Sacred Solutions – Strengthening strategies & techniques for managing floral waste in Worship places

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Abstract: India with a rich cultural heritage that includes numerous festivals, ceremonies, and religious rituals in worship places involving flowers as a major religious offering in most cases, the country generates a significant amount of floral waste regularly. Floral waste generated from religious activities, especially in the culturally rich city Chennai, Tamil Nadu in India, poses a significant environmental challenge due to its sheer volume and lack of proper disposal mechanisms. The study encompasses a comprehensive analysis of the patterns and quantities of floral waste generated during religious ceremonies, festivals, and daily rituals in Greater Chennai Corporation (GCC). The findings will contribute valuable insights to manage the current state of floral waste in the five major worship places of GCC Area and proposes sustainable solutions to mitigate its environmental impact.

Index Terms: Floral Waste, Greater Chennai corporation Area, Re-use, Landfill, Temples, Floral Markets, Revenue generation, Incense sticks etc.

I. INTRODUCTION

India, with its rich tapestry of religions and cultures, stands as a testament to the harmonious coexistence of diverse faiths. Nirmalya (निर्माल्यम्) is a Sanskrit word that means everything that is offered to God- like Flowers, Fruits, and other natural offerings during the time of worship. In these offerings, flowers constitute 60%-70% of its share. The total production of flowers in India was 2785000 MT as per the 2021 Just Agriculture report[13]. The dry and decayed floral offerings are still considered sacred as per religious belief, so they are not discarded as trash and hence dumped in landfills, or find their way into water bodies like rivers, lakes, etc. leading to severe environmental pollution and health hazards. As per the India tourism statistics report-2023, Tamil Nadu (TN) ranks 2nd in domestic tourism and majorly due to its beautiful Dravidian Architecture and temples. Amongst them Chennai ranks second after Kanchipuram for tourist footfall.

Tamil Nadu has a Hindu religious and Charitable Endowments Department which oversees 41327 temples in TN. According to a senior HR & CE officer, every day Tamil Nadu generates over 3.8 lakh kg of floral waste[10], with 41,327 temples under the jurisdiction of the HR & CE department alone. The commonly offered flowers are Mogra, rose, lotus, marigold, chrysanthemum, hibiscus, etc. which have the potential to be used for alternative purposes also. Presently, the waste is being dumped in the two landfills- Perungudi Landfill, Kodungaiyur Landfill, without any further treatments planned in the near future.

II. NEED OF THE STUDY

Approximately 500,000 individuals visit temples each day to make floral offerings. An estimated 800 million tons of flowers are offered daily in the nation's temples, mosques, gurudwaras, and other religious buildings. According to the 2021 Agriculture report[13], harmful pesticides and insecticides used to grow flowers are discarded in the river along with more than 8 million tons of flowers annually. Since this portion of waste is usually disregarded, it requires special consideration.

In India, approx. 20 tons of floral waste are produced every day by numerous places of worship. Most of it winds up in landfills, where it is mixed with other non-biodegradable debris and prevents it from decomposing as it would naturally.

III. RESEARCH PROCESS

The study aims for fulfilling the gaps in the technical & management strategies for floral waste management in the 5 large temples of Greater Chennai Corporation Area (GCC). The following are the objectives of the study:

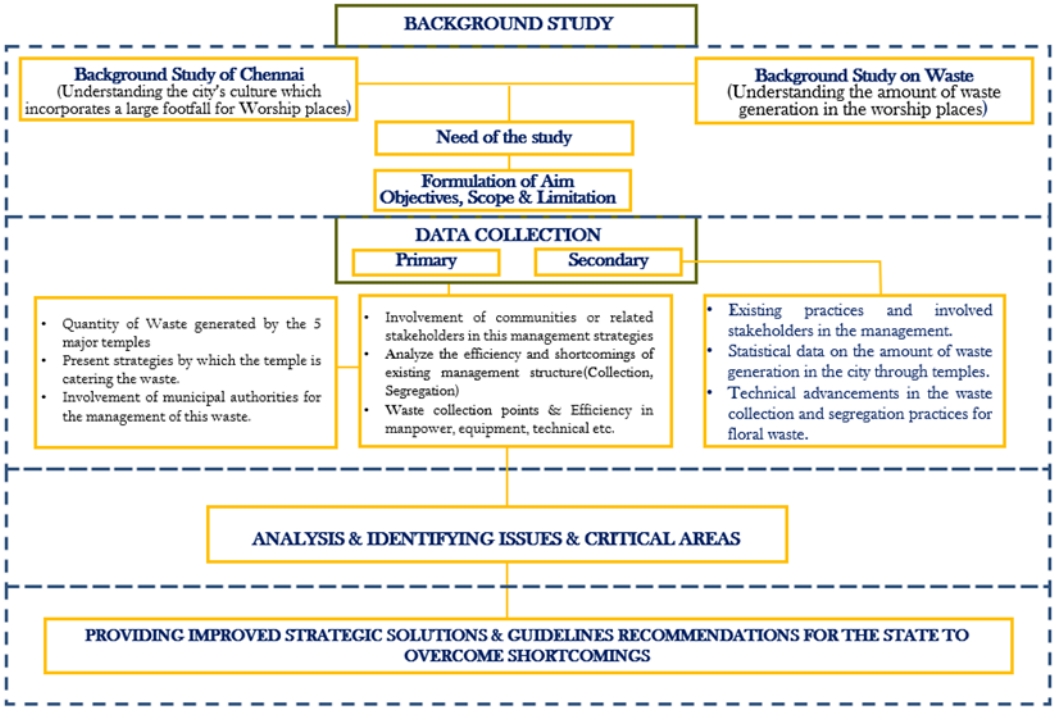
1. To study the existing strategies being implied by the Municipal authorities in temples to reduce 3500 kg/day floral waste in 5 temples and the relationship between temple authorities and municipal bodies to manage the waste.
2. To Identify the stakeholders and their engagement to address this issue at municipal level in GCC presently.
3. To analyze & identify the issues and conflicts in the management practices system.
4. To propose suggestions for improving the methods needed for better floral waste management in GCC temples for a ten-year period (2024–2034)

The Scope & Limitation of the study are as follows:

1. Delineating the geographical area- the study is focused upon Greater Chennai corporation Area only
2. There is a plethora of items in floral waste management- which includes Micro & Macro study. The macro-level study is majorly focused on.
3. The entire study will focus upon the technical & management strategies provided by the temple and municipal authorities to these temples in GCC.
4. A framework of guidelines for State will be created along with suggestions which shall help in creating a better alternative to the strategies already in place.

Limitations:

1. The study exclusively looks at the five temples in the Greater Chennai Corporation Area that generate the most floral waste and not the whole district.
2. The study is only limited to floral waste and not all of the temple waste in the study area.
3. Any other sources of floral waste like floral markets, wedding decoration etc. is not a part of the study but will only be studied to understand the linkages.



Methodology followed for the study was:

IV. About the Study Area – Greater Chennai Corporation

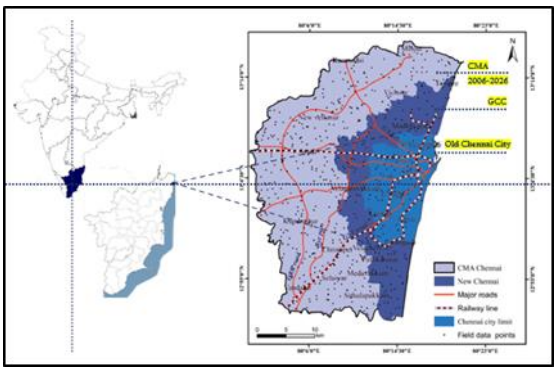


Figure 1:Location of old Chennai limits and CMA Boundary

Tamil Nadu lies towards the Southern part of the country. It has approximately 38 districts with Chennai being it's one of the major districts and the 4th major metropolitan of the country. The existing old Chennai limits has been expanded to Greater Chennai corporation Area (GCC) in 2011 with an increase from 175 Sq. Km to 426 Sq. Km. The Chennai Metropolitan area (CMA) has also been proposed from 2006-2026 with an area of 1186 Sq. Km and is further proposed from 2026-46 with an increase to 5904 Sq. Km.

Demographics of the GCC area in 2011 was 49.50 Lakhs and is expected to increase to 58.56 Lakhs in 2026. And the projected population of GCC in 2034(for the planning year) is projected to be 62.8 Lakhs.

The CMA boundary limits will be expanding to 5904 Sq. Km proposed for 2046, including 4 districts apart from Chennai itself, which includes Tiruvallur, Ranipet, Kancheepuram and Chengalpattu.
Presently CMA has three municipal corporations within its boundary limits, that is:

- Greater Chennai Corporation
- Avadi Municipal corporation
- Tambaram Municipal corporation

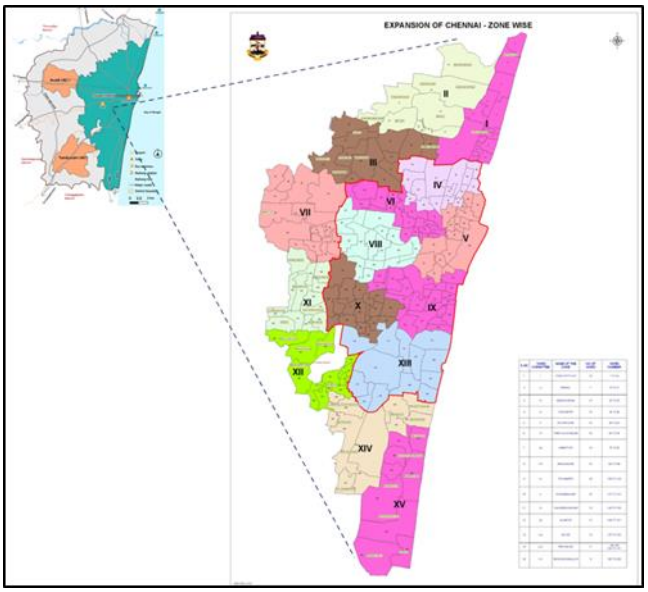


Figure 2:Zones of GCC in 2021

The GCC Zones have increased from 10 Zones, 155 Wards in 2011 to 15 Zones and 200 Wards in 2021. But presently only 5 Zones are taken care by Municipal Corporation (Zone 4-8). Even parts of Zone 7 are privatized b)

Share in Greater Chennai corporation's municipal solid waste:

This is a result showing the percentage of total municipal solid waste in GCC Area including the data from the Swachh Bharat mission and reports showing the total floral waste generated in India. This data is as of 2023:

- Total Municipal Solid Waste generated - 5768 Tons/day (0.6/capita)
- % of Organic Waste = 52% =3000 tons/day
- Total Floral Waste (Out of the total Biodegradable Waste): 13.68 %=411 tons per day or 4.11 Lakh tons per day

As per the Chief Planner (MC) Chennai: Out of 15 Zones, 5 Zones are taken care by MC (Zone 4-8). The rest 11 zones are Outsourced for Waste management after 2020-21 due to Expenditure issues, data loss. Urbaser & Ramkey are the companies taking care of the other Zones. There are 2 dump yards in the GCC Area: Perungudi and Kodungaiyur. There are various Wet composting methods like Micro composting centers, Windrow method, Bio CNG and horticulture. Overall processing capacity is 1000 TPD and the achieved is 695 TPD, rest goes to landfill.

The stakeholders involved in the floral waste management in the worship places are the following:

- Municipal Department
- Outside temple vendors
- Floral markets/ Floral Business
- Temple Staff/ Authorities
- Devotees/ Local Communities
- Recycling/Reusing of Waste organizations/ Biodegradable Product manufacturers
- Social Workers/ NGO's/ Environmentalists

- Research and Innovation Institutions

V. FLORAL MARKETS – GREATER CHENNAI CORPORATION

There are 2 Floral markets in the GCC Area:

1) Koyambedu Flower market

2) Parry's Flower Market

Koyambedu is the largest flower market in Chennai with 500 shops laid in 4 lanes (A, B, C, D). More than 200 Tempo is emptied carrying around 150 boxes of 8-10 Kg filled flowers every day and Around 80 Trucks carrying around 700-800 boxes of 8-10 Kg filled flowers are emptied every day. Parry's flower market is a one lane flower market and is very small comparatively. A 2Kg loss incurs with each transport agents in the process of collection, transportation and delivery from farmers to flower vendors in Koyambedu

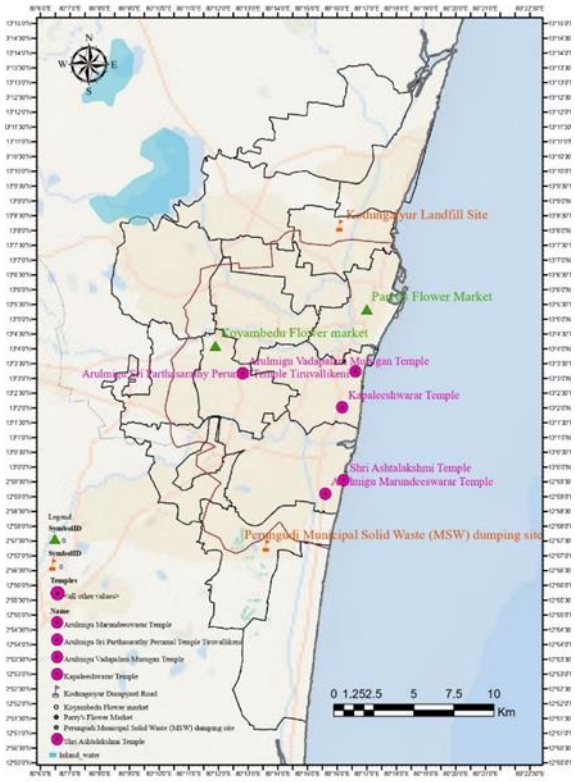
As per District Revenue Officer: the total flowers that come to the Koyambedu market is 200-250 Tons/Day (Approx.) and there is Total flower waste of around 20-25 Tons/ day (5-10%). 30 % increase in Total flower waste year on year and Kodungaiyur is the landfill where the waste is dumped. The contract was given in 2010 which didn't work out & is in litigation, in which the 20-ton waste was to be utilized in such manner:

- 6 Tons was supposed to be used for Manure
- 12 Tons for Bio methanation (To generate electricity)

Figure 3:Each Tempo can carry around 150 boxes of 8-10 Kg filled flowers

VI. SURVEY TEMPLES- WASTE GENERATION

VII. Figure 4: GCC Area with the temple's location



These are the major 5 temples based on which the Primary survey has been conducted in order to understand their existing strategies in place to cater the Floral waste and to fulfill the gaps based on this survey. These are the 5 Temples selected based on Footfall:

1) Kapaleehwarar Temple
2) Ashtalakshmi Temple
3) Marundeeswarar Temple
4) Parthasarathy Temple
5) Arulmigu Vadapalani Murugan Temple

As per Hindu Religious and Charitable Endowments Department, there are 41327 Temples in TN, in which 732 temples are there in GCC Area, 218 temples of Mid-size, and 10 temples of large size based on Property, Income & Footfall.

		Footfall		Area (Sq. m.)	Waste generated(Kg/Day)			
S.No.	Temple Name	Normal Days	Ceremonies		Total	Floral	Cowshed	Remaining
1	Kapaleeshwarar Temple	3000	8000-12000	42945	900	540 (60%)	225 (25%)	135 (15%)
2	Arulmigu Vadapalani Murugan Temple	3000	8000-12000	12370	800	580 (73%)		220 (27%)
3	Marundeeswarar Temple	2000	5000-8000	24427	700-800	550 (65%)	212 (25%)	90 (10%)
4	Parthasarathy Temple	2000	5000-8000	17995	650	422 (65%)	162 (25%)	65 (10%)
5	Ashtalakshmi Temple	500	1000-1500	3937	500-550	465 (85%)		85 (15%)

Figure 5: Waste generation based on Footfall for 5 major temples

WASTE GENERATION- EXISTING STRATEGIES

a) **Kapaleeshwarar temple**: As per the temple's authorities, there is a 30 % increase in floral waste during festivals. Presently the ITC is working with the Temple staff (Kapaleeshwarar& Ashtalakhsmi), also few smaller (50-60) on a Green Initiative which is Capacity building along with a partner agency that is Exnora Green Pammal (EGP) (ITC), by training the Temple Staff itself. The Green Temple initiative is a closed-loop waste management concept that turns garbage from temples into products that can be used on-site, such compost and biogas. Current Reuse is by providing 2 Biogas plant producing capacity of 150 Kg (10:1) each & composting for Manure. As per the Floral Vendors there are 15 Flower Vendors Outside the temple, roughly 50- 100p/day come to each shop. They buy the flowers from both the flower markets and every day they get around- 15-25 Kg in which 1-2 Kg is waste, which is collected by MC, but no segregation is done.

b) **Vadapalani Murugan Temple**: Presently there is no mechanism of the reuse of the floral waste or any other waste. The total waste is collected by the municipal corporation and dumped in landfill.

c) **Marundeeswarar Temple:** As per the temple authorities there is 10-20 % increase in floral waste during festivals. Segregation is done by the Temple staff and reused as Manure. 1 Acre land is owned as Nursery, the waste from temple is taken there and reused for Manure by Temple staff and the community volunteers. There is no reuse of floral waste. 20-30% Flowers are also given to the devotees as sacred procedural offerings and there are around 6 times that temple conducts pooja. As per the Floral Vendors there are 8 Flower Vendors outside the temple, roughly 50-60p/day come to each shop. They buy the flowers from Parry's flower markets and every day they get around- 10-12 Kg in which 1-2 Kg is waste, which is collected by MC.

d) **Parthasarathy Temple:** Presently there is no mechanism of the reuse of the floral waste or any other waste. The total waste is collected by the municipal corporation and dumped in landfill. As per the Floral Vendors there are around 15 Flower Vendors outside the temple, roughly 80-100p/day come to each shop. They buy the flowers from Parry's flower markets and every day they get around- 10-25 Kg in which 1-2 Kg is waste, which is collected by MC.

e) **Ashtalakshmi Temple:** As per the temple authorities there is 60-80 % increase in waste in 10 years. Segregation is done by the Temple staff and used as Manure within temple premises. During festivals excess waste if not catered is dumped at the MC bins. Residents complained about dumping waste in seawater at times as the temple is adjacent to the beach.

As per the 100-sample collection from the devotees of these five temples:

- 65% of them are not aware about the segregation practices, and 10% of them were aware about the segregation other than Dry/Wet.
- 95% of the devotees bring the flower offerings given by the priest's home, and 75% amongst them dispose it off after drying while 20% leave it in temple premises itself & 5% dispose it off in the nearest water body.
- None of them were aware about the floral waste usage, neither the temple staff.
- 86% were willing to volunteer for the waste management plan if planned and executed for these temples.

CHALLENGES FACED BY THE TEMPLE:

- Segregation is done only for Wet / Dry Waste and manually by the temple staff.
- Barrels provided under Green Initiative to Kapaleeshwarar and Ashtalakshmi but not fully utilized for segregation.
- The Ashtalakshmi temple is on the beach & as per residents, at times the waste is dumped in water.
- Temple staff not aware about the floral waste reuse.
- Awareness should be created for the Temple devotees also for Segregation by keeping various bin and awareness campaign.
- Administration is still not aware about any reuse strategies for the waste.

INSIGHTS FROM THE SURVEY OF 5 TEMPLES:

- Waste segregation for floral waste is not followed in any temple. Total organic waste is separated and used as a part of Biogas production, manure in 3 out of 5 temples. Rest 2 are dependent on Municipal corporation to take care of their waste.
- Total organic waste is reduced in 3 out of 5 temples, that is around 2350 KG per day.
- Total of 1300 kg/day to be dependent on municipal corporation to be collected.
- Recycling is done by Exnora pvt. Ltd. In Kapaleeshwarar, Marundeeshwar and Ashtalakshmi are using their temple premises for recycling. Still floral waste is not reused to its potential.
- For every 350 Kg – 150 Kg biogas is produced in kapaleeshwarar temple, and composting manure accounts to 60% of the waste.
- Municipal body is not aware about the reuse of waste. Public participation and awareness is not there in any temples.

VIII. PROPOSALS –CATERING THE EXISTING STRATEGIES FOR WASTE MANAGEMENT

Based on the challenges faced the proposal is given both at the Micro as well as Macro level. At micro level the temples are suggested for an improvised recommendation to cater to the total waste generated by each temple and at micro level guidelines are provided for the state to act upon.

MICRO LEVEL – IMPROVISED SUGGESTIONS

a) **Kapaleeshwarar temple**: In existing strategy the 900 Kg organic waste is utilised with no segregation in 2 x 150 Kg bio composter, but if we segregate the 300 Kg Organic waste and put it in 2 Biogas composter to produce 15 Kg of Biogas and can be utilised in the Worship place Kitchen itself and if produced extra on some days can be stored for ceremonial functions. Remaining 60 Kg/ day of Organic Waste can be collected weekly and used to produce manure on site, for the green spaces in the temple premises.

For the 540 Kg floral waste, 150-200 Kg can be utilized in order to get 28 Packets of Incense sticks. Which can be used inside the worship place premises itself, and this can be done under the ITC initiative only, train the self-help groups interested in making Incense sticks/cones out of the flowers (majorly mogra). For Remaining 340 Kg collaborate with NGO'S/ Organisation for oil extraction usage from these flowers, since it's a flower with good smell. One of the most expensive ingredients for perfume. 1Kg will be produced by 1million buds and around 180 ml is sold at Rs 5000-30000 approximately.

b) **Vadapalani Murugan Temple**: In existing strategy no segregation is done, but for an improved management segregate the 150 Kg Organic waste and put it in 1 Biogas composter of capacity 150 Kg to produce 15 Kg of Biogas. Remaining 70 Kg/ day of Organic Waste can be collected weekly and used to produce manure on site, for the green spaces in the premises.

For the 580 Kg floral waste, it can be fully utilized in order to get 83 Packets of Incense sticks. Which can be used inside the worship place premises itself & remaining to be sold commercially at Rs. 20-30/ packet to the nearby temple vendors/ smaller temples.

c) **Marundeeswarar Temple & Ashtalakshmi temple:** For these two temples it has combined, as it is approximately 2.5 Km far away from each other. In its existing strategy the total of 387 Kg organic waste was utilised for Manure. 1 Acre land owned for Nursery by Marundeeshwar temple, the waste was taken there and reused for Manure by Temple staff and the community volunteers but the improvised suggestion is to create a common "COMPOSTING BIN" to be established around the Nursery itself taken care by the Municipal Corporation which can be used for both the temples and many more within that 3 KM radius. It can be utilized by the temples and the nursery & the remaining can be sold at Rs 50-60/Kg

For the 985 Kg floral waste from both temples, 500 Kg can be utilized in order to get 71 Packets of Incense sticks. Which can be used inside the worship place premises itself, and this can be done under the ITC initiative only, train the self-help groups interested in making Incense sticks/cones out of the flowers & remaining to be sold commercially at Rs. 20-30/ packet to the nearby temple vendors/ smaller temples. For Remaining 485 Kg collaborate with NGO'S/ Organisation for oil extraction usage from these flowers.

d) **Parthasarathy Temple:** In existing strategy no segregation is done, but for an improved management segregate the 227 Kg of Organic waste to be used and establish a composting unit outside the temple premises at parking lot which can be used as a common "Composting Unit" too for the temples nearby also. About 200 kg of manure is obtained for every ton of waste. The manure obtained to be used in the temple gardens and can also be sold at Rs.20/kg to the locals living around the temple.

For the 422 Kg floral waste, 200 Kg can be utilized in order to get 28 Packets of Incense sticks and handmade papers. Which can be used inside the worship place premises itself and this can be done under the ITC initiative only, train the self-help groups interested in making Incense sticks/cones out of the flowers & remaining to be sold commercially at Rs.

20-30/ packet to the nearby temple vendors/ smaller temples. For Remaining 222 Kg collaborate with NGO'S/ Organisation for oil extraction usage from these flowers.

For segregation and awareness practices, install smart bins equipped with sensors that can detect the level of waste and send alerts when they need emptying. A community Engagement Co-Ordinator to be engaged for providing awareness campaigns and education regarding the same. Also, Infrastructure development for Biogas plant need to be done by the Municipal corporation for the waste recycling and the Skill enhancement shed places in or around the Temple premises providing employment generation and Waste reduction at a large scale.

MACRO LEVEL – GUIDELINES FOR FLORAL WASTE MANAGEMENT IN WORSHIP PLACES FOR THE STATE OF TAMIL NADU

It will be undertaken by: TN Pollution Control Board & State Religious & Charitable Endowments Board

The Guidelines aims to implement a systematic and environmentally conscious approach to floral waste management in worship places in Tamil Nadu, promoting the harmonious coexistence of religious traditions and ecological sustainability by minimizing the impact on the ecosystem. And the Guidelines shall come into force for 10 years i.e. from 2024 to 2034 and will be carried out in various phases.

About the Worship place: Worship places Management Board to be formed at every district level managing various types of worship places & implementing techniques to improve the management which will be governed by States Religious and Charitable Endowments Act at State level.

- The category of worship places will be based on Property, Income, Footfall and Area based on which it can be segregated to large, medium or small categories.
- The category of worship places for the waste management is based on Bulk and non-bulk generators same as in "Solid Waste Management Rules, 2016".

The objectives of the guidelines are:

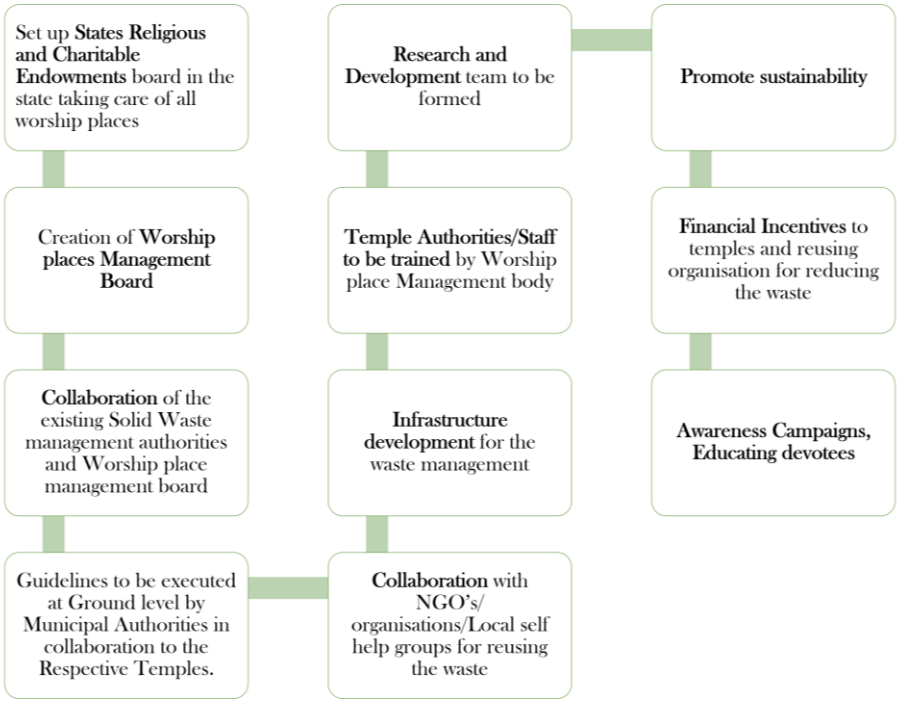
a) **Raise Awareness and Education campaign**: To raise awareness and build capacity among worship place authorities, devotees, and local communities regarding the importance of floral waste management and environmental conservation.

b) **Implement Segregation Practices & Establish Collection Centers on-site and around the premises:** The worship places management body to conduct training sessions for worship places staff and volunteers on effective waste segregation. Collaborate with local authorities and religious institutions to identify suitable locations for these centers.

c) **Sustainable Practices & Revenue Generation:** To encourage recycling, reuse, and resource recovery initiatives for floral waste, promoting circular economy principles based on bulk generators and others.

- Establish On-Site Composting Units: For non-bulk generators: Set up composting units within worship places compounds or within a 1 Km radius to process organic waste and also to engage local self-help groups/NGO's/Organizations in the recycling methods of floral waste.
- Facilitate Recycling: Promote and collaborate with local recycling facilitators/ organizations to sustainably recycle floral waste generated in worship places materials for uses like natural dyes, oil extraction, incense cones etc.
- Encourage Sustainable Practices: Promote the use of reusable materials for worship places decorations and offerings, so as to move towards "Zero waste" concept. Advocate for the reduction of single-use plastic and non-biodegradable items during religious ceremonies.
- Regulate Disposal Practices: Implement penalties for non-compliance with waste disposal guidelines. Enforce regulations for the proper disposal of floral waste to prevent illegal dumping.
- Employment Generation & Incentivizing: Employment opportunities to be created for individuals to collect floral waste from worship place and segregate it based on its disposal method. In order to add value to floral waste, outsourcing or non-governmental organizations (NGOs) to be worked with to turn the trash into different goods like incense sticks, organic fertilizers, or natural colors.
- Technology Advancement and Research & Innovation: Mobile Applications for Waste Tracking- Implementing mobile applications for tracking waste generation, collection, and disposal activities within worship places. Using innovative repurposing techniques to convert flower waste into goods that are helpful, such incense, handmade paper, or organic dyes. Implementing RFID tags on waste bins to monitor and track the disposal of different types of waste, ensuring proper segregation. Installing smart bins equipped with sensors that can detect the level of waste and send alerts when they need emptying and utilizing GIS technology to map waste generation hotspots, optimize waste collection routes, and plan waste management infrastructure.

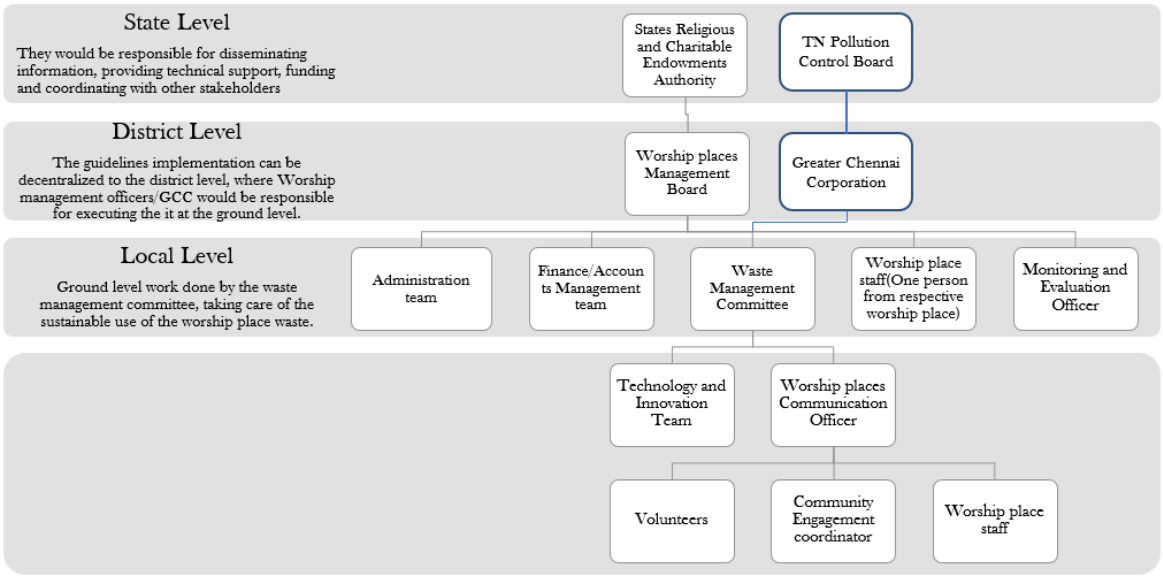
he Implementation of the following can be done through this:



Responsibilities:

- Responsibilities of the worship place authorities –to register on State religious and Charitable endowments Body portal; collect and ensure that the various waste generated during the ceremonial procedure within the worship place is segregated, recycled or disposed; and file annual and quarterly revenue generation/returns from the recycling in the prescribed form on the portal.
- Responsibilities of the recycler- All recyclers must: (1) register on the Worship Place Management Board portal; (2) ensure that the recycling procedures follow the materials and standards periodically set forth by the TN Pollution Control Board under the Worship Place Management Board; (3) make sure that any fractions or materials not recycled in the facility are sent to the appropriate registered recyclers; and (4) keep a record of the floral waste that is collected, recycled, and sent to registered recyclers on the portal, making all records available for verification or audit as needed; (6) raise awareness via print and broadcast media, publications, ads, posters, etc.
- Responsibilities of Tamil Nadu Government - The State Government-approved government agency in this regard is responsible for making sure that space or sheds are set aside for garbage collection, recycling, innovation, and disposal in both current and future projects. - The following tasks must be completed: (a) make sure that all workers involved in the process are identified and registered; (b) help form groups of these workers to facilitate the establishment of facilities for recycling and reusing materials; (c) provide skill development opportunities for workers engaged in segregation and recycling; (d) carry out yearly monitoring and ensure the health and safety of workers involved in the process.
- Responsibilities of the floral vendors outside worship place – to collect various waste generated after selling at a designated place provided by the local authorities ensuring it doesn't accumulate and cause littering and also ensure its segregation; Educating worshippers and visitors about the importance of proper waste disposal and encouraging them to dispose of flowers responsibly in the bins provided by the local authorities.
- Responsibilities of the devotee- to refrain from littering by properly disposing of floral waste in bins and avoiding scattering flowers or other offerings in the temple premises or surrounding areas; Support temple initiatives aimed at promoting sustainable practices, such as composting organic waste or recycling materials used in temple rituals.

Organogram for worship places: Providing a worship place waste management organizational structure defining the key roles and responsibilities at different levels. Below is an organogram with roles and responsibilities for effective waste management in worship places:



VIII. CONCLUSIONS:

The improvised solution is provided to strike a balance between religious practices and environmental conservation by promoting responsible floral waste management. Further, it seeks to integrate sustainable practices into the daily operations of worship places, ensuring that religious activities contribute positively to the environment. By fostering awareness, community involvement and collaboration, innovation, we aspire to create a sustainable model that can be replicated in other regions and set example for responsible floral waste management in the state for worship places.

Abbreviations and Acronyms

- Greater Chennai corporation- GCC
- Non- Governmental organization – NGO
- Chennai metropolitan Area- CMA
- Tamil Nadu- TN
- Municipal Solid waste- MSW
- Hindu religious and Charitable Endowments – HR & CE

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