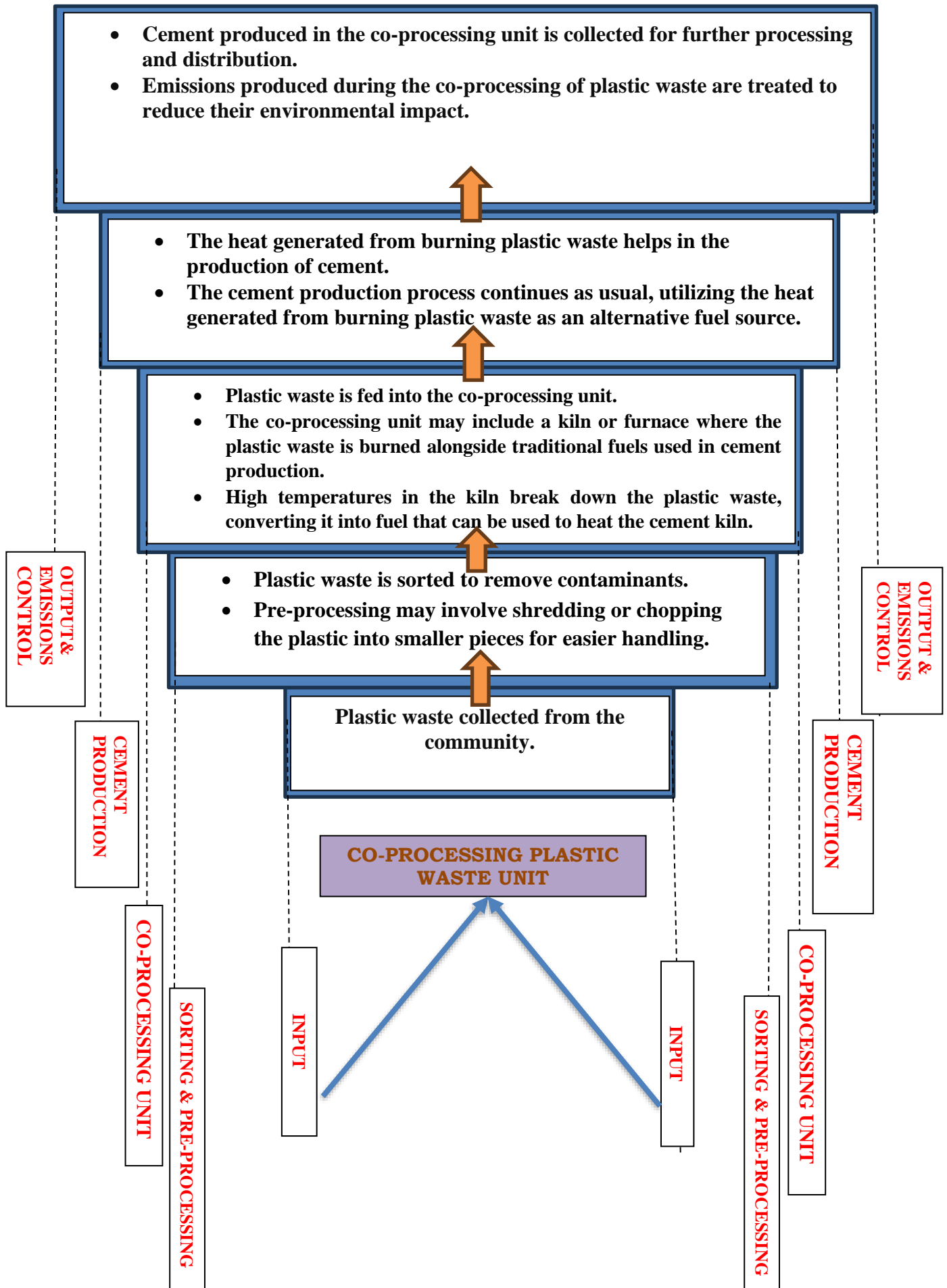
As a researcher, during the study i applied Ecological Systems Theory in waste management interventions which recognize the importance of addressing environmental issues within the broader context of individuals' social, cultural, and economic realities. By collaborating with diverse stakeholders, including community members, government agencies and environmental organizations develop comprehensive strategies that promote sustainable waste management practices while addressing underlying social inequalities.

Also, by considering the interplay between environmental factors and social systems, social workers can advocate for policies and interventions that not only protect the environment but also enhance the overall resilience and well-being of individuals and communities. As this theoretical framework, emphasizes the interconnectedness of various systems and levels of influence, ranging from the individual to the broader societal and environmental contexts.

- At the individual level, the researcher explored how personal beliefs and behaviors shape individuals' consumption patterns and waste disposal practices. This involved examining factors such as environmental awareness, perceived social norms, and the influence of cultural values on plastic usage and disposal habits.
- Moving to the microsystem level, researcher investigated the immediate social environments in which individuals interact, including families, peer groups, and local communities as how social networks, peer pressure and community norms influence waste management practices, such as the adoption of recycling initiatives or community cleanup efforts.
- The mesosystem level involves examining the interactions between different microsystems, such as the collaboration between households, businesses, and local government agencies in waste management initiatives.
- Zooming out to the exosystem level, the researcher analyzed the broader institutional and societal factors that shape waste management policies, practices, and infrastructure. This could involve examining government regulations, corporate responsibility initiatives, and the role of non-governmental organizations (NGOs) in advocating for sustainable waste management practices.

By employing the Ecological Systems Theory in qualitative research on plastic waste management, researcher gain a comprehensive understanding of the multifaceted factors influencing waste-related behaviors and practices at various levels of the ecological system. This approach facilitated the identification of the model and the development of contextually relevant strategies to promote more sustainable and environmentally conscious waste management practices.

CO-PROCESSING UNIT PROCESS MODEL FOR PLASTIC MANAGEMENT



Findings of Plastic Waste Management in Kerala

Unique Challenges in Plastic Waste Management

Kerala faces distinctive challenges in managing plastic waste due to its high population density, limited landfill space, and geographical constraints. The hilly terrain and scarcity of flat land pose difficulties in identifying suitable sites for plastic waste disposal.

As in Kochi, faces a significant challenge in plastic waste management due to inadequate facilities for waste collection, transportation, and disposal. The lack of efficient systems contributes to the indiscriminate disposal of plastic waste in public spaces and water bodies. The root cause of the plastic waste issue in Kochi is attributed to a prevailing lack of awareness and civic responsibility among residents. Indiscriminate disposal of plastic waste exacerbates environmental and health concerns in the city.

Communities in Kerala resist the establishment of new landfill sites, expressing concerns about environmental pollution, health risks, and property devaluation.

Public opposition complicates the identification and approval of suitable locations for plastic waste disposal.

Lack of Waste Segregation Awareness

There is a notable lack of awareness and compliance with waste segregation practices among the general public in Kerala. Insufficient waste segregation hinder the implementation of efficient plastic waste management systems and leads to the contamination of recyclable materials.

The scarcity of waste treatment plants, composting facilities, and recycling units, limits the available options for managing diverse types of plastic waste. The intricate governance structure and coordination challenges in Kerala contribute to inefficiencies in plastic waste management practices.

No active promotion of Eco-friendly product Alternatives for plastics

Encouraging the use of eco-friendly products is considered pivotal for effective plastic waste management. Government incentives and campaigns can play a role in influencing businesses and consumers to opt for environmentally conscious choices.

Poor enforcement of laws in the implementation of stringent penalties and fines

Legal measures, combined with public awareness, can create a deterrent effect, compelling citizens to adhere to plastic waste management regulations.

Holistic Approach Needed

Effective plastic waste management in Kerala requires a holistic approach that addresses population density, limited landfill space, public resistance, waste segregation, infrastructure development, and governance coordination. The findings underscore the need for integrated and comprehensive solutions to address the complex challenges surrounding plastic waste management in Kerala. A strategic approach involving various stakeholders, public awareness initiatives, and infrastructure development is crucial for the successful navigation of the state's plastic waste management dilemma.

The findings underscore the need for integrated and comprehensive solutions to address the complex challenges surrounding plastic waste management in Kerala. A strategic approach involving various stakeholders and infrastructure development is crucial for the successful navigation of the state's plastic waste management dilemma. Addressing the complex web of challenges in plastic waste management demands cohesive strategies that incorporate public awareness campaigns, infrastructure investments, and community engagement. A holistic approach is essential for forging a sustainable path forward in plastic waste management for Kerala, ensuring environmental conservation and public health protection.

Major findings regarding the plastic waste Management in Ooty

- Tourists contribute significantly to plastic waste in Ooty, leaving items like Lay's packets, straws, and covers in the serene surroundings.
- Local residents practice sustainable living, minimizing their use of plastics in daily life. Government recognizes the impact of tourism and intensifies efforts to combat plastic pollution.
- Ooty has a dedicated team of sanitary officers overseeing waste management operations.
- Waste collection is efficiently carried out through a government-private contract, with women assigned to households for diverse waste types. Meticulous segregation of collected waste, including plastic, occurs before transportation to **composting units** and **Biomethanation plants**. A Biomethanation plant handles food waste, producing methane and carbon dioxide-rich biogas for energy production, providing electricity for residents.
- **A specialized composting unit for plastic management converts processed materials into fuel for cement factories.**
- Plastic waste is brought to a composting unit, where it is smashed into fine powders and converted into cement, sold to cement factories.
- Active cooperation of the local community is integral to the success of waste management in Ooty. The community diligently picks up plastic items, preventing burning or disposal into rivers.
- Community commitment to reducing littering and burning contributes significantly to the overall success of the waste management system.
- Local bodies regularly organize mass cleaning campaigns involving students and NGOs to remove waste, including plastic bottles and other plastic debris. The collected waste is disposed of properly by the local authorities. Additionally, all local bodies and the District Pollution Control Board are actively raising awareness among tourists and the public regarding the use of banned plastic items. This is done through public announcements on vehicles, conducting rallies, and promoting alternatives to plastic bags.
- The Tamil Nadu government's initiative, known as the "Meendum Manjappai" campaign aims to encourage the use of alternatives to plastic carry bags.

Ooty's success in plastic waste management is attributed to community-led initiatives and collaboration between residents and the government. Innovative waste management practices, coupled with active community engagement, have resulted in a cleaner and greener environment. The practices followed in Ooty are practically applicable without harmful effects on residents, showcasing the efficacy of cooperation and unity in creating a sustainable, plastic-free environment. **These findings provide a basis for drawing lessons applicable to the state of Kerala, emphasizing the importance of community involvement, government initiatives, and innovative waste management practices in addressing the global concern of plastic waste.**

CHAPTER 6
CONCLUSION &
IMPLICATIONS FOR
PROFESSIONAL SOCIALWORK
PRACTICE

CONCLUSION

The integration of plastic waste management into the broader waste management framework is essential for effective solutions. Efficient segregation at the source, similar to general waste, emerges as a critical step in addressing the problem. Indiscriminate disposal of plastic waste is a significant challenge, necessitating targeted public awareness campaigns. Educating the public, especially through initiatives in schools, colleges, and public spaces, can raise awareness about the environmental impact of plastic waste and promote responsible disposal practices.

The comparative analysis with Ooty reveals a promising model for plastic waste management—the co-processing unit for plastic management. In Ooty, plastics are crushed into fine powders and utilized in cement factories, providing both an environmentally friendly disposal method and an income-generating opportunity. This model, if implemented in Kerala, could contribute to sustainable plastic waste management without causing harm to the environment. While recycling is a common practice, the research suggests limitations to its effectiveness for plastic waste control, especially considering that plastic can't be recycled indefinitely. The co-processing unit model presents itself as a viable alternative that aligns with environmental sustainability and energy production.

The study advocates for the adoption of a co-processing unit for plastic management in Kerala, based on the successful model observed in Ooty. This approach not only addresses the challenges posed by plastic waste but also provides an economically viable and environmentally friendly solution, contributing to the broader goal of effective waste management in urban areas. The success of Ooty's approach is attributed to community-led initiatives and collaboration between residents and the government, showcasing the importance of active community engagement in waste management practices. The findings suggest that this model can be applied in Kerala, emphasizing the need for similar cooperation, government support, and innovative waste management practices to create a sustainable and plastic-free environment.

IMPLICATIONS FOR PROFESSIONAL SOCIAL WORK PRACTICE

Plastic waste has become a major problem for the global environment; poses a threat to ecosystems, human health and general well-being. The Indian state of Kerala is known for its unique ecological diversity, and the impact of social action in managing plastic waste in the Kerala context is significant. As agents of change, social workers can play an important role in strengthening leadership, influencing policy change and encouraging community participation. Professionals in social work play an important role in leadership to reduce the negative impact of plastic waste. The role of social work in the management of plastic waste is broad and covers everything that contributes to solving the problem.

Plastic Waste Management an important aspect of social work is community participation and education. Community workers are involved in creating awareness programs to educate people and communities about the impact of plastic waste on the environment. Through workshops, seminars and training, experts teach people about the responsible use of plastic and proper disposal practices. By promoting common understanding in society, social workers help develop a common desire for sustainable living.

A Comprehensive Scope of Social Work Practice

Recognizing that behaviour change is necessary to reduce plastic use, social workers develop and implement interventions to change the behaviour of people and society. Education technology is designed to create tailored plans that include school, work and family. Social workers want to change perceptions and encourage healthy lifestyles by promoting a culture of sustainability, thus helping to reduce plastic waste.

Social workers are driven to work to create change through their expertise in human behaviour and communities. They design and implement intervention plans to improve how people interact with and use plastic. For example, in schools, social workers can work with teachers to integrate environmental education into the curriculum. Through interaction and participation in activities, students learn about the impact of plastic waste on the environment and develop an early understanding of responsible consumption. Education in schools may also include appropriate strategies such as waste reduction issues or sustainable practices in schools. Social workers decide on training appropriate to the context of the organization when solving business problems. This may include running a program to introduce employees to sustainable practices in the workplace or providing consultancy to help businesses transition to green alternatives.

- Social workers work with businesses to reduce their overall plastic footprint, creating a real impact across society. The general aim of these courses is to promote social security culture.
- Social workers contributed to reducing plastic waste by promoting healthy lifestyles. This reduction is achieved not only through policy changes or large-scale measures, but also through grassroots processes that encourage the participation of individuals and communities and advocate leadership.
- Community workers are involved in policy advocacy and development to address issues related to plastic waste. They work with policymakers to advocate for the development and implementation of regulations governing the production, use and disposal of plastics. This includes advocating for plans such as Extended Producer Responsibility (EPR) programs, plastic bag bans, and other legislation that will hold individuals and businesses accountable for their impact on the environment.

To solve the local problem of plastic waste, community workers support the creation of community waste management plans. This includes the establishment of recycling facilities, compost facilities and measures for the collection and disposal of plastic waste. Community workers actively involve communities in the development and implementation of sustainable waste management practices that meet their specific needs and requirements. An important part of good community work in plastic waste management is research and data collection. Community workers conduct research to understand local patterns of plastic waste and disposal practices and analyze their impacts on communities and ecosystems. These empirical data form the basis of evidence-based interventions, allowing professionals to monitor progress, adjust strategies, and continue to improve the outcomes of plastic waste products management programs. Social workers recognize the importance of early learning and incorporate environmental awareness into the school curriculum. Also Social workers advocate for improved employment, access to healthcare and social services, and help improve the health of people negatively affected by plastic waste problems.

Through community engagement, behavioural interventions, policy advocacy, community initiatives, research, education, and collaboration, social workers contribute to the creation of effective solutions in society. The role of social workers in raising environmental awareness, justice and environmental advocacy makes social workers important in solving many problems related to plastic waste management.

CHAPTER 7

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CHAPTER 8

APPENDIX

The Interview with the Participants was conducted with consent which was a face-to-face interaction. For the Qualitative research Study, unstructured interviews, observations were the tools and Case study was the method used.

Questionnaire prepared for case study

1. Can you describe a general Overview about Waste Management in your area?
2. How efficient and comprehensive are the collection and segregation practices?
3. What methods are currently in place for the collection and segregation of plastic waste?
4. How actively do the residents participate in initiatives to reduce and manage plastic waste?
5. What infrastructure is available in your area for the proper disposal and recycling of plastic waste?
6. What are the adequate recycling facilities, and how accessible are they to the community?
7. Can you explain any innovative practices or technologies being employed for plastic waste management?
8. How effective are these innovations in reducing the impact of plastic waste?
9. How the monitoring and evaluation is effective in plastic waste management?
10. How do you follow the educational programs in place to inform the community about the environmental impact of plastic waste?
11. How effective are these programs in changing behavior and fostering responsible waste disposal habits?
12. What measures are being taken to reduce the use of plastic waste?
13. What alternative materials to plastic are currently available in the market?
14. How well are different stakeholders (government, private sector, NGOs, etc.) collaborating in waste management efforts?
15. What specific initiatives or interventions have been undertaken by the authorities in your area in plastic waste management?

- **Plastic Waste Generation Data collection**
 1. Annual plastic waste generation
 2. Plastic waste composition analysis
 3. Plastic waste generation trends over the past decade
- **Plastic Waste Collection and Disposal Methods**
 1. Overview of plastic waste collection methods (curbside pickup, drop-off centers, etc.)
 2. Comparison of different plastic waste disposal methods (landfill, recycling, incineration)
 3. Plastic waste management policies and regulations by region/country
- **Case Studies**

Successful plastic waste management initiatives in Ooty & Description of the initiative.
Key outcomes and impacts & Challenges faced in implementing plastic waste management strategies.
- **Discussions & Findings**
 1. Overview of innovative technologies for plastic waste recycling (chemical recycling, pyrolysis, etc.)
 2. Comparative analysis of the environmental impact of different plastic waste recycling technologies
 3. Description of community-based initiatives for plastic waste reduction and recycling
- **Model Recommendations/Conceptualising a model**

Model recommendations for improving plastic waste management
- **Bibliography**

